

“Gateway to the Stars:”  
Science, Civic Identity, and Tourism at the Dominion Astrophysical Observatory, Victoria B.C.  
1903-1941

by

Daniel Posey  
BA, University of Victoria, 2013

A Thesis Submitted in Partial Fulfillment  
of the Requirements for the Degree of

MASTER OF ARTS

in the Department of History

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## **Supervisory Committee**

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## Abstract

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The Canadian astrophysics program rapidly developed between 1903 and 1914, leading to the wartime construction of what was hoped to be the world's largest research telescope. The institution opened in Victoria British Columbia in 1918 with fanfare. Throughout the 1920s, the new Dominion Astrophysical Observatory (DAO) contributed to discoveries on the frontiers of astrophysics, while educating residents of Victoria about astronomy. In a history often overshadowed by the advent of cosmology in the 1920s, the discoveries of Victoria's astronomers produced lasting insight into the size and scale of our own galaxy. Accordingly, historians of astronomy have probed the scientific accomplishments of Canadian astronomers, devoting relatively little attention to the regional importance of these scientific facilities. The Victoria observatory itself developed into a widely visited tourism destination as staff astronomers regularly engaged in public education initiatives. This study utilizes newspaper sources, scientific papers, and contemporary publications in assessing the cultural relationship between the DAO, Victorians, and Canadians, while examining the significance of the scientific research conducted with the world's second largest telescope. In doing so it engages themes of public interest in the achievements of the institution, and Victoria's civic identity as an emerging tourism destination.

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### **Dedication**

First and foremost I dedicate this thesis to my grandparents Janet Elizabeth Heath (Acton) and Wilfred R. Heath. Throughout my youth and my undergraduate they both emphasized the importance of education, and encouraged me to pursue the interests that have resulted in this work. I also dedicate these efforts to my parents, Mary Heath and Dave Posey, for their constant support and (sometimes feigned) interest in the progress of my research and writing.

## **Introduction**

Built in Victoria British Columbia between 1914 and 1918, the Dominion Astrophysical Observatory (DAO) opened with fanfare, and has been an important feature of Victoria's scientific and cultural landscape since 1918. This study seeks to address how the institution contributed to shifts in local and national identity as a destination for intellectual tourism, and as a centre of scientific research. Victoria was a city in transition at the turn at the twentieth century, as Vancouver emerged as British Columbia's primary economic centre. Promoters quickly incorporated the new observatory into the city's identity, seizing on the prestige of the institution in an effort to boost tourism. On a national level, the pride associated with the construction of the world's largest telescope expressed the maturation of the Canadian state.

The development of the DAO was informed by three influential shifts within the scientific community: the emergence of American observatories on the Pacific Coast; the transition to reflector telescopes for scientific research; and the desire for a Canadian telescope capable of reaching the fainter targets necessary to pursue astrophysical research. Though these factors characterize the interests of the project for scientists, astronomer John Stanley Plaskett and the Chief Astronomer William King promoted the telescope as a national and cultural icon, pointing to the arrival of Canada as a mature nation in the international community. Given that most of the observatory's construction process occurred while Canada was involved in the First World War, a period of inflation and restrictive wartime conditions, the high degree of support from astronomers, politicians, and the public reflects both local and national interest in the DAO. Indeed, the observatory was constructed on the leading edge of a new approach to astronomy. Between the late 19<sup>th</sup> and early 20<sup>th</sup> century astronomers shifted from refractor to reflector technologies, grounded in work conducted at the recently developed Lick and Mt. Wilson observatories of California. Thanks to these new instruments astronomy received new levels of

public exposure as theories regarding the size and scale of the universe emerged as a precursor to the field of cosmology.

The excitement surrounding the developing field of astrophysics, combined with the prospect of constructing the world's largest telescope, generated support for the Victoria facility from both political elites and the local population. Prior to the DAO, astronomy in Canada grew out of what I will label "practical astronomy," concerned with navigation, boundary surveys, and time keeping. Just as Victoria and Vancouver were emerging as metropolitan centres, Plaskett was looking to the south, seeking to transform Canadian astronomy into a scientific endeavor. Unlike the Dominion Observatory (DO) established at Ottawa in 1905, the DAO's location on the Pacific Coast would both challenge and complement the great western observatories of the United States. During his work at the DO in Ottawa, Plaskett saw the opportunity to transform Canadian astronomy with a modern astrophysics program, one that would give Canada a world leading research centre. In the end, despite the high cost of locating the telescope in BC, Victoria's superior climate and atmospheric conditions, necessities for astrophysical research, dictated that Victoria would host the DAO. Eager to attract the telescope, BC Premier Richard McBride contributed by providing a land grant and constructing a road for the institution.

The telescope design utilized at the DAO was a massive and complex engineering marvel. The mounting devised by Plaskett and the Warner and Swasey Company allowed the telescope to reach almost any area of the sky.<sup>1</sup> The completed telescope had a rotational mass of forty-five tons, powered by a gravity driven governor that required winding each night by the staff, and an electric motor. Despite the telescope's weight, its tracking of the stars was flawless.

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<sup>1</sup> Richard A. Jarrell, "J. S. Plaskett and the Modern Large Reflecting Telescope," *Journal of the History of Astronomy*, 30, (1999): 367.

The optics were similarly impressive. Plaskett's design for a 72-inch primary mirror was unique among the great observatories, utilizing a true Cassegrain focus in addition to the common Newtonian focus. This decision required a ten-inch hole to be cast in the five-thousand pound mirror, an innovation that provided the flexibility needed to conduct both optical imaging and spectroscopic work, supplying a dedicated focus for each task.<sup>2</sup>

The construction of the DAO was a fundamental development for Canadian astronomy. Astronomy in general experienced a transition at the end of the 19<sup>th</sup> century, shifting from the positional measurements of planets and stars, to astrophysics, the study of the physical properties of these objects. Unlike the DO, devoted primarily to timekeeping and positional astronomy, the DAO was constructed explicitly as a functional astrophysical research institution. Thus, between 1900 and 1920 the Canadian astronomy program grew from relative obscurity to boast two major federal institutions, including for a brief period the largest functioning observatory in the world in Victoria. Constructed with remarkably few delays despite the inevitable distractions caused by the First World War, the DAO contributed to the scientific and cultural maturation of Victoria, British Columbia, and the nation. It provided a destination for visitors to learn about astronomy, while training students from the new University of British Columbia. Public outreach performed by staffers, led by Plaskett himself, helped the new institution connect with Victorians. The institution also provided immediate contributions to the astrophysical community. As the world's largest operating telescope, albeit for just five months after its construction, and second largest

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<sup>2</sup> Telescopes utilizing a Cassegrain focus reflect light off of the primary (large) mirror to a secondary mirror located near the mouth of the tube. The light is then directed through a hole in the primary mirror, allowing the eyepiece or camera to rest at the base of a telescope. This design increases the effective focal length (distance light travels) of the telescope, as light must traverse a third length of the tube. Standard Newtonian focus telescopes reflect light off the secondary mirror to a focus located near the top of the telescope. This leaves the observing platform in a precarious position for such a large instrument; George E. Webb, "Victoria Welcomes the Dominion Astrophysical Observatory: Science and Society in the Pacific Northwest," *The Pacific Northwest Quarterly*, 94, no.4 (Fall, 2003): 174.

until 1935, the DAO was an important research centre, capable of making observations only rivaled by the telescopes on Mt. Wilson in California. During the 1920s the observatory's staff made dramatic discoveries in astrophysics. In 1922 Plaskett identified the most massive known binary star, "Plaskett's star," garnering attention from national newspapers.<sup>3</sup> Throughout the decade the staff conducted spectrographic surveys of stars, measured binary systems, and generated insights into the structure and nature of the Milky-Way galaxy. These discoveries, especially those concerning the Milky-Way, were of international importance, making Victoria a centre of astrophysics research.<sup>4</sup> Led by Plaskett, Victoria's astronomers made significant contributions to the fundamental questions of astrophysics, bringing both national and international fame to the DAO and Victoria.

In 1913 the Royal Astronomical Society of Canada (RASC), an organization for amateur and professional science, opened a Victoria chapter. Supported by interest in the new observatory the RASC centre quickly grew into the third largest in Canada, incorporating both interested locals, and DAO astronomers. Due to growing local interest in astronomy, the DAO also developed into an important destination for intellectual tourism by the 1920s. Local promotional efforts incorporated the new observatory in boosting Victoria's attractions, and by 1925 the institution received a staggering rate of annual attendance. The institution drew these visitors as a symbol of both modernity and engineering, as the world's largest publically accessible telescope. By 1929 the telescope, and the successes of the DAO staff were important

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<sup>3</sup> "New Discovery by Star-Gazer," *Globe*, July 14, 1922, 18.

<sup>4</sup> The Copernican question, was alive and well in the 1920s as astronomers struggled to understand competing models of the universe, and humanity's place within it.

elements of Victoria's identity, and the institution continued to offer both intellectual and economic promise with the onset of the Great Depression.

Interpreting the DAO's origin and development demands attention to the historiography of Canadian science.<sup>5</sup> Defining Canada's scientific contributions has proven difficult, due to both the international nature of scientific discovery, and the nation's colonial past. Considered broadly, the historiography of Canadian science reflects a fragmented, even adversarial pattern of development due to the competing interests of historians and scientists. With both scientists and historians contributing to the growing field, the question of authority over the topic promoted division. The extensive technical knowledge needed to practice the history of science often requires interdisciplinary experience with the literature of both science and history. Accordingly, an interdisciplinary approach developed to accommodate the production of the history of Canadian science. As the field advanced, historians brought new perspectives centered on social and cultural issues to the investigation of Canadian science. The following discussion will consider early works by scientists, and selected modern works in assessing the historiographical evolution of the discipline.

Early histories of science, epitomized by scientist and academic administrator H. M. Tory's 1939 *A History of Science in Canada*, were more chronicle than history. Gathering ten scientific experts to provide brief, field specific surveys of Canadian science, Tory's enterprise yielded a predominantly linear accounting of 'facts,' focused on the gradual progress of Canadian scientific knowledge and infrastructure within the British tradition.<sup>6</sup> The text supplies detailed information on the work done by Canadian scientists, but fails to connect the individuals

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<sup>5</sup> The history of technology and medicine, while important to Canadian science, are tangential to this study and will only be discussed insofar as they are relevant to the scope of this study.

<sup>6</sup> H. M. Tory, *A History of Science in Canada* (The Ryerson Press, Toronto 1939).

and their achievements to Canadian social and cultural history. Canadian science is presented on a continuum that began with the needs of the fur trade, and developed to accommodate the growing needs of the nation.<sup>7</sup> Tory identifies government funding through the National Research Council, established in 1916, as a “sort of *finale*” for the development of Canadian science.<sup>8</sup> While caught up in his progressive narrative, Tory’s observation on the interaction between the government and Canadian science persists as a theme in the modern literature. But Tory and his collaborators did not engage broader questions of how the concept ‘Canadian’ scientific research should be approached, nor did they engage the active role of science in the development of Canadian culture and identity.<sup>9</sup> Nevertheless, despite their limitations these early works were important in establishing the idea of ‘Canadian science’ for historians to interact with.

DAO astronomer W.E. Harper’s 1939 account of Canadian astronomy, featured in *A History of Science in Canada*, parallels Tory’s approach, offering a technical account written primarily for educated professionals. Harper’s discussion highlights Canadian contributions to the discipline, defining the advance of science as a series of ‘stages,’ beginning with requirements for surveys or timekeeping and concluding with the modern infrastructure of research based science.<sup>10</sup> The role of post-Confederation science as a state-building tool is an important element of the discourse of progress in Harper’s narrative, presenting science as a fundamental aspect of this process.<sup>11</sup> While hedged in the nationalistic terms of ‘Canadian Astronomy,’ Harper’s narrow focus neglects the broad connections between science and Canadians themselves. He briefly acknowledges the Canadian public and ‘amateur astronomers,’

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<sup>7</sup> Ibid, 2-3.

<sup>8</sup> Ibid, 5.

<sup>9</sup> A. Norman Shaw, “The Advance of Physics in Canada,” in *A History of Science in Canada*, 121.

<sup>10</sup> W. E. Harper, “The History of Astronomy in Canada,” in *A History of Science in Canada*, 92-93.

<sup>11</sup> Ibid, 90.

however this failed to extend beyond their relationship with the professional field.<sup>12</sup> The process of scientists producing history raises secondary questions, as the progressive narratives trumpeting Canadian scientific accomplishments had implications for funding.

Published in 1962, Thomas Kuhn's book, *The Structure of Scientific Revolutions*, redefined how historians approached the history of science. Kuhn broke down notions of linear progress within scientific fields, introducing the concept of the paradigm, or framework of thought within a given discipline, as a mechanism for explaining shifts in scientific thought. For Kuhn, scientists were primarily puzzle solvers, with the paradigm supplying the questions that inform the process of experimentation.<sup>13</sup> Kuhn provided historians with an effective method to identify and assess the process of change over time through studying the scientific literature produced during a period. Given that the paradigm provides the intellectual framework and assumptions of a scientific field or sub-field, historians can identify the presence of a paradigm through a close reading of the publications it yielded. Kuhn also encouraged historians to examine the external stimulus for scientific achievement, probing the relationship between science and society. Kuhn's identification of paradigms introduced a new method of historical change for scientific practice. Paradigms, functioning as abstract rules for a field, are only modified when the puzzle solving process of normal science introduces an anomaly.<sup>14</sup> Anomalies fuel scientific discovery, as experiments are designed to address the questions they present, moving away from what Kuhn terms the 'cumulative enterprise' of normal science to engage the 'novelties of fact' they present, and ultimately the introduction of new theories to explain them.<sup>15</sup>

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<sup>12</sup> Ibid, 98.

<sup>13</sup> Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Second Edition, enlarged. Volume II No. 2 (Chicago: University of Chicago Press, 1970), 38, 39, 42.

<sup>14</sup> Ibid., 46, 47, 50.

<sup>15</sup> Ibid., 52-3, 57.

The presence of anomaly does not detract from the importance of a paradigm, Kuhn noting that, they appear “only against the background provided by the paradigm.”<sup>16</sup> Unless rectified, anomalies building within a paradigm ultimately lead to crisis, allowing for “the blurring of a paradigm and the consequent loosening of the rules for normal research,” and the introduction of competing theories.<sup>17</sup>

Kuhn’s analysis of scientific change shattered the simplistic narrative of progress found in H. M. Tory’s anthology, shifting away from the description of science as a purely empirical process, to acknowledge the human element of the individuals involved. *Structure* breaks down the imagined linearity of science, instead suggesting that scientific inquiry occurs in a revolutionary pattern, as new generations of scientists question and re-construct the paradigms of their predecessors. Although the introduction of a new paradigm may not prompt a field to shift immediately, its presence alters the perspective of its adopters, providing new questions for a discipline to answer.<sup>18</sup> For historians of science, paradigms supplied a new method of analysis with the capacity to incorporate both professional and cultural shifts into their discussions. Kuhn’s insights, in short, allowed for a broad, non-linear perspective on the development of scientific knowledge that encompasses culture and other external stimuli.

The United States, like Canada, faced similar challenges with the early history of science, namely its production by scientists, and an obscure image of ‘American science’ as an entity. A. Hunter Dupree examined these issues in a 1966 article recognizing both the importance of historians engaging in the history of science, and the specialized knowledge required for its production. For Dupree the history of American science shifted from accounts of science itself,

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<sup>16</sup> Ibid., 65.

<sup>17</sup> Ibid., 69, 82, 84-86, 88, 90-3.

<sup>18</sup> Ibid., 111, 136-7, 140, 144.

to accounts of how science and culture interacted. “The scientists study the things,” he asserted: “the historians study the scientists.”<sup>19</sup> With this division Dupree distinguished between the scientist’s ability to understand pure scientific knowledge, and the historian’s skill in understanding its broader human promise and consequences. These observations encouraged historians to acknowledge the increasing importance of science in Cold War America, opening earlier periods of history up to new forms of investigation that probed connections between science and society.<sup>20</sup> As a result of these shifting perspectives the study of American science also departed from the often linear accounting of individuals and their discoveries, placing science into its cultural context.

The question of ‘authority’ did not disappear, as the idea that scientific training was required to understand the history of science persisted. While the history of science was evolving the historical profession shifted from a relatively narrow focus on political and economic themes toward broader definitions of ‘history’ that encompassed social and cultural issues. Nevertheless, historians strove to make science more relevant for ‘mainstream’ historical studies during the nuclear age. Increasingly, professional historians rejected American historian of science George Sarton’s early position that historians of science required professional scientific experience, instead emphasizing the need for special training in understanding scientific thought.<sup>21</sup>

Regardless of national context, historians of science would require infrastructure and training. The first graduate programs devoted to the history of science in Canada emerged at the University of Toronto in 1967, followed by the University of Montreal, with students from the

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<sup>19</sup> A. Hunter Dupree, “The History of American Science: A Field Finds Itself,” *American Historical Review* 71, no.3 (April, 1966): 869.

<sup>20</sup> *Ibid.*, 872,74.

<sup>21</sup> *Ibid.*, 865-66.

Toronto program delivering papers at a 1972 meeting of the Canadian Historical Association (CHA).<sup>22</sup> By 1976 the first repeating publication on the topic emerged in the *HSTC Bulletin*. In 1977 a second meeting of engaged historians was held to discuss the establishment of scientific archives.<sup>23</sup> As members of the Canadian historical profession increasingly engaged the history of science, these early organizational steps allowed for the exchange of ideas to provide direction for the emerging field.

In November 1978, Kingston, Ontario hosted the first conference on the study of the history of Canadian science and technology. The outcomes of that conference are captured in *Science, Technology, and Canadian History*, edited by historians Richard Jarrell and N. R. Ball. The Kingston Conference sought to address the needs and infrastructure of a growing, and often fragmented, scholarly interest in the history of science. Like Dupree, Canadian historians expanded their focus, reconstructing conceptions of what Canadian science represented on a cultural level while seizing a measure of authority over the field. As historians struggled to define what constituted ‘Canadian science,’ a “canonical” issue in the field’s historiography, the discipline formed around them.<sup>24</sup> By 1980 the journal *Scientia Canadensis* had emerged out of the *HSTC Bulletin*, allowing historians to address fundamental questions of method and meaning in a national journal.

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<sup>22</sup> Richard Jarrell and Norman Ball, “The Study of the History of Canadian Science and Technology,” in *Science, Technology, and Canadian History*, ed. R. A. Jarrell and N. R. Ball (Ontario, Wilfrid Laurier University Press, 1980), 2.

<sup>23</sup> Richard A. Jarrell, “The Infrastructure of an Emerging Field,” *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 11, no.1, Issue 32 (1987): 39.

<sup>24</sup> Edward Jones-Imhotep, “Critical Histories: A Round Table on Historiography of Science,” *Scientia Canadensis: Canadian Journal of the History of Science, Technology, and Medicine* 28, (2005): 3-5; Edward Jones-Imhotep, “Laboratory Cultures,” *Scientia Canadensis: Canadian Journal of the History of Science, Technology, and Medicine* 28, (2005): 6-26.

The Kingston conference had shown that the early historians of Canadian science were a collective of ‘outsiders,’ gathered from different professions, and linked only through their shared interest.<sup>25</sup> As late as 1980 few professional historians studied the history of science and technology, sharing the field with contributors from other fields such as science and medicine.<sup>26</sup> As historian Donald Wright argues, the developing professionalism of Canadian history created a “set of shared assumptions,” and a demarcation between amateur and professional contributors.<sup>27</sup> For Jarrell the diverse backgrounds of contributors left historians entering the field with no clear ideological or methodological guide. Embracing Dupree’s example of the importance of social and cultural perspectives in American history, Jarrell notes that while many works have been produced on the technical aspects of the railways or aircraft, “more is required to turn this information into history.”<sup>28</sup> As the supporting infrastructure of archives developed along with *Scientia Canadensis*, historians gained increasing control of the field, allowing for new forms of analysis that moved beyond technical accounts to forcefully engage the cultural and social history of science.

Some strengths flowed from the approaches of the 1980s as the field began to find its identity. A diverse group of practitioners created eclectic topics of study. Jarrell notes that the field emerged after the Canadian “university boom,” of the 1960s.<sup>29</sup> This early collective of historians and scientists was interdisciplinary by nature, requiring a linking of “two cultures,” to

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<sup>25</sup> C. E. S. Franks, “The Kingston Conference and Beyond,” in *Science, Technology, and Canadian History*, ed. R. A. Jarrell and N. R. Ball (Ontario, Wilfrid Laurier University Press, 1980), 10.

<sup>26</sup> Ibid.

<sup>27</sup> Donald Wright, *The Professionalization of History in English Canada* (Toronto: University of Toronto Press, 2005), 5.

<sup>28</sup> Franks, “The Kingston Conference and Beyond,” 10.

<sup>29</sup> Ibid., 42.

accommodate the respective needs of the histories of science and technology.<sup>30</sup> The varied backgrounds and interests of contributors led to topical fragmentation, but the benefit was a range of approaches to the topic. However, defining the field itself remained a challenge. The few dedicated programs for the study of the history of science meant that amateur or science-based contributions remained prominent.

Distinguishing professional practitioners from amateurs was the former's increasing preoccupation with theory. The previous tendency of studying institutional histories had discouraged theoretical engagement, but by the late 1980s an increasing number of graduate students in history promised a more coherent future.<sup>31</sup> Theoretical perspectives from the broader discipline of Canadian history, including Marxism, Post-Modernism, and even Post-Colonialism would eventually inform the historiographic leanings of the history of Canadian science. Jarrell notes that by 1987 social history was "the area of greatest attraction" for contributors, with labour history and gender issues emerging as important areas of analysis for historians of Canadian science.<sup>32</sup> While welcoming these new directions in the social history of science and technology, Jarrell stressed that "studies of individual industries, institutions and lives cannot be ignored."<sup>33</sup> Historians of Canadian science were still trying to define the field's boundaries, and to understand what direction it should move in.

Suzanne Zeller did just this in her 1987 publication *Inventing Canada*, a study of Canadian science in the Victorian era, and its contributions to both nation building, and the

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<sup>30</sup> The three topics of study, science, technology, and medicine often overlapped in awkward ways, as the history of science used the history of technology; however the reverse was not always true. As a third variable, the history of medicine can interact with both, or neither; *Ibid.*, 11, 37.

<sup>31</sup> Franks, "The Kingston Conference and Beyond," 4, 6.

<sup>32</sup> *Ibid.*, 43-44.

<sup>33</sup> *Ibid.*, 44-45.

Canadian identity. Zeller, a graduate of the University of Toronto, studies the inventorial sciences and their influence on the formative state, beginning with the geographical study of Canada by the Royal Engineers in 1815.<sup>34</sup> She goes on to trace the indexation of natural resources as a European effort to impose rationality on the wilderness through the application of Newtonianism, the understanding that the world is ordered and governed by universal mathematical laws, and Baconianism, the concept that through observation one understands the realities of their surroundings.<sup>35</sup> These surveys were an important expression of Canadian science in the Victorian era, with both economic and political implications. For example, the geological survey's failure to find coal in the province of Canada had dire implications for an industrial economy, encouraging future 'nation-building' initiatives to include the Maritime Provinces.<sup>36</sup>

Zeller tracks the progress of geology through individuals, but also through government offices, concluding that scientific endeavors crossed political lines. Delving deeper, she imagines science as a 'cultural adhesive' that transcended religion and language, "help[ing] pave the way towards the sense of Canadian and... British North American community" in a geography of cultural diversity.<sup>37</sup> But Zeller is careful to connect the development of science in Canada to its Imperial context, while developing a persuasive engagement with national culture. Although she follows the efforts of sometimes obscure individuals within a range of scientific fields, hers is no 'bottom up' approach characteristic of social history. More attention is devoted to prominent figures such as Sir William Edmond Logan in the development of Canadian Geology and the

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<sup>34</sup> Suzanne Zeller, *Inventing Canada: Early Victorian Science and the Idea of a Transcontinental Nation* (University of Toronto Press: Toronto, 1987), 16.

<sup>35</sup> *Ibid.*, 4.

<sup>36</sup> *Ibid.*, 60-63

<sup>37</sup> *Ibid.*, 152-153.

Geological Survey of Canada, the work of Sir Edward Sabine and Sir Henry Lefroy in terrestrial magnetism, and the Toronto Magnetic and Meteorological Observatory.<sup>38</sup> These individual accounts are woven throughout her investigations of the inventorial sciences, often engaging public opinion, the role of the state, and the challenges of the Canadian physical environment.<sup>39</sup> In her discussion of Victorian-era magnetism and meteorology, for example, Zeller states that “one of the most important contributions of these sciences was to encourage Canadians to re-evaluate their position and even their character as a northern people.”<sup>40</sup>

Following on Zeller’s efforts to engage science in a sweeping fashion, Richard Jarrell’s 1988 *The Cold Light of Dawn* tracks the development and maturity of Canadian astronomy.<sup>41</sup> Jarrell engages the educational and institutional infrastructure that emerged as Canada transitioned away from the pre-Confederation practices of ‘colonial astronomy’ devoted to timekeeping and surveying, and embraced a modern astrophysics program in the 20<sup>th</sup> century.<sup>42</sup> While Jarrell traces individual and institutional developments, it is the cultural connections he draws to the process of urbanization, professionalization, and the search for national identity that distinguishes his scholarship from previous work by astronomers. Jarrell concludes that Canadian astronomy followed two distinct patterns of ‘practical’ and ‘pure’ science, shifting to the latter in 1905. Jarrell’s discussion of education in the development of Canadian astronomy examines how curriculum shifted from the liberal arts, to the training of professional astronomers in the late 19<sup>th</sup> century, attributing the pursuit of scientific knowledge to the Dominion

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<sup>38</sup> Ibid., 52-54, 125-6, 272.

<sup>39</sup> Ibid., 52, 126.

<sup>40</sup> Ibid., 116.

<sup>41</sup> Richard A. Jarrell *The Cold Light of Dawn: A History of Canadian Astronomy* (University of Toronto Press: Toronto, 1988), 3-5, 25-6, 55.

<sup>42</sup> Ibid., 58, 87.

Government's nation-building aspirations.<sup>43</sup> The role of science in society is determined by both political and economic conditions, he suggests, incorporating discussions of the developing Canadian state into his narrative.

Zeller and Jarrell seek to understand what is unique in the efforts of Canadian researchers and science. While both Zeller and Jarrell focus on the link between science and culture, their respective conclusions are divergent. Zeller concludes that Canadian science directly influenced the development of the nation on an economic and cultural level. Jarrell, in contrast, agrees that while early Canadian astronomy was invaluable to exploration, timekeeping, and surveying, the field rapidly lost economic relevance for the developing nation following the transition to 'pure' scientific studies at the turn of the 20<sup>th</sup> century.<sup>44</sup> The development of astronomy, both pure and practical, was dependant on the maturity of the Canadian state, in Jarrell's work, and he goes further than Zeller by delving into the cultural importance of astronomy as 'nation building' in a 20<sup>th</sup> century context, as the construction of the DAO announced an unprecedented public investment in Canadian science. Jarrell's work is thorough in its treatment of the broad field of Canadian astronomy, with the author maintaining a balance between the new social history of science and the more traditional institutional studies that defined early works.

Women are largely absent from Jarrell and Zeller's works, as early scientists were predominantly male. As historical studies shifted from the 19<sup>th</sup> to the 20<sup>th</sup> century, and the social history of science became more prominent, new topics came under scrutiny. The Fall of 1988 saw the first issue of *Scientia Canadensis* devoted to women and children in science. Clara Chu and Bertrum MacDonald examined the participation of women in science and technology prior

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<sup>43</sup> Ibid., 58, 62-3, 71, 108-110.

<sup>44</sup> Ibid., 187-88.

to the First World War through a bibliographical analysis. Their study identifies 145 female contributors to Canadian science, detailing their contributions and educational status, and concluding that women authored just 1.4 percent of early Canadian scientific works.<sup>45</sup>

Nevertheless, in documenting the careers of scientists such as Clara Benson, one of the first women to receive a PhD from the University of Toronto, Chu and Bertrum brought gender analysis to the study of Canadian science.<sup>46</sup>

The state remained an important focus for historians of Canadian science, as it played an significant role that differentiates Canada from the United States. The Fall 1991 issue of *Scientia Canadensis* dedicated to celebrating the National Research Council's (NRC) 75<sup>th</sup> anniversary. In their introduction to the issue Richard Jarrell and Yves Gingras trace the development of the NRC, and its decisive influence on 'Canadian' science in the 20<sup>th</sup> century, as much inquiry flowed through or was guided by the NRC.<sup>47</sup> Historians' interest in the NRC can be readily understood given its extensive funding from the Federal government; in 1986 the NRC's expenditure totalled \$408,025,000.<sup>48</sup> Historian Donald Phillipson's article in the same issue notes that the original histories of the NRC were produced by staff members, but beginning in 1978 historians engaged with the topic.<sup>49</sup> Phillipson's overview of the institution, including examinations of the NRC's interactions with Canadian research, and compatibility with

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<sup>45</sup> Clara M. Chu and Bertrum H MacDonalld "Women in Canadian Science and Technology before World War I," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 12, no.2 Issue 35 (1988): 76-77, 85-87, 91.

<sup>46</sup> *Ibid.*, 85.

<sup>47</sup> Richard A. Jarrell, and Yves Gingras, "Introduction: Building Canadian Science," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 15, no.2 Issue 41 (1991): 8.

<sup>48</sup> *Ibid.*, 13.

<sup>49</sup> Donald J. C. Phillipson, "The National Research Council of Canada: Its Historiography, its Chronology, its Bibliography," *Scientia Canadensis: Canadian Journal of the History of Science, Technology, and Medicine* 15, no.2 Issue 41, (1991):177, 179.

provincial agendas, reflects the field's preoccupation with the relationship of Canadian science to the developing state.<sup>50</sup>

Marriane Gosztonyi Ainley and Catherine Millar also contributed to the NRC issue, studying the role of women in the agency between 1916 and 1991. Their work brings a sharp feminist critique to the NRC's representation and promotion of women.<sup>51</sup> In documenting the transition of women from the 'private sphere' into scientific space at the NRC, Ainley and Millar go so far as to condemn "the short-sighted archival policies of the NRC and other government institutions [that] made a detailed study of women's experiences at the NRC practically impossible."<sup>52</sup> The study, nevertheless, contributed to historians' growing interest in engaging themes of gender inequality in the social history of science.

*Scientia Canadensis* featured a second issue on women and gender in Canadian science in the Fall of 2006. Introducing the issue, historian Ruby Heap argued that since the 1988 issue "feminist historians [have] incorporated... new insight, concepts and theoretical frameworks emanating from other disciplines."<sup>53</sup> Reprising the trend, Alison Prentice's featured article studied women's participation in the University of Toronto graduate physics program over the late nineteenth and twentieth century, providing a welcome emphasis on their drive and passion for science. Identifying three expansionist periods of female participation in the program — 1890-1933, 1943-1961, and 1962-1990 — Prentice follows the employment of graduates and finds that of the 146 women employed in research or education in the university between 1900

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<sup>50</sup> Ibid., 190.

<sup>51</sup> Marianne Gosztonyi Ainley et Catherine Millar, "A Select Few: Women and the National Research Council of Canada, 1916-1991," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 15, no.2 Issue 41, (1991): 105.

<sup>52</sup> Ibid., 106, 109.

<sup>53</sup> Ruby Heap, "Introduction: Women and Gender in Canadian Science, Engineering and Medicine," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 29, no. 2 (2006): 6.

and 1920, an impressive twenty-five were physicists.<sup>54</sup> Women continued to have an important presence in the department until the 1940s when opportunities for female scientists rapidly declined, a decline that Prentice attributed to family obligations.<sup>55</sup> The completion of PhDs by women also declined following the 1920s, only resuming in the early 1960s with the growing awareness of women's rights movements.<sup>56</sup> Prentice successfully avoids presenting a linear account of women and progress in science, relating the rise and fall of opportunity to changing social and cultural trends.

Increasing interdisciplinarity has recently seen environmental history become an important aspect of the history of Canadian science through its power to assess the function of the natural world. Stephen Bocking's history of science and the environment in northern Canada provides a representative example. In Canada, he observes, "science has proven to be an effective instrument in the extension of authority over space."<sup>57</sup> Through an examination of scientific studies of wildlife and ecological diversity, Bocking argues that state-sponsored scientific exploration featured an exchange where scientists both shaped, and were shaped by the north as they adapted their methods to match environmental challenges in the region. Following established trends in the history of Canadian science, Bocking asserts both the NRC's importance and the economic interests of industry in using science to colonize Canada's North. Bocking presents a persuasive argument for how science and the environment interact, a striking departure from the institutional frameworks of early works on Canadian science that underscores the necessity of interdisciplinary skills.

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<sup>54</sup> Alison Prentice, "A Blackboard in Her Kitchen: Women and Physics at the University of Toronto," *Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine* 29, no. 2 (2006): 17-8, 21.

<sup>55</sup> *Ibid.*, 28-9, 40.

<sup>56</sup> *Ibid.*, 30.

<sup>57</sup> Stephen Bocking, "Science and Spaces in the Northern Environment," *Environmental History* 12, no. 4 (Oct., 2007): 867-894: 869, 882-86.

Julie Cruikshank's *Do Glaciers Listen?* provides a remarkable example of the new and exciting direction the history of science can follow by integrating new perspectives. While it is unlikely she would consider her work to be a history of science, Cruikshank's study of glaciers in Athapaskan and Tlingit First Nations' culture illustrates how historians can engage science from a post-colonial perspective through the use of Traditional Ecological Knowledge (TEK).<sup>58</sup> Cruikshank examines how glaciers appear in both Indigenous and European memory, counterposing First Nation's conceptions of glaciers as sentient entities to Western understandings of geophysics. Promoting an exchange capable of going in both directions, Cruikshank illustrates how TEK can inform modern preoccupations with climate shift through the use of oral traditions from the Little Ice Age, complimenting Western scientific outlooks.<sup>59</sup> A liberal use of this approach could potentially reorient the history of science, transcending certain limitations imposed by Western approaches and reconceptualizing what constitutes scientific knowledge. Her argument that glaciers, scientific entities from a Western perspective, function as cultural actors offers a broader definition of 'Canadian science.'<sup>60</sup> While this immediately suggests Indigenous studies, it could be applied to various forms of 'local knowledge,' examining cultural connections between agriculture and towns on the prairies, or fishing on the Newfoundland coast. In this sense I view Cruikshank's work as a potential start to the conversation on 'new' forms of the history of Canadian science that transcend the paradigms of Western knowledge.

The history of Canadian science has grown from a loose collective of scientists and historians, to an important fixture of interdisciplinary exchange, although the validity of

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<sup>58</sup> Cruikshank, *Do Glaciers Listen?: Local Knowledge, Colonial Encounters & Social Imagination* (Vancouver: UBC Press, 2005), 3-4, 181-2.

<sup>59</sup> *Ibid.*, 41-45, 69, 248-50.

<sup>60</sup> *Ibid.*, 220-21, 255-56.

Canadian science as a *historical* field continues to provoke discussion. In the past thirty years efforts of Canadian historians have established the realities of a ‘Canadian’ science, and the institutional roots of the history of science have given way to a broad spectrum of approaches. Nevertheless, the adoption of broader theoretical frameworks such as Cruikshank’s use of oral tradition and TEK stands out as an important example of new directions the history of Canadian science can take. Like the atomic awareness of the Cold War that sparked new interest in the history of science, increasingly creative approaches will be important for the continued development of the field.

The historiography of Canadian astronomy developed within the broader field of Canadian science, and exhibited the tendencies in the above discussion. For example, W. E. Harper’s chapter in Tory’s *A History of Science in Canada*, lacked the scope of historian Richard Jarrell’s studies on Canadian astronomy.<sup>61</sup> In a collection that defines the historiography of Canadian astronomy Jarrell examines the contrast between the utilitarian motivations of the Dominion government for accurate timekeeping, and the foundation these early relationships formed for Canadian astronomy in the twentieth century.<sup>62</sup> Beginning in the late 1970s Jarrell shifted his focus towards the history of early twentieth century astronomy, with publications on the development of astrophysics during the institutionalization of Canadian astronomy at the Dominion Observatory, and following Kuhn’s example, assessing Einstein’s theory of Relativity

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<sup>61</sup> W. E. Harper, “The History of Astronomy in Canada.”

<sup>62</sup> R. A. Jarrell, “Origins of Canadian Government Astronomy,” *JRASC* 69, no.2 (1975): 77-85; Richard A. Jarrell, “The Origins of the Dominion Observatory, Ottawa,” *Journal of the History of Astronomy* 22, (1991): 45-67; Richard A. Jarrell, “The Instrument was Instrumental: Plaskett’s Telescope and Canadian Astronomy Between the Wars,” *JRASC* 87, no.4 (1993): 218-222; John H. Hodgson, *The Heavens Above and the Earth Beneath: A History of the Dominion Observatories Part 2 1946-1970* (Ottawa: Geological Survey of Canada, 1994); Richard Jarrell, “The Formative Years of Canadian Radio Astronomy,” *JRASC* 91, (February, 1997): 20-27; Richard A. Jarrell, “J. S. Plaskett and the Modern Large Reflecting Telescope,” *Journal of the History of Astronomy* 30, (1999): 359-390.

in the Canadian context.<sup>63</sup> These articles provide a foundation for the more expansive accounts of Canadian astronomy that would emerge during the 1980s, highlighted by Jarrell's survey of colonial and modern astronomy, *The Cold Light of Dawn*.<sup>64</sup> Historians continued to share the field with scientists such as J.H. Hodgson, former director of the Physics Branch of Energy Mines and Resources, whose history of Canadian Astronomy drew upon his institutional knowledge.<sup>65</sup> Hodgson presents an extensively researched study of the Dominion observatories, organized to follow the respective administrations of the Chief Astronomer. His scientist's perspective complemented Jarrell's more scholarly inquiries into the intersection of science and state policy. George Webb's 2003 contribution helped to reorient our understanding of the DAO, exploring the relationship between the budding institution and the community that would host it.<sup>66</sup> While incorporating technical information into his narrative, Webb's focus on "society" surpasses both Jarrell and Hodgson through his ability to engage the social importance of science for Victorians.

The historical study of Canadian astronomy did not develop in isolation, drawing upon an international literature. General histories appearing in the 1960s presented broad, technical chronicles of early 20<sup>th</sup> century astronomy, a practice continued by David Leverington's *History of Astronomy* almost thirty years later.<sup>67</sup> At the same time, more focused accounts emerged on various fields of astronomy such as cosmology, astrophysics, and the historical development of

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<sup>63</sup> R. A. Jarrell, "The Birth of Canadian Astrophysics: J. S. Plaskett at the Dominion Observatory," *JRASC* 71, no.3 (1977): 221-233; Richard A. Jarrell, "The Reception of Einstein's Theory of Relativity in Canada," *JRASC* 73, no.6 (1979): 358-369.

<sup>64</sup> Jarrell, *The Cold Light of Dawn*.

<sup>65</sup> J. H. Hodgson, *The Heavens Above and the Earth Beneath: A History of the Dominion Observatories, Part 1 to 1946* (Ottawa, Geological Survey of Canada: 1989).

<sup>66</sup> George E. Webb, "Victoria Welcomes the Dominion Astrophysical Observatory: Science and Society in the Pacific Northwest," *The Pacific Northwest Quarterly* 94, no.4 (Fall, 2003): 171-182.

<sup>67</sup> Otto Struve and Velta Zebergs, *Astronomy of the 20<sup>th</sup> Century* (New York: The Macmillan Company, 1962); David Leverington, *A History of Astronomy: From 1890 to Present* (London: Springer-Verlag, 1995).

telescopes.<sup>68</sup> Institutional histories remained prominent, with many dedicated to the ‘great observatories’ of the American Pacific Coast. Donald E. Osterbrock made significant contributions to the history of the Lick Observatory in the 1980s through his work on early astronomers Edward Holden and James Keeler, culminating in a popular history of the institution’s first century of operation.<sup>69</sup>

Recent works, such as Maracia Bartusiak’s *The Day We Found the Universe*, reflect a rewarding engagement with American Astronomer Edwin Hubble’s discovery of galactic bodies, and early evidence of the expansion of the universe.<sup>70</sup> Bartusiak’s work successfully weaves a detailed but accessible discussion of the science behind Hubble’s research, while imparting the cultural and scientific influence of these discoveries. These international works inform the studies of Canadian historians through their shared timelines, corresponding subject matter, and the generally collaborative nature of North American astronomy. Robert Smith’s narrative on the history of the stellar system is an excellent treatment of the international, multifaceted nature of scientific discovery, incorporating contributions from Canadian, American, and European astronomers in his discussion of the Milky Way galaxy.<sup>71</sup>

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<sup>68</sup> J. D. North, *The Measure of the Universe: A History of Modern Cosmology* (Oxford: University of Oxford Press, 1965); Richard Berendzen, Richard Hard, and Daniel Seeley, *Man Discovers the Galaxies* (New York, Science History Publications, 1976); Henry C. King, *The History of the Telescope* (New York: Dover Publications Inc., 1979, originally published 1955); Owen Gingerich ed. *Astrophysics and Twentieth-Century Astronomy to 1950 The General History of Astronomy, 4A* (Cambridge: Cambridge University Press, 1984).

<sup>69</sup> Donald E. Osterbrock, “The Rise and Fall of Edward S. Holden: Part 1,” *Journal of the History of Astronomy* 15, (1984): 81-127; Donald E. Osterbrock, “The Rise and Fall of Edward S. Holden: Part 2,” *Journal of the History of Astronomy* 15m (1984): 151-175; Donald E. Osterbrock, *James E. Keeler: Pioneer American Astrophysicist* (Cambridge: Cambridge University Press, 1984); Donald E. Osterbrock, John R. Gustafson, and W. J. Shiloh Unruh, *Eye on the Sky: Lick Observatory’s First Century* (Berkeley: University of California Press, 1988).

<sup>70</sup> Maracia Bartusiak, *The Day we Found the Universe* (New York: Vintage Books, 2010, originally published 2009).

<sup>71</sup> Robert W. Smith, “Beyond the Big Galaxy: The Structure of the Stellar System 1900-1952,” *Journal of the History of Astronomy* 37, (2006): 307-342.

My study seeks to build on all of the above literature. Chapter one will treat the emergence of the Canadian astrophysics program at the Dominion Observatory in Ottawa and the nationalistic sentiments that promoted the political will for the DAO project. Focusing on the process that led to the construction of what was for a short time the world's largest telescope, this chapter will treat the rapid development of astrophysics in the early twentieth century, and the modernization of Canadian astronomy between 1905 and 1914. My second chapter will address the hope and promise the new facility represented, and the challenges of wartime construction between 1914 and 1918. It will also examine the early promotional efforts of J.S. Plaskett to foster support from Victorians for the new telescope. Chapter three will engage scientific discovery, the growing reputation of Canadian astronomy, and the development of a sophisticated program for public engagement between 1918 and 1941.

The construction of the DAO between 1914 and 1918 symbolized a growing national commitment to science, and contributed to Victoria's identity during the 1920s and 30s. As Canada's first 'big science' infrastructure project and preeminent astrophysical institution, the DAO modernized the Canadian astronomy program, developing an international reputation of excellence. Following its construction the DAO operated as a destination of 'high culture,' accommodating political and social elites. Promotional initiatives that began in 1914 transformed the facility into an important tourism destination for Victoria, and redefined the international reputation of the city as a scientific centre for astronomy. This study will build on the foundation provided by Jarrell, Hodgson, and in particular Webb, to examine the social and cultural relationship between the DAO, science, and the city of Victoria. Both Hodgson and Jarrell provide detailed institutional accounts of the DO and DAO, but the latter's work lacks the regional focus to fully develop the significance of the facility for Victorians. While Webb seeks

to situate the observatory as a part of Victoria's early twentieth century development, my study will expand this focus to incorporate the first twenty years of the facility's operation and its enduring importance to science, education, and civic pride.

## Chapter 1 – “A telescope more in keeping with her character and aspirations:” The Formation of Canadian Astrophysics 1903-1914

The first director of Victoria British Columbia’s Dominion Astrophysical Observatory (DAO), John Stanley Plaskett, remarked in 1918 that the institution represented a “second epoch in the history of astronomical research in Canada.”<sup>72</sup> From the perspective of the international community, however, it was surely the first. Nationalism was a critical force in the construction of the observatory. The Dominion Government’s aspiration to construct the world’s largest telescope emerged in part from the nationalistic desire to announce the maturity of the Canadian state.<sup>73</sup> Until the turn of the twentieth century, the fledgling Canadian astronomy program experienced slow growth, limited educational facilities, and insufficient infrastructure. While the American astronomy program transitioned to address the new field of astrophysics, Canadian Chief Astronomer Dr. William King shifted Canadian astronomy away from its original emphasis on boundary setting, navigation, and timekeeping to its emergence as a modern, professionalized field devoted to scientific research. As British Columbia emerged as an urbanized province and Canada began to take a more prominent place on the world stage, Plaskett looked south to the United States, seeking to engage the growing field of astrophysics. Plaskett and King harnessed public and political interest to develop the infrastructure required to facilitate a continuing professional astronomy program for Canadians. Ultimately, while the

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<sup>72</sup> J. S. Plaskett, “The 72-Inch Reflecting Telescope of the Dominion Astrophysical Observatory, Victoria B.C.,” *Publications of the Astronomical Society of the Pacific* 30, no.177 (San Francisco 1918): 266.

<sup>73</sup> Jarrell, *The Cold Light of Dawn*, 5, 110, 187-8; J. S. Plaskett, “Description of Building and Equipment,” *Publications of the Dominion Astrophysical Observatory* 1, no.1 (1918): 103.

nationalist goal of building the world's largest telescope fell short, a highly modernized and successful astrophysical program emerged between 1903 and 1919.<sup>74</sup>

An analysis of newspapers and contemporary astronomy publications demonstrates that Victoria's DAO had both local and national importance. During much of the observatory's construction process between 1914 and 1918, Canada was involved in the First World War. The financial and logistical constraints of organizing this civil project during a period of high inflation and wartime conditions suggests a high degree of dedication among astronomers, politicians, and Victoria's residents during the observatory's development. Indeed, the observatory was constructed on the leading edge of a new approach to astronomy. Between the late nineteenth and early twentieth century astronomers shifted from refractor to reflector technologies, grounded in work conducted at the recently developed Lick and Mt. Wilson observatories in California. Thanks to these new instruments astronomy received greater levels of public exposure, with theories regarding the size and scale of the universe emerging as a precursor to the field of cosmology.<sup>75</sup> The excitement surrounding the developing field of astrophysics, combined with the prospect of constructing the world's largest telescope, generated support for the Victoria facility from both political elites and the local population. For Canadians the observatory symbolized the efforts of a rapidly modernizing nation. For Victorians the

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<sup>74</sup> The American Mt. Wilson Observatory completed the Hooker 100 inch telescope in 1917; however, mechanical issues prevented the telescope from realizing full operation until almost a year later. This left the Victoria telescope as the largest operational telescope for nearly six months following its completion in 1918. The noted date range between 1903-1919 begins with the hiring of Plaskett at the Dominion Observatory (DO) Ottawa in 1903, and extends to the first established staff of the Dominion Astrophysical Observatory Victoria in 1919 (J. S. Plaskett, R. K. Young, W. E. Harper, and H. H. Plaskett). Richard Jarrell successfully establishes the origins of Canadian Astrophysics at the DO between 1906 and 1911, which laid out the staff and research focus (radial velocities) for Canadian astronomers. This program was then modernized and expanded with the construction of the DAO; Richard A. Jarrell, "The Birth of Canadian Astrophysics: J. S. Plaskett at the Dominion Observatory," *The Journal of the Royal Astronomical Society of Canada* 71, no.3, (June, 1977): 221-233.

<sup>75</sup> For an engaging account of the advent of cosmology, including work done in this period at the Lick and Mt. Wilson observatories see Maracia Bartusiak, *The Day we Found the Universe*, (New York: Pantheon Books, 2009).

telescope enhanced local prestige, representing opportunities for economic growth through tourism promotion.

While the pursuit of scientific astronomy was a new direction for Canada, different groups had long employed astronomy as a tool. Aboriginal populations and European explorers used the stars as navigational aids. Early Canadian astronomical pursuits consisted of “practical astronomy,” focused not on research, but on time keeping and geographical mapping.<sup>76</sup> Broader scientific aspirations in conjunction with these practical goals contributed to the completion of the Dominion Observatory (DO) in Ottawa in 1905. The Ottawa observatory was equipped with the standard telescope design of the day: a refractor.<sup>77</sup> During the 1890s great American observatories of the Pacific Coast, in contrast, began to transition away from refractors as the standard of telescope design.

Reflector telescopes, using large mirrors to form an image, began to see professional use in the final years of the nineteenth century. Upon its completion in 1888, the Lick Observatory on Mt. Hamilton on the California coast employed a thirty-six inch refractor.<sup>78</sup> In 1895 English astronomer Edward Crossley donated a thirty-six inch glass-mirror reflecting telescope to the

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<sup>76</sup> Jarrell, *The Cold Light of Dawn*, 31.

<sup>77</sup> Refractors incorporate large glass lenses precisely shaped to focus light into an image. This required polishing a minimum of two surfaces, and often four surfaces, in an exact manner to render an accurate image. Producing lenses for large refractors became increasingly difficult with exacting demands for the quality of materials. The presence of any bubbles in the glass objective negatively impacted the image of the telescope. Lenses were also thick and heavy and mounting large refracting telescopes required expensive, rigid structures to support the weight of the objective lens at the end of the tube. Aside from cost, refractors had other drawbacks, as they absorbed light at each end of the visible spectrum, limiting their effectiveness for spectroscopy. Refractors also suffered from chromatic aberration and spherocromatism, resulting in unfocused light, similar to the effect of passing light through a prism. Adequately correcting these errors for scientific research required relatively long focal lengths that in turn limited the imaging effectiveness of a refractor by increasing the length of time required to expose a photograph.

<sup>78</sup> For an excellent history of the Lick Observatory and the Lick Refractor see; Donald E. Osterbrock, John R. Gustafson, and W. J. Shiloh Unruh *Eye on the Sky: Lick Observatory's First Century* (University of California Press, 1988); Donald E. Osterbrock, *James E. Keeler: Pioneer American Astrophysicist and the early development of American astrophysics* (Cambridge: Cambridge University Press, 1984).

Lick Observatory.<sup>79</sup> James Keeler, a former Lick staff astronomer, assumed the directorship of the facility in 1898. Keeler, returning to Lick from the Allegheny Observatory in Pittsburgh quickly recognized the potential of the reflecting telescope for imaging and work in spectroscopy.<sup>80</sup> The Crossley telescope was in deplorable condition upon delivery in 1896, having sat idle for three years. Keeler refitted the reflector and began photographing spiral nebula in the spring of 1899, revealing previously unseen detail in the brighter nebulas, cloudlike objects of unknown origin in deep space.<sup>81</sup> Historian Donald Osterbrock observes that modern reflectors like the Crossley “had a long enough focal length to show the fine detail [in nebulas], and a fast enough focal ratio to record the faint diffuse nebulosity.”<sup>82</sup> Under Keeler’s guidance the Crossley’s wide field of view showed that spirals were prevalent throughout the sky. His photographs revealed faint nebula and spirals in the background of each photograph he captured,

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<sup>79</sup> Osterbrock et al, *Eye on the Sky: Lick Observatory’s First Century*, 96-98. Reflector telescopes were both more affordable, and allowed a higher rate of light transmission relative to refractive optics. Reflectors also had the benefit of focusing all wavelengths of light at a single point, as they do not experience the chromatic aberration commonly found in the refractive optics of this period. Glass also absorbs parts of the visual spectrum, limiting the applicability of the instruments to spectroscopy. Reflectors had been an unpopular choice due to their reliance on surrounding conditions, namely atmospheric stability, and a historical tendency to craft them from metal plates (speculum mirrors). With new techniques developed that allowed a fine layer of silver to be deposited on a glass mirror, the telescopes gained increasing popularity due to the relative simplicity of finely figuring one surface instead of the four required by a refractor.

<sup>80</sup> *Ibid.*, 124.

<sup>81</sup> Osterbrock, *James E. Keeler: Pioneer American Astrophysicist*, 314; In the early twentieth century the term nebula represented objects of unknown origin in the night sky. Prior to Hubble’s discovery of extra-galactic systems there was a great deal of uncertainty on the different types of nebula. Two competing theories for spiral nebula imagined them as both young stars being born, and distant star clouds. The latter was established by Hubble in 1925. Within the Milky-Way galaxy nebulas are collections of dust and gas. They can be divided into three main types: emission, reflection and dark. Emission nebula accompany star-forming regions within the galaxy, emitting light due to ionization or excitement from the proximity of hot young stars in a manner similar to florescent light bulbs. In contrast reflection nebula are gas clouds that merely reflect the light of nearby stars. Dark nebula consist of gas clouds that block line of sight and absorb light, appearing as dark patches in the night sky.

<sup>82</sup> For a scientific instrument the focal ratio and focal length of an optical system are two terms that work together to describe how it functions either visually or photographically. The focal length of a telescope is an expression of the length of the optical path for an optical system. In practical terms, when paired with a standard photographic plate the focal length determines the effective magnification and field of view for an image. The focal ratio is the ratio of the focal length and the aperture or diameter of the primary objective. The ‘focal ratio’ is a general term for the photographic speed of an instrument, suggesting how quickly it can gather light. As higher focal lengths or magnifications spread out light on a photographic plate there are fewer photons of light falling on a given area of the plate. Balancing the focal ratio of a telescope was increasingly a challenge as film is weakly sensitive to light, requiring higher speed instruments to produce usable images; *Ibid.*, 306; Bartusiak, *The Day we Found the Universe*, 28.

leading him to a conservative estimate that upwards of 120,000 unknown objects existed within reach of the Crossley.<sup>83</sup> In discovering an unprecedented number of new nebula Keeler demonstrated the potential of reflector telescopes, influencing a new generation of observatories. His observational work reignited a historical debate over spiral nebula, a class of nebula that were later determined to be galaxies. The work done with these early reflectors helped introduce the widespread use of photography by astronomers. However, it would be another decade before Canadian astronomers realized the potential of these instruments.

Historian Richard Jarrell has called Ottawa's DO a "splendid observatory that no one needed."<sup>84</sup> The facility was initially intended to provide time-keeping services to the Dominion, while allowing the staff to pursue scientific studies. The Canadian astronomy program in 1903 hardly warranted the \$300,000 commitment made by the federal government to build the facility.<sup>85</sup> With just a handful of trained astronomers, and no meaningful post-secondary programs, the Dominion Observatory was built without a widespread demand. The facility was too grand for the straightforward task of time keeping, but was devised and constructed at great cost while a technological transition between refracting and reflecting technologies occurred within the larger astronomical community. Measuring only fifteen inches in diameter, the telescope met the initial needs of the DO but had little to offer on the frontiers of the developing field of astrophysics. Nevertheless astronomer and mechanic John Stanley Plaskett, hired in 1903, helped the DO develop an international reputation that was critical to the Canadian astronomy program.

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<sup>83</sup> James E. Keeler: *Pioneer American Astrophysicist*, 315, 346-7.

<sup>84</sup> R. A. Jarrell, "A Splendid Observatory that No One Needed: the Origins of the Dominion Observatory, Ottawa," *Bulletin of the American Astronomical Society* 21, (1989): 1229-1230.

<sup>85</sup> This is the figure Jarrell provides. Hodgson's history places the cost of the unfinished observatory at \$93,800, for the building alone in an estimate from public works instead of the completed cost; Jarrell, *The Cold Light of Dawn*, 55; Hodgson, *The Heavens Above and the Earth Beneath*, 20.

Dr. William King, observatory director and Canada's Chief Astronomer in the Department of the Interior, hired Plaskett during construction and named him a staff astronomer in 1905.<sup>86</sup> Historians Richard Jarrell and George Webb agree that the development of Canadian astronomy rested on the reputation that Plaskett gained with his work in this position.<sup>87</sup> In Plaskett, King found an uncommon blend of scientific ability and mechanical aptitude. Plaskett arrived at astronomy late in life. Born on an Ontario farm in 1865, he had worked as a machinist for a Woodstock engineering firm, as electrical engineer for the Edison Company, and as the foreman of the University of Toronto machine shop where he also received formal training in physics and mathematics.<sup>88</sup> Plaskett's interest in astronomy led him to complete a mathematics and physics degree while he worked, graduating with honours from the University of Toronto at the age of thirty-four in 1899.<sup>89</sup> Even in these early years Plaskett's research began to appear in the public eye; his experiments with tri-coloured film at the University of Toronto drew mention in an advertisement for Cadett photographic plates that appeared in the April 1901 *Globe*.<sup>90</sup> Though not hired as a professional astronomer until his late 30s, his experience in mechanics and engineering would be invaluable for the research paths he followed.

The adoption of contemporary research practices in conjunction with infrastructure development modernized the Canadian astronomy program in the early twentieth century. Pursuing astrophysics as a specialty, Canadian astronomers gained stature as members of the

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<sup>86</sup> Ibid., 89.

<sup>87</sup> Richard A. Jarrell, "The Birth of Canadian Astrophysics: J. S. Plaskett at the Dominion Observatory," *The Journal of the Royal Astronomical Society of Canada* 71, no.3 (June, 1977): 221-222; George E. Webb, "Victoria Welcomes the Dominion Astrophysical Observatory: Science and Society in the Pacific Northwest," *The Pacific Northwest Quarterly* 94, no.4 (Fall, 2003): 171-182, 173.

<sup>88</sup> J. H. Hodgson, *The Heavens Above and the Earth Beneath: A History of the Dominion Observatories, Part 1 to 1946* (Ottawa, Geological Survey of Canada:1989), 20.

<sup>89</sup> Ibid.

<sup>90</sup> "Color Value," *Globe*, April 13, 1901, 2; Hodgson, *The Heavens Above and the Earth Beneath*, 20.

international science community. The invention of sensitive photographic plates revolutionized the astronomical profession. The first experiments to capture celestial objects were done with ‘wet’ plates in the 1840s. These early plates required astronomers to expose their object immediately after the plate had been prepared, a messy and complicated process. By the 1880s ‘rapid dry’ photographic plates had been developed, providing incredible latitude for exposures, and allowing astronomers to gather light from a given target for hours.<sup>91</sup> As a consequence of these advances two major branches of astronomy, astrophysics and photometry, began to dominate the professional field. This was not always a smooth transition. “During the 1880s and 1890s” John Lankford observes, “the clash between the old and new astronomies frequently manifested itself in disputes over the scientific value of photography.”<sup>92</sup> Photometry evaluated the size and distance to different stellar and non-stellar objects by measuring the intensity – or brightness – of objects on photographic plates. Also reliant on photography, the field of astrophysics studied the physical nature of the celestial bodies, a significant departure from traditional astronomy’s emphasis, limited to mapping and measuring the position of those bodies.<sup>93</sup> In these formative years, astrophysicists relied on spectrographs, breaking apart the light of objects, allowing them to examine the physical properties and motions of a celestial object.<sup>94</sup> Canadian astronomers initially devoted their efforts to the geodetic survey. Under King Canadian astronomy incorporated studies of both astrophysics and photometry in preparation for the completion of the DO in 1905.

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<sup>91</sup> John Lankford, “The Impact of Photographic Plates on Astronomy,” in *Astrophysics and Twentieth-Century Astronomy to 1950: Part A*, edited by O. Gingerich (Cambridge: Cambridge University Press 1984): 16, 23.

<sup>92</sup> *Ibid.*, 26.

<sup>93</sup> A. J. Meadows, “The Origins of Astrophysics,” in *Astrophysics and Twentieth-Century Astronomy to 1950: Part A*, edited by O. Gingerich (Cambridge: Cambridge University Press, 1984): 3.

<sup>94</sup> Historically celestial objects were considered to be exotic bodies, utterly different from the chemical makeup of the Earth. By combining spectrographs with large telescopes astronomers were able to calibrate their observations of stellar and non-stellar objects with an atomic ‘fingerprint,’ and determine that while the relative abundance of chemicals in a star differed from those on the Earth, they were made of the same basic ‘stuff,’ or elements.

Following King's recommendation, Clifford Sifton, Liberal Minister of Interior, formally appointed Plaskett as the DO's mechanical superintendent in 1903. With his physics degree, Plaskett was well positioned to make significant contributions to the astrophysics programs at the new observatory. A brief article in the *Globe* covered Plaskett's promotion, detailing his qualifications and the duties he would assume in Ottawa, which would include "work in spectrum analysis and stellar spectroscopy, for which he is peculiarly fitted on account of his special training and qualifications."<sup>95</sup> Plaskett was promoted to full astronomer with the institution's completion in 1905.<sup>96</sup> Robert M. Stewart, with degrees in mathematics and physics from the University of Toronto, was also hired for the new institution. In his diary Otto Klotz, the only other full astronomer aside from King prior to Plaskett's appointment in 1905, lamented this promotion among other staffing choices. "I don't think there's an office in the government where less work is done," he noted; "we are overmanned and there is a lack of system and order."<sup>97</sup> The first year of work at Ottawa was indeed slow. Under King's guidance Plaskett and representatives of the Royal Astronomical Society led an eclipse expedition to Labrador in 1905. Plaskett's mechanical skills remained important, as he "designed a total of three cameras and three spectroscopes" for the trip, each with a unique purpose.<sup>98</sup> Unfortunately, clouds ruled the day, and the astronomers failed to make any observations despite almost six months of preparation.

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<sup>95</sup> "Plaskett Promoted," *Globe* March 16, 1903, 4.

<sup>96</sup> Jarrell, *The Cold Light of Dawn*, 89; Hodgson, *The Heavens Above and the Earth Beneath*, 20-1.

<sup>97</sup> Klotz quoted in Hodgson, *The Heavens Above and the Earth Beneath*, 21.

<sup>98</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 32.

The rudimentary equipment limited achievements at the DO.<sup>99</sup> Following the eclipse expedition, the astronomers there focused on improving the observational capacity of the new institution. Plaskett and Stewart combined their efforts to improve the mechanical function of the refracting telescope. Plaskett also modified the observatory's spectrograph, a tool for analyzing the chemical properties of an object through its light, in an effort to increase its performance for astrophysical research.<sup>100</sup> The close link between spectroscopy and astrophysics in this period challenged telescopes. Spectroscopes were designed to break down the light of a celestial object into its composite wavelengths – think of the way a prism forms a rainbow – allowing for a range of evaluations. The only drawback of this approach was the difficulty of forming a useably bright image on film. Plaskett's interest in spectroscopy drove him south to visit the 'great observatories' of the United States, where he built relationships with American astronomers while refining his knowledge on spectroscopy.<sup>101</sup> Through such collaborations, Plaskett became a world leader in spectrograph design while helping the Canadian astronomy program take its first steps into the world of astrophysics.

Between 1905 and 1912 Plaskett, in conjunction with King, oversaw the formation of a Canadian astrophysics staff.<sup>102</sup> In July 1906 King hired William E. Harper, another University of Toronto graduate.<sup>103</sup> Ralph E. Delury and R. M. Motherwell also joined the astrophysics division

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<sup>99</sup> J.S. Plaskett, "The History of Astronomy in British Columbia," *Journal of the Royal Astronomical Society of Canada* 77, no.3 (1983): 108-120, 116. This is a post-humus publication of a manuscript from a talk delivered in the late 1930s, likely the December 1939 RASC meeting, see editors note page 108.

<sup>100</sup> Jarrell, *The Cold Light of Dawn*, 93; Hodgson, *The Heavens Above and the Earth Beneath*, 32, 35.

<sup>101</sup> Jarrell, *The Cold Light of Dawn*, 93-4.

<sup>102</sup> Jarrell provides a detailed account of the development of a Canadian astrophysics staff, as well as the inter-personal dynamics that defined professional relationships within the Astronomy Branch under the King Administration; Jarrell, "The Birth of Canadian Astrophysics," 225.

<sup>103</sup> Harper joined Plaskett at the Victoria observatory in 1919 following its construction. He succeeded Plaskett as the director of the institution in 1935; Hodgson, *The Heavens Above and the Earth Beneath*, 35.

in 1907, followed by J. B. Cannon and T. H. Parker in 1910.<sup>104</sup> Reynold K. Young, who would be an important observer in Victoria, joined the division in 1912. Together Plaskett and Harper began an observational program for spectrographic binary stars, pairs of stars that could only be detected through the analysis of spectra.<sup>105</sup> After years of productive research the astrophysical staff at the Dominion Observatory had nearly exhausted the binary stars within reach of the telescope. For his efforts Plaskett was elected a fellow of the Royal Society of Canada in 1910, and received an honorary doctorate in science from the University of Pittsburgh in 1913.<sup>106</sup> Of the observatory staff King and Klotz were also elected to the Royal Society of Canada, and received *Legum Doctor* degrees from the University of Toronto amongst other honors.<sup>107</sup>

The work of DO staff contributed to the growing cultural and national identity of Canadian astronomy. Speaking in Toronto during the construction of the DO, King observed that Canadian astronomy remained in its formative stage. “Owing to the necessity of our students earning their own livings,” he explained, “they naturally turned to the branches of science from which they could derive practical results, and therefore astronomy had not made as great progress here as in old and more wealthy countries.”<sup>108</sup> When the DO opened, *Globe* readers learned that the facility represented “another step in Canada’s advance towards nationhood.”<sup>109</sup> The observatory was just one of numerous public infrastructure projects sponsored by the Laurier Administration, including the National Museum, the Royal Mint, and the National

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<sup>104</sup> Jarrell, “The Birth of Canadian Astrophysics,” 225.

<sup>105</sup> Jarrell, “The Birth of Canadian Astrophysics,” 228; Hodgson, *The Heavens Above and the Earth Beneath*, 35

<sup>106</sup> “In the Public Eye,” *Ottawa Evening Journal*, March 27, 1913, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.; Hodgson, *The Heavens Above and the Earth Beneath*, 29; the Digital News Clipping Archive maintained by the DAO is a collection of historical articles relating to facility staff. The archive is extensive, but incomplete, with unknown origins or dates for some articles. As a result using the collection included additional research to confirm publishers and dates.

<sup>107</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 29.

<sup>108</sup> “Astronomy in Canada,” *Globe*, November 7, 1902, 2.

<sup>109</sup> “Dominion Astronomical Observatory at Ottawa,” *Globe*, September 23, 1905, A4.

Archives.<sup>110</sup> Canadians read that the “Parliamentary Press Gallery were star-gazing” during a tour of the Ottawa observatory.<sup>111</sup> In a tradition that would continue a decade later in Victoria the Ottawa observatory held public nights. The grounds were open daily, and King scheduled public viewings each Saturday night. Six months following its construction the guest-book had already registered 2,666 names.<sup>112</sup> A *Globe* journalist eager for Toronto to take part in astronomy’s advance, hoped that “Toronto, as well as Ottawa will in the near future be made the home of a first-class astronomical... observatory. If the Commonwealth of Australia can support four such institutions, it is clear that Canada, with its greater population, might well maintain two.”<sup>113</sup>

While Toronto would wait thirty years for the construction of the David Dunlap Observatory, the *Globe* was content to report on discoveries and public events hosted by members of the Ottawa observatory. Plaskett’s discovery of a new comet in June 1907 gained front-page mention in the *Globe*, encouraging Canadians to look for it in the night sky.<sup>114</sup> The following year, members of the Toronto chapter of the Royal Astronomical Society received a lecture on the optics of the Dominion Observatory.<sup>115</sup> “Science was a function of the state in Canada” historian George Webb notes, and articles in the *Globe* credited Sifton with the construction of the new facility, arguing he “was impressed by the necessity of making an advance in scientific research as well as in industrial enterprise.”<sup>116</sup> The reputation of excellence the Ottawa staff earned in the public eye provided persuasive motivation for Canadian politicians’ continued support of the national astronomy program. The importance of this support

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<sup>110</sup> Ibid.,

<sup>111</sup> “A Visit to the New Dominion Observatory,” *Globe*, May 1, 1905, 1.

<sup>112</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 68.

<sup>113</sup> “Observatories in the Empire,” *Globe*, August 29, 1903, 9.

<sup>114</sup> “Comet Coming Along,” *Globe*, June 28, 1907, 1.

<sup>115</sup> “The Optics of the Telescope,” *Globe*, June 16, 1908, 12.

<sup>116</sup> Webb, “Victoria Welcomes the Dominion Astrophysical Observatory,” 172; “A Visit to the New Dominion Observatory,” 1.

cannot be understated, as by 1910 it was apparent that the refractor at the Dominion Observatory had reached the limits of its utility for astrophysics, and Canadian scientists required a larger telescope.

Refractors reached their feasible limits with the construction of the forty-inch telescope at the Yerkes Observatory in Wisconsin, orchestrated by George Ellery Hale in 1897. This project signified a sort of finale for refracting telescopes, as Hale abandoned the design for his next observatory project. Built any larger, and the glass lens could distort under its own weight, rendering the images and indeed the telescope unusable. In contrast, reflectors could be produced in dramatically larger sizes with designs optimized for imaging.<sup>117</sup> The demands of astronomy, and in particular the new field of astrophysics, called for larger telescopes. Size mattered, dictating the brightness and resolution of a photographic image. In a watershed moment for modern astronomy Hale established the Mt. Wilson observatory in 1908, locating this new facility at high altitude in the California coastal mountains to limit the atmospheric interference and turbulence that often troubled large telescope designs. Plaskett's visit to Mt. Wilson in 1910 provided both the inspiration and contacts required to pursue constructing a great Canadian reflector.<sup>118</sup> Returning from the trip, Plaskett reported to King that a spectrum "requiring upwards of an hour with our refractor, can be photographed ... in about five minutes" from the 60-inch Mt. Wilson reflector.<sup>119</sup> The ambitious Plaskett argued that Canada needed a modern

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<sup>117</sup> The first great reflector was designed with a much faster optical path, allowing for wider fields, and dramatically shorter exposure times in addition to the increased aperture of the instrument. Casting large glass blanks presented challenges for both reflecting and refracting telescopes. The key difference between the two is that refracting lenses required nearly perfect clarity and exotic forms of glass, as bubbles or other imperfections interrupt light passing through the lens. In contrast glass mirror blanks could have internal flaws, provided they did not interrupt the figure of the surface, or the ability of the disk to uniformly cool during a nights observations. Since the mirror itself would be covered in a silvered coating, the interior appearance of the mirror was largely academic, simplifying the casting process and allowing for larger blanks.

<sup>118</sup> Plaskett, "The History of Astronomy," 116-7.

<sup>119</sup> Canada, Department of the Interior, *Report of the Chief Astronomer, 1911* (Ottawa 1915), 135.

telescope to progress in astrophysical research, and reflectors could deliver this within a reasonable budget. Hale's new observatory employed a 60-inch reflector, gathering nearly sixteen times as much light as the refractor at the DO, for a lower total cost.

Plaskett framed his proposal for a new observatory to politicians and the public in nationalistic terms to elicit support for an institution that offered few apparent benefits for the average Canadian. As he put it in a 1918 reflection, Canada needed "a telescope more in keeping with her character and aspirations."<sup>120</sup> While his visit to Mt. Wilson solidified Plaskett's belief that the nation's scientific program required a large reflector, securing funding for such an undertaking after the recent construction of the DO proved to be difficult. Unlike privately funded American observatories, the Dominion Government had financed the Ottawa facility, and funds for the proposed reflector would need to come from the same source. Politicians would have to be convinced of scientific opportunities the proposed telescope presented and how these might contribute to nation-building. Canada, Plaskett urged, should have "the distinction of having the largest in the world."<sup>121</sup> Fortunately for Plaskett and King, Canada's desire for a more prominent place on the international stage provided the nationalist sentiment to support constructing the world's largest scientific observatory. While the Victoria facility ultimately fell short of this goal, nation-building aspirations figured prominently in the rapid advance of the Canadian astronomy program between 1900 and 1920. The construction and early operation of the DAO paralleled dynamic shifts in national identity during the early twentieth century as state modernization and Canada's wartime experience stirred nationalist sentiments.<sup>122</sup> Constructing

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<sup>120</sup> J. S. Plaskett, "Description of Building and Equipment," *Publications of the Dominion Astrophysical Observatory* 1, no.1 (1918): 20.

<sup>121</sup> Plaskett quoted in Jarrell, "Plaskett and the Modern Large Reflecting Telescope," 364.

<sup>122</sup> Brief examples of attempts to construct a Canadian identity through pageantry can be found in H.V. Nelles "Historical Pageantry and the 'Fusion of the Races' at the Tercentenary of Quebec, 1908" *Historie Sociale / Social*

what was hoped to be the world's largest telescope both drew upon and fed Canadians' sense of themselves as citizens of a maturing nation.<sup>123</sup>

Both Plaskett and King emphasized the prestige of a great Canadian reflector in their proposal to Sifton's successor as Minister of Interior, Frank Oliver, following Plaskett's 1910 visit to the Mount Wilson Observatory in Pasadena.<sup>124</sup> A 1911 meeting of the Astronomical and Astrophysical Directors of America in Ottawa resulted in a resolution supporting a Canadian reflector, bolstering their lobbying efforts. However, Prime Minister Wilfred Laurier's government fell in the 1911 Federal election, and Dr. William J. Roche replaced Oliver as the Minister of the Interior in Prime Minister Robert Borden's Conservative cabinet. Forced to restart their lobbying effort, Plaskett and King canvassed support from influential American astronomers including Lick Observatory director William Campbell.<sup>125</sup> Once again, Plaskett and King emphasized the nationalistic merits of hosting the world's largest telescope, helping to secure Roche's political support.<sup>126</sup> The continued success of Canadian astronomers on the international stage demonstrated the growing identity of the Canadian astrophysics program. Plaskett was appointed to an international committee assessing stellar radial velocities in 1911, along with representatives from the Lick and Yerkes observatories.<sup>127</sup> Citing the professionalism

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*History* 29, no. 58: 391-415; Robert Cupido, "Appropriating the Past: Pageants, Politics, and the Diamond Jubilee of Confederation," *Journal of the Canadian Historical Association* 9, (1998): 155-56; Jarrell, *The Cold Light of Dawn*, 7, 110.

<sup>123</sup> Jarrell, *The Cold Light of Dawn*, 100-102, 110.

<sup>124</sup> J.S. Plaskett, "A Great Reflector for Canada," *JRASC* 7, (May-June 1913): 448-455.

<sup>125</sup> Jarrell, *The Cold Light of Dawn*, 101.

<sup>126</sup> Political support was a necessity as the Federal government and universities almost exclusively funded the Canadian astronomy program in late 19<sup>th</sup> and early 20<sup>th</sup> century. Historian Suzanne Zeller argues that the state drove scientific development preceding this period of Canadian history. While the DAO was modeled on Mt. Wilson, it was constructed with public funds rather than private investors. For a detailed analysis of the history of astronomy in Canada see Richard A. Jarrell, *The Cold Light of Dawn*, and for an assessment of the early history of Canadian science see Suzanne Zeller, *Inventing Canada: Early Victorian Science and the Idea of a Transcontinental Nation*, (University of Toronto Press: Toronto 1987).

<sup>127</sup> Radial velocities indicate the apparent motion or speed of a star moving towards or away from the Earth. As binary stars orbit each other, looking at an edge on pair would show one star to be moving towards the observer,

and accuracy displayed by the staff of the Ottawa observatory, Plaskett and King stressed the opportunity for Canada to gain a “reputation second to none.”<sup>128</sup> As members of the Royal Society of Canada, both Plaskett and King had utilized the lobbying influence of the organization to encourage the Dominion government to invest in the proposed institution.<sup>129</sup> The Royal Astronomical Society of Canada also promoted the Canadian reflector, issuing a resolution to Roche in January 1913 outlining the favorable nature of the project.<sup>130</sup> Together, interest from professional, amateur, and international parties formed a persuasive argument for Roche. He subsequently formed a parliamentary committee to discuss the proposal in February 1913, providing conditional support for a 72-inch telescope pending a survey of prospective locations, and estimates from manufacturing firms.

Initially, the residents of Victoria were exposed to the observatory project through this nationalist lens. Six months after Roche’s approval of a 72-inch reflector, an October 1913 *Daily Colonist* edition published a lengthy account of the proposed institution despite the expectation the facility would be located near the Ottawa observatory.<sup>131</sup> “Within two years Canada will have a telescope larger than that possessed by any observatory in the world,” Victorians learned, highlighting the nationalistic discourse present in the early discussions of the project.<sup>132</sup> Although atmospheric testing to determine the final location of the telescope would not be completed until the following winter, the *Colonist* had introduced Victorians to the idea of a new national observatory that would place Canada at the forefront of astrophysics research.

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while one moved away. This results in shifting spectral lines on the photographic plates due to the influence of the Doppler effect. In this way astronomers could identify ‘spectroscopic binary’ systems, where two stars were not optically visual, but are identified by their spectral characteristics; J. S. Plaskett, “Report by J. S. Plaskett B.A. on Astrophysical Work,” in *Report of the Chief Astronomer*, (Ottawa 1915).

<sup>128</sup> *Report of the Chief Astronomer* (1911), 140.

<sup>129</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 69; Plaskett “Description of Building and Equipment,” 23.

<sup>130</sup> Jarrell, *The Cold Light of Dawn*, 101; Hodgson, *The Heaven Above and the Earth Beneath*, 38.

<sup>131</sup> “Canada Will Have Largest Telescope,” *Daily Colonist*, 25 October, 1913, 19.

<sup>132</sup> *Ibid.*

Just as the DAO was a symbol of nation building, it can also be considered a symbol of province building. When construction on the DAO began in 1914, British Columbia was experiencing economic decline after a period of significant growth. The completion of the Canadian Pacific Railway in 1885 had sparked a population boom, drawing investment capital to the Pacific Coast, and promoting urbanization. The stable political climate provided by Premier Richard McBride's Conservative government, elected in 1903, incited a dramatic shift in the debt-stricken economy, producing a surplus by 1905 during a resource economy boom that lasted for much of the following decade.<sup>133</sup> Industry rapidly developed, as mining, forestry, fisheries, and even British Columbia's limited agricultural sector matured under McBride's dynamic leadership.<sup>134</sup> Following another majority victory in the 1909 provincial election, McBride supported the construction of numerous infrastructure projects, including two new transcontinental rail lines, and the proposed Pacific Great Eastern railway, to open up the province's interior. McBride also supported the development of intellectual infrastructure, funding the Provincial Archives after it was established as an independent body in 1908.<sup>135</sup> Following this trend, in 1908 the province chartered the University of British Columbia in Vancouver.<sup>136</sup> By 1913, however, this economic boom had slowed as the housing market collapsed and the economy increasingly relied on foreign investment in provincial railway bonds.<sup>137</sup> As early as 1912 the provincial deficit returned, reaching \$5 million by 1914.<sup>138</sup> In this dismal economic climate only Plaskett and King's mandate that the telescope be "located at the

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<sup>133</sup> Jean Barman, *The West Beyond the West*, (Toronto: University of Toronto Press, 2007), 191.

<sup>134</sup> Ibid, 192-202, for more on McBride's administration and early life see Patricia E. Roy *Boundless Optimism: Richard McBride's British Columbia*, (Vancouver: UBC Press, 2012).

<sup>135</sup> Chad Reimer, *Writing British Columbia History: 1784-1958* (UBC Press, 2009), 51-2.

<sup>136</sup> Roy, *Boundless Optimism*, 127-8; Barman, *The West Beyond the West*, 207.

<sup>137</sup> Ibid, 209; George E. Webb, "Victoria Welcomes the Dominion Astrophysical Observatory," 171-2.

<sup>138</sup> Barman, *The West Beyond the West*, 210; Webb, "Victoria Welcomes the Dominion Astrophysical Observatory," 172.

place most suitable, astronomically, in Canada,” would ultimately ensure the DAO’s construction on the Pacific Coast.<sup>139</sup>

Telescopes have an exacting set of environmental requirements, and considering clear nights are a critical element, Victoria may not have seemed to be the best location. The Mt. Hamilton and Mt. Wilson observatories in California were built at high altitude only after extensive tests of atmospheric conditions. A similar battery of tests would be conducted in Canada to choose a suitable site.<sup>140</sup> Professor J. C. McLennan, a member of the Royal Society of Canada, insisted that “the telescope should be placed at the most suitable astronomical location in Canada,” a stipulation that all but eliminated Ontario’s candidacy.<sup>141</sup> W.E. Harper, a senior Astrophysicist from the DO would conduct the tests using the largest portable telescope maintained in Ottawa, visiting prospective locations to make precise measurements of atmospheric stability.<sup>142</sup> Initially American astronomers encouraged Plaskett to locate the telescope in the southern hemisphere or “some tropical English colony.”<sup>143</sup> This may have been an acceptable option from a scientific perspective for Plaskett, giving Canada an opportunity to dominate studies of the southern sky with an unrivalled instrument. However, this would have contradicted the nation-building theme so prominent in his lobbying of the Canadian government.

The selection of a suitable Canadian location for the telescope was a complicated process that had to balance political, public, and scientific interests. In 1910, Canadian astronomers

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<sup>139</sup> Plaskett, “The 72-Inch Reflecting Telescope,” 268.

<sup>140</sup> J. S. Plaskett, “The Dominion Astrophysical Observatory,” *Publications of the Astronomical Society of the Pacific* 39, no.228 (1927): 88-96, 89.

<sup>141</sup> Plaskett, “Description of Building and Equipment,” 23; Plaskett, “The Dominion Astrophysical Observatory,” 89.

<sup>142</sup> Plaskett, “Description of Building and Equipment,” 24; Plaskett, “The Dominion Astrophysical Observatory,” 89.

<sup>143</sup> Jarrell, *The Cold Light of Dawn*, 102.

operated as a small, relatively obscure branch within the Department of the Interior. Originally Plaskett and King intended to locate the telescope in Ottawa to minimize construction costs. The advantages of building at the DO were not insignificant, as a completely new location would require the purchase of land, construction of roads, and the supporting structures of offices, residences, water, and power.<sup>144</sup> Eager to garner state support for their proposal, Plaskett and King's initial contemplation of Ottawa accepted perceived political realities. As Plaskett put it, their objective was to induce...

the Government to consent to the large appropriation for purposes of purely scientific research without complicating the matter by further requiring the establishment of a separate institution, a new observatory at some point in Canada away from the seat of Government.<sup>145</sup>

Mindful of reluctance for excessive government investment in pure scientific research in a nation experiencing economic turbulence as the early 20<sup>th</sup> century boom faded, the two astronomers initially tailored their proposal to secure approval for a reflector at the Dominion's existing facility. Fortunately, Plaskett was well positioned following his 1910 visit to the Mount Wilson Observatory to address Minister of the Interior Roche's concerns over the expense of a scientifically superior site, wherever that might be.<sup>146</sup>

Persuaded, Roche granted \$10,000 for a series of atmospheric tests at various sites, including Ottawa. Harper conducted these measurements in the Summer of 1913, evaluating the suitability of climatic conditions for the proposed telescope at five representative Canadian locations: Ottawa, Medicine Hat, Banff, Penticton, and Victoria.<sup>147</sup> In the end four of the locations outside of Ottawa were selected to provide potential access to the celestial equator.

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<sup>144</sup> Plaskett, "The 72-inch Reflecting Telescope," 180-1.

<sup>145</sup> Plaskett, "Description of Building and Equipment," 23.

<sup>146</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 37-8.

<sup>147</sup> Plaskett, "Description of Building and Equipment," 24; Plaskett, "The Dominion Astrophysical Observatory," 89.

Medicine Hat was selected as a representative sample for the prairies, Banff to test the high altitude of the Rocky Mountains, Penticton to assess the British Columbia dry belt, and Victoria due to its small diurnal temperature range.<sup>148</sup> The astronomers at the DO assembled a list of criteria required for a large reflecting telescope. In order of importance, the institution required a high quality of “seeing,” or the steadiness of the atmosphere; a low range of diurnal - day to night - temperature variation; a high transparency of the sky; clear nights; and sheltered environmental conditions to avoid excessive wind or earthquakes.<sup>149</sup>

Initially Victoria was not a frontrunner, the other locations all boasting clearer skies throughout the year. In a survey of meteorological data between 1895 and 1908 for each region, Victoria trailed with ninety-one clear days to an average of nearly one hundred and ten for the other locations.<sup>150</sup> Victoria also led in total days of significant precipitation, trailing only Ottawa in total precipitation.<sup>151</sup> Victoria, however, was considered ‘remarkable’ due to its uniquely low temperature variation.<sup>152</sup> Moreover, the daily temperature range in Victoria was just twelve and a half degrees Fahrenheit; Ottawa, the next lowest varied by over eighteen degrees, a dramatic difference.<sup>153</sup> Large temperature variations deform the shape and image of large mirrors, negatively impacting the quality of measurements, setting Victoria apart from the other sites.

Using a portable four and a half inch Cooke reflecting telescope, Harper spent approximately two weeks testing the ‘seeing’ and observing conditions at each of these four

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<sup>148</sup> W.E. Harper, “Atmospheric Conditions Suitable for the 72-Inch Reflector,” *JRASC* 8, (May-June 1914): 173; W.E. Harper, “Tests Made to Ascertain Where Conditions Were Most Suitable for the 72-inch Reflector,” *Publications of the Dominion Observatory* 2, no. 11 (1915): 278-9.

<sup>149</sup> Harper, “Atmospheric Conditions Suitable for the 72-Inch Reflector,” 172.

<sup>150</sup> Harper, “Tests Made to Ascertain Where Conditions Were Most Suitable for the 72-inch Reflector,” 276.

<sup>151</sup> *Ibid.*

<sup>152</sup> Harper, “Atmospheric Conditions Suitable for the 72-Inch Reflector,” 173.

<sup>153</sup> Temperature stability is increasingly important with larger telescopes, as the glass of a mirror or lens will expand or contract to follow temperature shifts. These movements also shift the focus, a potentially harmful concern for precision work; Harper, “Tests Made to Ascertain Where Conditions Were Most Suitable for the 72-inch Reflector,” 276.

locations, beginning with Medicine Hat in late June 1913.<sup>154</sup> Harper visited Banff and Penticton in July before arriving in Victoria in early August. Banff was quickly eliminated due to poor conditions. Both Penticton and Medicine Hat were promising, but Harper found that at Victoria “the seeing was of a high standard of excellence the images on many nights reminding one of a ‘steel engraving’ effect, so beautiful and steady was the diffraction pattern.”<sup>155</sup>

In late August, Harper traveled to the Lick Observatory in California to compare the Canadian conditions to those of an established, reputable institution and calibrate his measurements before returning to both Medicine Hat and Penticton for a second round of tests. Canadian conditions “are as good as those enjoyed by the observers on mount Hamilton,” Harper argued, as he conducted a second battery of tests.<sup>156</sup> While the higher altitudes of Medicine Hat, Banff, and Penticton rendered more transparent skies, the ‘seeing’ in Victoria remained superior to all, including Ottawa, still the frontrunner for the proposal.<sup>157</sup> In addition, Victoria’s nightly temperature range only shifted by 3.8 degrees Celsius during Harper’s test, while no other location experienced less than a 7 degree change. After reviewing Harper’s findings and consulting with Campbell at the Lick Observatory and Walter S Adams at the Mt. Wilson Observatory, Plaskett concluded that...

the superior conditions of ‘seeing’ and the low daily temperature range would enable more than double the quantity of work of higher quality and accuracy to be performed at Victoria and would further render possible of production certain kinds of work at Victoria which the poor ‘seeing’ conditions at Ottawa would prevent.<sup>158</sup>

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<sup>154</sup> Harper conducted baseline tests at the Dominion Observatory before visually and photographically evaluating each of these sites. At each destination he observed double stars through the portable telescope, with the quality of separation between the stars and the stability of the image providing rankings for the respective locations; “Atmospheric Conditions Suitable for the 72-Inch Reflector,” 175.

<sup>155</sup> *Ibid.*, 175-6.

<sup>156</sup> *Ibid.*, 318.

<sup>157</sup> The seeing in Victoria was termed a ‘3.8/5’ on a five point scale Harper developed for these tests, while Ottawa trailed at an average of ‘2.6/5’; *Ibid.*, 176.

<sup>158</sup> Plaskett, “Description of Building and Equipment,” 24-5.

In Plaskett's mind the issue was settled, with Victoria being the clear choice for the Canadian reflector. King, suspicious that the quality of the Victoria measurements were merely a result of the favorable August conditions, and perhaps worried about the reaction of his political superiors, dispatched Harper for a second trip to Victoria in December 1913. Though clouds dominated half of the nights, the stability of the 'seeing' still bested any of the conditions tested elsewhere in Canada that year.<sup>159</sup> When weighing the advantages of Victoria, Plaskett concluded a "72-inch telescope at Victoria could do as much work and of better quality than one of 114 inches aperture at Ottawa."<sup>160</sup> In comparison, the tremendously expensive Hooker 100-inch telescope then under construction at Mt. Wilson completed in 1917 would be the world's largest until 1947.<sup>161</sup> The cost of constructing such a large telescope was untenable for the Dominion Government, so it was important to achieve the highest efficiency possible from the Canadian reflector. Based on the strength of Harper's findings Roche approved Victoria as the telescope's location in January 1914.

With the acceptance of Victoria as the location for the new instrument the question of where to locate the telescope in the region itself became pressing. During his trips Harper had attempted to find the best possible site for testing at each candidate location. Lofty elevations, such as Tunnel Mountain's 5540-foot peak near Banff, were not available in Victoria, but the region's climate featured a unique, albeit geographically limited rain shadow effect of clear skies and low precipitation. A difference of ten miles in the final location could result in over twice the

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<sup>159</sup> Harper, "Atmospheric Conditions Suitable for the 72-Inch Reflector," 177.

<sup>160</sup> Plaskett, "The 72-Inch Reflecting Telescope," 181.

<sup>161</sup> The Hooker telescope saw first light on November 2, 1917, however mechanical issues with the mounting delayed full operation until October 1918; Albert Van Helden, "Building Large Telescopes, 1900-1950" in *Astrophysics and Twentieth-Century Astronomy to 1950, Part A*, edited by O. Gingerich (Cambridge: Cambridge University Press, 1984): 142-3.

yearly precipitation.<sup>162</sup> As a result, Harper carefully surveyed the region around Victoria for high quality sites that were also capable of supporting the institutional infrastructure that would accompany the 72-inch reflector. After dismissing the Highland district, in March of 1914 Plaskett surveyed five potential locations on the Saanich Peninsula: Little Saanich Mountain, Mt. Douglas, Mt. Newton Bear Hill, and Mt. Work.<sup>163</sup> Mt. Work, the highest peak at over 1,400 feet was eliminated due to its isolation and surrounding mountains that would detract from the ‘seeing’ conditions, while the shallow slope of 1,000 foot Mt. Newton also produced too much atmospheric instability.<sup>164</sup> Although the elevation of the remaining three sites only varied by five feet the final choice was easy. The summit of Little Saanich Mountain was atmospherically ideal, and suitable for the construction of an expansive research institution, as both the Interurban railway and West Saanich Road passed the base of the mountain, providing access to the city.<sup>165</sup> Historian George E. Webb slightly misrepresents the timing of the selection of Little Saanich Mountain, stating it was approved as the observatory site in January 1914. Webb’s source, a manuscript produced by Plaskett for a public lecture in the late 1930s, merely states that it was the selection of *Victoria* that was approved in January 1914.<sup>166</sup> In the authoritative account of the observatory’s construction produced by Plaskett in 1918, he instead explains that the selection of

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<sup>162</sup> Despite the stringent criteria and careful approaches used to select Victoria, a slight misstep in the selection of the final site could have resulted in inferior conditions to the Dominion Observatory; Harper, “Atmospheric Conditions Suitable for the 72-inch Reflector,” 178; Harper, “Tests Made to Ascertain Where Conditions Were Most Suitable for the 72-inch Reflector,” 314; Plaskett, “Description of Building and Equipment,” 25.

<sup>163</sup> Harper, “Tests Made to Ascertain Where Conditions Were Most Suitable for the 72-inch Reflector”; Plaskett, “Description of Building and Equipment,” 25, 314.

<sup>164</sup> The atmospheric conditions across a region can vary dramatically based on the local geographical features. The atmosphere is a fluid, and flows around any obstacles it encounters. When selecting locations forested locations were preferred, as the canopy minimized local turbulence as air was forced over the mountain; *Ibid.*

<sup>165</sup> Harper, “Atmospheric Conditions Suitable for the 72-inch Reflector,” 178; Plaskett, “Description of Building and Equipment,” 25-6.

<sup>166</sup> Plaskett, “The History of Astronomy in British Columbia,” 108, 119.

Little Saanich Mountain occurred during his February and March 1914 visit, during which he met with Premier Richard McBride.<sup>167</sup>

Reflecting on the challenges of the decision to reject Ottawa as the site in 1918, Plaskett recalled that King “was not so enthusiastic, as he probably realized more clearly than I did the financial and administrative difficulties involved” in attaining approval.<sup>168</sup> King’s economic concerns were well founded. The scientific advantages Victoria presented over Ottawa were significant, but without support from McBride’s provincial government the proposal was unfeasible. By 1913 Victoria was experiencing a severe real estate slump from highly inflated prices, making the question of land acquisition increasingly pertinent to the future of the observatory.<sup>169</sup> In February and March of 1914 Plaskett met with Premier Richard McBride and other government officials to request support from the province for the project.<sup>170</sup> Although McBride’s government had undertaken massive infrastructure projects, the worrisome financial situation prompted Plaskett to enlist the aid of Arthur W. McCurdy, an interested Victorian who maintained “considerable influence with the Premier,” and had helped secure the recently constructed Gonzales Meteorological Observatory for the city.<sup>171</sup> Reflecting on the meeting in 1918, Plaskett noted that he had stressed that the “erection of such a large telescope near Victoria would be a great education and advertising asset and if some aid could be obtained from the Province, the Dominion Government would be much more likely to sanction its location away from Ottawa.”<sup>172</sup> Plaskett’s lobbying efforts succeeded; the McBride Administration committed

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<sup>167</sup> Plaskett “Description of Building and Equipment,” 15.

<sup>168</sup> *Ibid.*, 25.

<sup>169</sup> Roy, *Boundless Optimism*, 213-15; Barman, *The West Beyond the West*, 209, 214-15.

<sup>170</sup> Holdings of the DAO, Memorandum from Chief Astronomer Dr. William King to Deputy Minister J. B. Hunter, 25 October, 1916; Plaskett, “Description of Building and Equipment,” 25; Jarrell, *The Cold Light of Dawn*, 102; Webb, “Victoria Welcomes the Dominion Astrophysical Observatory,” 175-6.

<sup>171</sup> Plaskett, “Description of Building and Equipment,” 25.

<sup>172</sup> *Ibid.*

\$10,000 towards the project for the future site, and a road to the summit originally estimated to cost \$20,000.<sup>173</sup> Ultimately the Provincial commitment rose to over \$45,000 for the purchase of fifty acres and the construction of a road up Little Saanich Mountain; the remainder of the contract to construct the DAO including the main dome, an office building, a director's residence, and housing for observers would draw on Dominion funds.<sup>174</sup> Even with McBride's support, the troubled local economy presented challenges for the project. "Real estate even over the rocky inaccessible summit of this hill [Little Saanich Mountain] was held at fancy prices," Plaskett observed with irritation, "and it was only after protracted negotiations that the 50 acres needed were obtained at \$280 per acre."<sup>175</sup>

Support for the DAO emerged from the political will to modernize the Canadian state. Plaskett and King emphasized the economic feasibility of a 'great' reflecting telescope, capturing the imagination of Canadians and politicians alike. While Victorians did not search out, or initiate the bid for the telescope, when Little Saanich Mountain was announced as the preferred destination they aggressively pursued, supported, and welcomed the project. The choice was not made lightly. While King provided Plaskett with unwavering support throughout this process, the latter was certain that

if he had consulted his personal feelings, Dr. King would have much preferred this splendid instrument to have been placed at Ottawa, as part of the great scientific institution he had built up, where it would have been under his direct supervision and control.<sup>176</sup>

Whatever King's personal preferences and ambitions might have been, Canadian astronomers had embraced modern, scientific approaches in selecting a telescope location. The rigorous

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<sup>173</sup> Ibid.; Holdings of the DAO, Memorandum from Chief Astronomer William King to Deputy Minister of Public Works J.B. Hunter, 24 October, 1914.

<sup>174</sup> Holdings of the DAO, Memorandum from Chief Astronomer William King to Deputy Minister of Public Works J.B. Hunter 25 October, 1915; Jarrell, *The Cold Light of Dawn*, 102.

<sup>175</sup> Plaskett, "Description of Building and Equipment," 26.

<sup>176</sup> Ibid., 25.

testing conducted by Harper prior to this decision gave them the confidence to proclaim that Victoria's superior conditions for astrophysics were unique in Canada. During a July 1914 public lecture by King in Victoria, Sir Richard McBride who had been of "some direct service in the great enterprise," according to the *Colonist*, predicted that the institution "would surely redound to the credit of Saanich and Victoria."<sup>177</sup> The *Colonist*, indeed, adopted a thoroughly boosterist tone in hailing Victoria's superiority and the city's destiny as a scientific centre.<sup>178</sup> The newspaper was happy to report that the observatory would represent "the largest single contribution ever made by any government to the cause of pure science."<sup>179</sup> The local and national excitement generated by the project would see the facility completed in 1918 despite the turmoil of the First World War.

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<sup>177</sup> "Astronomers' Work is of Great Value," *Daily Colonist*, July 8, 1914, 5.

<sup>178</sup> "A Great Observatory," *Daily Colonist*, May 13, 1914, 4.

<sup>179</sup> "Dr. King's Address," *Daily Colonist*, July 8, 1914, 4.

## Chapter 2 –“The greatest tourist feature on the Pacific Northwest Coast:” Home-front Construction, Boosterism, and the Opening of the DAO 1914-1918

Victorians regarded the DAO as a spark of hope for the faltering local economy. Atmospheric stability and minimal diurnal temperature variation were of paramount importance for the performance of early large telescopes. Victoria bested competing Canadian locations in these scientific prerequisites, winning the project bid. In addition to vaunting the city’s “superlative climatic and atmospheric conditions,” the *Daily Colonist* speculated the project would draw newcomers to Victoria from elsewhere in the British Empire and the world, to live in such a desirable and stable climate.<sup>180</sup> “It was fitting... that such an observatory should have been located near Victoria, where the conditions were the most favorable for the great work it was destined to do,” boasted the *Colonist*.<sup>181</sup> Hope that the international notoriety generated by the DAO would then help to revitalize the real estate market unfortunately proved groundless, as the onset of the First World War in 1914 further destabilized the economy and curtailed immigration.<sup>182</sup> Nor did construction proceed smoothly, the conflict and complexity of the reflector’s design causing repeated delays.

In 1914 Victoria was a city searching for an identity, with an increasing emphasis on promotional efforts to attract investment and settlement. Victoria developed in the 1850s as a gold rush boom-town, and continued to flourish in the wake of the rush. Historian Peter Baskerville notes that for some “the gold rush accelerated existing economic, political, and social

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<sup>180</sup> “Canada Will Have Largest Telescope,” *Daily Colonist*, October 25, 1913, 19; “Huge Telescope For Victoria,” *The Daily Colonist*, May 13, 1914, 1; “Victoria Best Site for Big Telescope,” *The Daily Colonist*, November 30, 1916, 7; “Huge Telescope for Victoria,” *Daily Colonist*, May 13, 1914, 1.

<sup>181</sup> “Astronomical Party Visits Observatory,” *Daily Colonist*, October 22, 1916, 17.

<sup>182</sup> Barman, *The West Beyond the West*, 212-15.

trends,” while for “others it fostered new developments.”<sup>183</sup> With speculation that Victoria would be the terminus for the Canadian Pacific Railway, the city experienced remarkable expansion in the 1880s. Indeed, the CPR “energized the province’s economy.”<sup>184</sup> However, while the province’s economy grew, increasing the production of exports by 62 percent in the 1890s, Victoria’s economy suffered when the CPR stopped in Vancouver. As a result, by the turn of the 20<sup>th</sup> century Vancouver had succeeded Victoria as the province’s metropolitan and economic centre.<sup>185</sup> Tourism offered new economic opportunities for the struggling city with attempts to promote Victoria emerging from the city’s Board of Trade as early as 1891.<sup>186</sup> Prompted by the efforts of tourism promoter Herbert Cuthbert, Victoria established the Tourist Association of Victoria in 1902. In an effort to develop the national and international profile of Victoria, the new organization focused on promoting the city to attract both settlement and investment. The DAO represented a new attraction for the city, as it promised to bring prominent scientists and cultural luminaries to the region. The presence of these individuals encouraged intellectual tourism, promoting the city as a destination of ‘high culture.’ Tourism, then, was regarded as an avenue to both economic prosperity and a new identity for Victoria.

Tourists were drawn to BC to “escape the hectic pace of modern life,” according to historian Michael Dawson.<sup>187</sup> Promoters emphasized the climate and natural attractions of BC as an alternative to urbanization and modernity. Yet Dawson identifies a dualist approach to modernity in the first two decades of the twentieth century. While the province maintained the

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<sup>183</sup> Peter A. Baskerville, *Beyond the Island: An Illustrated History of Victoria*, (Canada: Windsor Publications Ltd., 1986), 70

<sup>184</sup> Barman, *The West Beyond the West*, 121.

<sup>185</sup> Baskerville, *Beyond the Island*, 47-8; Michael Dawson, *Selling British Columbia: Tourism and Consumer Culture, 1890-1970*, (Vancouver: UBC Press, 2004), 24.

<sup>186</sup> Dawson, *Selling British Columbia*, 27-9.

<sup>187</sup> *Ibid.*, 17.

image of an ‘escape’ from modern pressures, infrastructure and modernity projects were viewed through a lens of progress and development, allowing tourism organizations to promote a new and sophisticated BC. Victoria was imagined as a civilized metropolis buttressed against the “pristine wilderness” of Vancouver Island.<sup>188</sup> While nature offered something to be respected, and in cases conquered, technology represented new opportunity. The CPR’s Empress Hotel, completed in 1908, is just one early example of how Victoria’s image incorporated modern infrastructure to serve tourism interests. Promoters quickly incorporated the pending Victoria reflector into the tourism profile of the region as both a feat of modern engineering, and a tangible connection to the region’s ‘natural wonders.’<sup>189</sup> Indeed both the local and national tourism implications of the project were accounted for during the design and construction process as initial proposals included options for both a 60 and 72-inch telescope, with the latter being selected to promote public interest. King and Plaskett determined that the larger six-foot mirror, while more expensive, was advantageous, allowing Canada and by extension Victoria to claim the world’s largest telescope, prior to the expected 1917 completion of the 100-inch reflector on Mt. Wilson.<sup>190</sup>

Plaskett’s mechanical experience was invaluable in his role as the lead designer for the Victoria telescope. King extended tenders to multiple manufacturers in Europe and the United States. Through their experience producing large telescopes and work on the Ottawa DO, the Warner and Swasey Company of Cleveland and the Brashear Company of Pittsburgh won the

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<sup>188</sup> Ibid., 17, 20-3.

<sup>189</sup> Victoria and Island Publicity Bureau, “Follow the Birds to Victoria B.C.,” (Victoria B.C. Victoria & Island Development Association: 1918?), Special Collections, University of Victoria, Victoria B.C.

<sup>190</sup> Holdings of the DAO, Memorandum, from Chief Astronomer William King to Deputy Minister of Public Works J. B. Hunter, 24 October 1914.

contracts of \$60,000 for the mounting and \$30,750 for the optical parts respectively.<sup>191</sup> In 1914 King officially handed the project to Plaskett, who collaborated with E. P. Burrell and Ambrose Swasey to finalize the mounting design, and John Brashear for the optical construction.<sup>192</sup> The optical design Plaskett chose was based loosely on the Mt. Wilson reflector, though with a series of modifications to optimize the telescope for his research program. Plaskett's design, completed by the summer of 1914, deviated significantly from the Mt. Wilson example, with Plaskett electing to incorporate a classical Cassegrain focus into the traditional Newtonian design.<sup>193</sup> In practice this change required casting a ten-inch hole in the center of the 5000lb mirror blank, something that had never been attempted on the scale of this project.<sup>194</sup> Aside from the logistical difficulties of safely producing the mirror blank, this added complications for smoothly figuring the optics once the disk arrived from St. Gobain Glassworks to Brashear Optical in Pittsburgh.<sup>195</sup>

From a scientific perspective there was much to be gained from Plaskett's design. Although the Mt. Wilson reflectors also incorporated a Cassegrain and Newtonian focus, this involved a flat mirror that reflected light to a heavy spectrograph hanging off the side of the optical tube, making the telescope inherently difficult to balance.<sup>196</sup> Incorporating the Cassegrain focus into the primary mirror allowed Plaskett to locate the spectrograph along the axis of the

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<sup>191</sup> Tenders went out to Sir Howard Grubb's telescope company in Ireland, the Warner and Swasey Company of Cleveland Ohio, the Brashear Optical Company of Pittsburgh Pennsylvania and the Alvan Clacks Son's Corporation of Cambridge Massachusetts. The accessibility of the Warner and Swasey, and Brashear Co. in combination with their lower bids elevated them over Howard Grubb; Plaskett, "Description of Building and Equipment," 19-20; Jarrell, *The Cold Light of Dawn*, 54-5.

<sup>192</sup> Jarrell, *The Cold Light of Dawn*, 102; Plaskett, "Description of Building and Equipment," 20-1.

<sup>193</sup> Newtonian focuses reflect light off of the primary mirror before bouncing it off of a small flat secondary mirror creating a short, but simple light path. In contrast the Cassegrain design reflects light from the primary mirror off a concave secondary, directing the light back downward through a hole cut in the bottom of the primary mirror.

<sup>194</sup> Producing just the mirror itself was a challenging process, as only three mirrors on this scale had ever been cast. In 1914 St. Gobain Glassworks was the only manufacturer capable of undertaking these contracts.

<sup>195</sup> Plaskett, "Description of Building and Equipment," 21, 38.

<sup>196</sup> Plaskett, "Description of Building and Equipment," 9-10; Jarrell, "J.S. Plaskett and the Modern Large Reflecting Telescope," 368.

optical tube, but at the cost of far greater challenges in both casting and figuring the mirror blank.<sup>197</sup> This had never been attempted on a reflector larger than thirty seven-inches, adding enormous risk to the process, but the separate configurations increased the magnification of the telescope for spectrographic work dramatically.<sup>198</sup> Just as important, in Plaskett's system the spectrograph was permanently mounted to the telescope, allowing operators to maintain the balance of the latter while working on different projects. Along with other innovations, the design provided flexibility for numerous research programs as the telescope could be customized to fit various needs without limiting its pointing accuracy across the sky.

While having two foci was advantageous, incorporating the central hole into the optical disk complicated an already delicate process, compromising the rigidity necessary for precision research work while introducing challenges for the optical figuring process.<sup>199</sup> St. Gobain glassworks in France was the only manufacturer capable of producing mirror blanks for large reflectors.<sup>200</sup> George Ritchey, the optician at Mt. Wilson was "insistent on the impossibility of obtaining a good disc with a hole cast in it," but Plaskett's confidence in his own engineering abilities, and the design he had devised with Brashear Optical of Pittsburgh, led him to reject Ritchey's advice.<sup>201</sup> He instead suggested that St. Gobain force a core into the centre of the disk after it had been poured, an unprecedented and decidedly risky technique. His gamble paid off;

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<sup>197</sup> Plaskett, "Description of Building and Equipment," 38.

<sup>198</sup> The telescope operated at a focal length of 30 feet in the Newtonian focus, and 108 feet in the Cassegrain focus providing a higher linear resolution for spectroscopic studies while maintaining the capacity for fast focal ratio direct imaging. Brashear's suggestions allowed the two secondary mirrors that controlled the light path to be changed in less than ten minutes, adding enormous versatility to the telescope; Plaskett, "The Dominion Astrophysical Observatory," 91-2.

<sup>199</sup> Optical figuring transforms a large, relatively flat glass blank into a precisely shaped mirror by removing material to create a paraboloid – or bowl – shaped surface. It is a very delicate and time consuming process, as the removal of material (accomplished with files and other tools) heats and warps the glass, requiring cooling between each figuring session; Jarrell, "J. S. Plaskett and the Modern Large Reflecting Telescope," 366-7.

<sup>200</sup> Albert Van Helden, "Building Large Telescopes, 1900-1950," in *Astrophysics and Twentieth-Century Astronomy to 1950*, edited by O. Gingerich (Cambridge: Cambridge University Press, 1984): 142.

<sup>201</sup> Ritchie argued that if the mirror blank was produced with a central hole it would not cool uniformly; Plaskett, "Description of Building and Equipment," 19.

by late June St. Gobain confirmed they had successfully cast the mirror after a single failed attempt, allowing for an overly optimistic prediction by King that “the whole instrument will be ready for installing in the fall of 1915.”<sup>202</sup> Plaskett was delighted with the disk, but the risks were greater than he knew. The mirror, shipped from Antwerp just three days before the outbreak of the First World War, was almost lost in transit, and the St. Gobain Glassworks was subsequently destroyed during the fighting. The project narrowly avoided crippling setbacks, but with St Gobain in ruins, and the failure of a nearby Pittsburgh Plate Glass Company to produce an adequate mirror required to test the disk, over a year would pass before Brashear began the fine optical figuring on the main disk.<sup>203</sup>

Plaskett’s selection of the mounting for the telescope was also problematic.<sup>204</sup> The English equatorial style he favoured had never been applied on a project of this scale; in the end the mounting Plaskett devised in collaboration with E. P. Burrell of Warner and Swasey would re-define the standard design for large reflectors in the early twentieth century.<sup>205</sup> While the mounting Ritchie utilized at Mt. Wilson offered only restricted viewing of the southern horizon, and the 100-inch Hooker telescope at that facility denied observers access to the north celestial pole, Plaskett’s telescope would reach almost any area of the sky.<sup>206</sup> The cost of this design was additional weight. The piers and tube used to support the mirror weighed a combined nine and a

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<sup>202</sup> Holdings of the Dominion Astrophysical Observatory, Memorandum from Chief Astronomer to W. W. Cory, Deputy Minister of the Interior, 19 June, 1914.

<sup>203</sup> Even for a comparatively small fifty-five inch disks these attempts were unsuccessful, highlighting the importance of St. Gobain for the production of the great reflectors. The lack of this second disk delayed attempts at figuring the primary mirror for nearly a year. Ultimately producing a replacement disk proved unsuccessful, and Brashear opted to make a proxy out of plywood for the testing process; Plaskett, “Description of Building and Equipment,” 37; Jarrell, *The Cold Light of Dawn*, 103.

<sup>204</sup> This design was based on the smaller ‘Crossley’, and Melbourne reflectors; Plaskett, “The 72-Inch Reflecting Telescope of the Dominion Astrophysical Observatory, Victoria B.C.,” 268-9

<sup>205</sup> Jarrell, “J.S. Plaskett and the Modern Large Reflecting Telescope,” 385; Jarrell, “The Birth of Canadian Astrophysics,” 230.

<sup>206</sup> Plaskett, “The 72-Inch Reflecting Telescope of the Dominion Astrophysical Observatory, Victoria B.C.,” 269; Jarrell, “J. S. Plaskett and the Modern Large Reflecting Telescope,” 367; Plaskett, “Description of Building and Equipment,” 10.

half tons, with the total assembly resting at approximately forty-five tons.<sup>207</sup> The Warner and Swasey Company of Ohio did an excellent job fabricating the mounting, utilizing a nine-foot diameter worm gear to provide smooth tracking with “the slightest touch.”<sup>208</sup> The gearing system and clock drive was outfitted to such precision that the telescope drove “perfectly,” without “a trace of periodic error” that plagues the tracking of large telescopes.<sup>209</sup> The engineering of the telescope set a new standard for large reflectors throughout the first half of the twentieth century.<sup>210</sup> Historian Richard Jarrell argues that upon its completion Plaskett’s telescope “was truly the prototype for most modern large reflectors,” including the David Dunlap Observatory in 1935, the 69-inch reflector of the Perkins Observatory, and the 82-inch McDonald Observatory.<sup>211</sup>

Enthusiasm for the DAO was not lost with the outbreak of the First World War in August 1914. Construction began in late 1914 and finished in 1918. New priorities delayed the construction process, as Prime Minister Borden refocused Canadian public works toward the war effort, but McBride and Roche contested Borden’s suggestion of delay, saving the project.<sup>212</sup>

The *Daily Colonist* discussed the progress of the facility with enthusiasm, though accounts of the

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<sup>207</sup> After the telescope was installed Plaskett noted “a pressure of two or three pounds on the upper end of the tube suffices to overcome the friction in these bearings” despite the total weight of the assembly; Plaskett, “The Dominion Astrophysical Observatory,” 93.

<sup>208</sup> Plaskett, “The 72-Inch Reflecting Telescope of the Dominion Astrophysical Observatory, Victoria B.C. 271; Plaskett, “The Dominion Astrophysical Observatory,” 93.

<sup>209</sup> Periodic error is a mechanical error in the drive trains of telescope tracking systems. As the main gear moves through the worm drive, the image at the focus moves along a wave like path due to the drive running alternatively slow and fast. Modern telescopes can use electronic analysis of the worm cycle to minimize this effect, but for early observatories such precision was extracted only from exquisite machining of the drive system; Berry and Burnell, *The Handbook of Astronomical Image Processing*, (United States of America, Willmann-Bell Inc., 2000) 65-6; Plaskett, “The 72-Inch Reflecting Telescope of the Dominion Astrophysical Observatory, Victoria B.C.,” 271.

<sup>210</sup> Jarrell “Plaskett and the Modern Large Reflecting Telescope,” 384-85.

<sup>211</sup> Variations of the design were utilized in various forms at nine locations with optics over 60 inches; Richard A. Jarrell, “The Instrument was Instrumental: Plaskett’s Telescope and Canadian Astronomy Between the Wars,” *JRASC* 87, no.4 (1993): 220.

<sup>212</sup> Jarrell, *The Cold Light of Dawn*, 102.

war took priority.<sup>213</sup> The construction began in earnest during January 1915, as McBride followed through on the promise to provide a road for the institution. In a flurry of correspondence beginning on 12 December 1914 Dominion Consulting Architect D. Ewart emphasized the need to commence construction of the road without delay.<sup>214</sup> King, expecting the road would be completed by 1 April 1915, was eager to secure ‘official assurance,’ as the early estimates for the completion of the facility relied on maintaining this timeline.<sup>215</sup> On 29 January Plaskett received confirmation that a fifty-man provincial government crew had commenced work on the road, and he was delighted to learn the wagon road would be “complete and in a passable condition by the end of February.”<sup>216</sup>

Eager to promote the new design in February 1915, the Warner and Swasey Steel Company presented a miniature working model of the telescope in San Francisco at the Panama-Pacific Exposition. The *Colonist* reported that Warner and Swasey’s efforts would “bring a great deal of publicity to Victoria,” and that the climate “which warranted the erection of the machine here should also appeal to those who see the exhibit.”<sup>217</sup> With the road finished the Dominion Department of Public Works began work on the concrete pier that would support the telescope in June 1915. The intervening months, however, were fraught with frustration and delay. Plaskett visited the Warner and Swasey facility in Ohio numerous times to consult on design and fabrication decisions but by May 1915 the firm had not yet received the formal order for the

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<sup>213</sup> “The World’s Large Telescopes,” *Daily Colonist*, August 9, 1914 13.

<sup>214</sup> Holdings of the DAO, Memorandum from Deputy Minister of the Interior J.B. Hunter to Chief Astronomer W. King, 12 December 1914.

<sup>215</sup> Holdings of the DAO, Memorandum from Chief Astronomer W. King to Deputy Minister of the Interior J.B. Hunter, 16 January, 1915.

<sup>216</sup> Holdings of the DAO, Telegram from Gray Donal to J.S. Plaskett, 20 January 1915; Holdings of the DAO, Memorandum from the Minister of Public Works to J. S. Plaskett, 23 January, 1915.

<sup>217</sup> “City News in Brief: Model Exhibit,” *Daily Colonist*, February 14, 1915, 6.

dome or payment for the telescope.<sup>218</sup> An irate Plaskett beseeched King to “ascertain the cause of the delay... and perhaps hasten [the chief architect’s] movements.”<sup>219</sup> These delays were not taken lightly, as King was aware that...

the decision of our Government to purchase the six-foot telescope, rather than the alternative five-foot one, which would have cost some \$20,000 less, was doubtless due, in some degree, to the consideration, which was set forth in the representations made to them, that the six-foot telescope would be the largest in the world. There is danger of being forestalled in this respect if the installation of the telescope is delayed beyond the year 1915.<sup>220</sup>

While bureaucratic barriers interrupted the production of the mechanical parts, construction continued in Victoria. The huge concrete pier set deep into the bedrock on the southern summit of Little Saanich Mountain took nearly three months to complete, requiring two separate visits from Plaskett to confirm the orientation of the polar axis.<sup>221</sup>

With the gravel road in place, and the pier only half built, the Victoria and Island Development Association (VIDA) organized a 6 July, 1915 outing to the observatory site.<sup>222</sup> Nearly fifty public visitors, including British Columbia Minister of Public Works Thomas Taylor, attended the event. After a drive showcasing substantial improvements to the roadway between Victoria and the Hill, guests received a lecture from the VIDA on the future of the institution, including a publicity campaign the organization was preparing to “make known to the world at large the presence here of the observatory.”<sup>223</sup> “Not only will the observatory be one of

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<sup>218</sup> Holdings of the DAO, Telegram from J. S. Plaskett to W. F. King, 5 May, 1915.

<sup>219</sup> Holdings of the DAO, Letter from J. S. Plaskett to W. King, 30 May, 1915.

<sup>220</sup> Holdings of the DAO, Memorandum from Chief Astronomer William King to Deputy Minister of Public Works J. B. Hunter, 24 October, 1914.

<sup>221</sup> The polar axis is aligned to point towards the north celestial (geographic) pole. When the telescope was aligned with this point in the sky powering the mount at the sidereal rate (the speed of the Earth’s rotation) allowed astronomers to indefinitely track an object while it was above the horizon; Plaskett, “Description of Building and Equipment,” 27.

<sup>222</sup> In 1922 the Victoria and Island Development Association changed its name to the Victoria and Island Publicity Bureau.

<sup>223</sup> “Visit Observatory Site,” *Daily Colonist*, July 7, 1915, 5.

the chief attractions from the scientific standpoint” the *Colonist* predicted, “but the remarkable beauty of the view will undoubtedly prove a strong attraction to the tourist.”<sup>224</sup> The city of Victoria was enamored by the prospect of another tourist attraction to go along with the Butchart Gardens, the Inner Harbour, and the Empress Hotel. While the official contributions from the Province had been met, local governments continued to support the venture by improving the Quadra and Saanich roadways from the city to Little Saanich Mountain in preparation for the new facility. “When this work is completed there will be a paved highway from the centre of the city to the observatory site, and in time this route will undoubtedly become one of the chief tourist highways,” the ever-enthusiastic *Colonist* declared.<sup>225</sup> Evidently, civic leaders hoped their excitement would catch the imagination of both Victorians and visitors. Anticipating completion of the facility by 1916, the VIDA planned an international publicity campaign to attract attention to “the largest telescope in the world.”<sup>226</sup> Victorian boosters welcomed the opportunities presented by the new facility, as Canadian astronomers scrambled to finish the scientific infrastructure within the tight construction schedule. On 21 July 1915, in a display of regional competitiveness, the *Colonist* suggested naming the institution the “Victoria Observatory,” noting “the observatory is to be on Vancouver Island, and if we are not careful it may be called the Vancouver Observatory.”<sup>227</sup>

While neither Victoria nor Vancouver were included in the formal title for the observatory, the construction process did contribute to the regional economy. Work on the building commenced with the completion of the concrete pier in September 1915. As Plaskett departed from Victoria for Ottawa, the steel structure of the main building, being fabricated in

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<sup>224</sup> Ibid.

<sup>225</sup> Ibid.

<sup>226</sup> Ibid.

<sup>227</sup> “A Suggestion,” *Daily Colonist*, July 21, 1915, 4.

Vancouver, was expected for delivery within the month.<sup>228</sup> Constructing the circular structure that would support the dome took longer than anticipated, but was completed early in the new year, built with a double-wall to help insulate the telescope from thermal variations that could compromise the performance of the mirror.<sup>229</sup> The dome and mechanical parts for the telescope finally arrived in Victoria in April 1916 and the entire building was ready to receive a sheet-metal covering by late July.<sup>230</sup> That Spring Robert Borden's Conservative Government leveraged their support for the project; a May 1916 election advertisement featured in the *Daily Colonist* reminded Victorians of the commitment of \$300,000 toward the construction of the observatory amidst a much larger endowment for a series of public works projects.<sup>231</sup> Despite the apparent progress Victorians learned the project was running behind schedule, the *Colonist* predicting that it would be "fall before the observatory will be ready for full operations," though this too proved optimistic.<sup>232</sup>

By September the building was ready to receive the telescope's mounting from the Warner and Swasey Company.<sup>233</sup> It took two ferries, four rail cars and a local horse team to transport the enormous mounting to the observatory. With the polar axis alone weighing in at nine and a half tons, the daunting task of hauling the mounting took two weeks of constant work for Skilling and Hamon's local horse team, with the polar axis requiring a team of twelve

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<sup>228</sup> "City News In Brief: Returning to Ottawa," *Daily Colonist*, September 1, 1915, 6.

<sup>229</sup> Even though Victoria had the smallest temperature variance of the respective Canadian locations, the observatory structure still had to compensate for diurnal shifts, as even minor variations in temperature had a severe impact on the mirror; Plaskett, "Description of Building and Equipment," 27; "City News In Brief: Returning to Ottawa," *Daily Colonist*, September 1, 1915, 6.

<sup>230</sup> Plaskett, "Description of Building and Equipment," 27.

<sup>231</sup> "What the Conservative Government has Done for Victoria During the Past Six Years," *Daily Colonist*, March 4, 1916, 11.

<sup>232</sup> "Work on Telescope has Been Delayed," *Daily Colonist*, July 11, 1916, 5.

<sup>233</sup> Warner and Swasey fully assembled and tested the telescope mounting before shipping it to Victoria during the last week of July.

horses.<sup>234</sup> Plaskett oversaw the preliminary work at the site, and with the arrival of George A. Decker, a Warner and Swasey superintendent, everything was in place for the final installation.<sup>235</sup> Skillings modified a horse-driven capstan designed to move houses to lift the pieces of the mount into place using the frame of the dome as a winching point, to lift the fourteen-ton mass of the partially assembled polar axis into place.<sup>236</sup> This was delicate work, as “it was necessary that no strain should be put on any of the wheels,” that would drive the telescope.<sup>237</sup> Plaskett admitted that this was an “anxious time,” but the installation went smoothly, and “the whole work was completed in about six weeks without hitch or accident of any kind.” The building was finished in October 1916.<sup>238</sup>

The quick pace of construction was quite the accomplishment given the available equipment, and on 22 October the *Daily Colonist* announced that the telescope was ready for installation of the optical parts. Plaskett invited members of the Victoria RASC to tour the telescope dome following the completion of the mounting in an event “[n]ext in importance to the formal opening of the great observatory.”<sup>239</sup> Over a hundred guests inspected the “marvelous mechanism” devised by the Warner and Swasey Co.<sup>240</sup> According to one account, “Victoria rejoiced in having the largest telescope in the world, and all felt grateful to Dr. Plaskett, to whose foresight the selection of Little Saanich mountain as a site was due.”<sup>241</sup> Cultivating public

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<sup>234</sup> Plaskett, “Description of Building and Equipment,” 27-8; “Explains Details of New Observatory,” 1916, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

<sup>235</sup> Plaskett, “Description of Building and Equipment,” 28, 30.

<sup>236</sup> The axis was lifted into position with the massive right ascension gear attached, adding substantially more weight; *Ibid.*

<sup>237</sup> *Ibid.*, 30.

<sup>238</sup> *Ibid.*, 31.

<sup>239</sup> “Astronomical Party Visits Observatory,” *Daily Colonist*, October 22, 1916, 17.

<sup>240</sup> *Ibid.*; “Dominion Telescope Marvelous Structure,” October 1916, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

<sup>241</sup> “Dominion Telescope Marvelous Structure,” October 1916, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

interest at these events was important in fostering continued political and financial support for the scientific aspirations of the new institution. Although cheered by the installation of the mounting Plaskett would experience a frustrating series of delays in making his telescope operational, delays that deprived Canada of the honor of hosting the world's largest reflector.

The final figuring of the mirror was not completed until 1918.<sup>242</sup> John Brashear had started grinding the glass blank from St. Gobain in 1915, but due to a missing testing flat - a slightly smaller mirror to test quality - that did not make it out of France, Brashear did not begin the fine shaping process until 1916. George Ellery Hale, the director of the Mt. Wilson Observatory, offered the 60-inch flat being used to figure the facility's 100-inch telescope after they were done using it.<sup>243</sup> However, by accepting this offer Canada would cede the anticipated title of 'largest telescope' to the American facility. Tests were instead conducted with a smaller disk that Brashear had on hand and a testing flat constructed from plywood.<sup>244</sup> The mirror was almost ready in August 1917, but with the discovery of a mysterious scratch the opticians insisted upon refiguring the mirror. Again in October 1917 the mirror had to be refigured due to irregularities around the central hole.<sup>245</sup> Ultimately, then, Plaskett's decision to integrate a central hole in his design had unforeseen consequences. The intervening months were not idle, with preparation for the delivery of the mirror involving balancing the telescope and installing the spectrograph in Victoria. The Hooker 100 inch telescope on Mt. Wilson saw first light

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<sup>242</sup> Figuring is the process of removing material from the glass blank to produce an optical surface. In this case John Brashear ground the mirror into a highly precise paraboloid. The tool used to create a parabolic shape in the mirror was modified for this task, having about 11 inches removed at its center. This modification resulted in an uneven result, further delaying completion; Jarrell, "J.S. Plaskett and the Modern Large Reflecting Telescope," 375; Plaskett, "Description of Building and Equipment," 38.

<sup>243</sup> Plaskett, "Description of Building and Equipment," 37.

<sup>244</sup> Jarrell, *The Cold Light of Dawn*, 103.

<sup>245</sup> Plaskett, "Description of Building and Equipment," 38.

November 2 1917, six months ahead of the DAO's 72-inch mirror, completed on 6 May 1918.<sup>246</sup> However, Mt. Wilson too experienced delays in bringing the Hooker instrument into full operation, providing a small victory for Canadian politicians; for nearly six months, until October 1918, the DAO was the largest operational telescope in the world. Despite many setbacks the Canadian astronomy program underwent remarkable advances, with the DAO primed to become one of the world's most productive institutions.

Locally, public interest remained high during the construction of the institution. An optimistic *Daily Colonist* 13 May 1914 front-page story on the construction of the DAO proclaimed that the city would be a major "scientific centre."<sup>247</sup> "As a consequence of having the instrument," the paper predicted two years later, Victoria "would at once become a centre for scientific thought in the world and an inspiration towards higher thought for the community."<sup>248</sup> Plaskett reinforced this message in a 1916 report to the Victoria Board of Trade, explaining that the observatory "will contain a telescope larger than any in existence, and will undoubtedly increase the attractiveness of Victoria for the ordinary visitor, and especially for men of culture and science."<sup>249</sup> While this message reinforced the underlying hopes of the project's sponsors, it also highlights the inherent inequalities of a predominantly white, male, protestant, scientific institution, and indeed early twentieth century Victoria. Plaskett's demarcation between 'ordinary' and 'cultured' visitors was not accidental, nor was the expectation that the project would improve Victoria's claim to cultural sophistication. Due to the observatory's relatively remote location, wealthy Victorians and tourists with access to horse-drawn carriages or

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<sup>246</sup> Bartusiak, *The Day we Found the Universe*, 185; K.O. Wright, "Fifty years at the Dominion Astrophysical Observatory," *JRASC* 62, no.6: 271.

<sup>247</sup> "Huge Telescope for Victoria," *Daily Colonist*, May 13, 1914, 1-4, 11.

<sup>248</sup> "Astronomical Party Visits Observatory," *Daily Colonist*, October 22, 1916, 17.

<sup>249</sup> "Explains Details of New Observatory," 1916, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

automobiles disproportionately benefitted from its presence. For city officials and those hoping to cash in on Victoria's status as a 'residential paradise' and tourist destination, however, the telescope was a feat of modern engineering worthy of civic pride.<sup>250</sup> Herbert Cuthbert, the Commissioner of the VIDA, declared in 1917 that the yet unfinished DAO was destined to be "the greatest tourist feature on the Pacific Northwest Coast."<sup>251</sup> By 1918 the *Colonist* estimated that "thousands have made the trip up the mountain" to see the mechanical parts of the nearly completed telescope.<sup>252</sup>

Plaskett kept Canadians informed of the project's progress through numerous publications in the *Journal of the Royal Astronomical Society of Canada (JRASC)*, and on a local level through the *Daily Colonist* and *Victoria Daily Times*.<sup>253</sup> Plaskett's 1913 *JRASC* article titled "A Great Reflector for Canada" certainly highlights the nationalistic goals of the project, hailing this "splendid opportunity for Canada to take a prominent part in this exceedingly important work... and to place herself in the forefront among the nations for her enterprise in promoting scientific research."<sup>254</sup> Plaskett's consistent efforts to inform Canadians of the project's status, and the resulting hope that Victoria would emerge as both a national and international destination for astronomers, contributed to the growing local interest in the observatory.

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<sup>250</sup> Aside from its size, the design of the telescope itself was a feat of modern engineering for its day, employing several techniques that would become the standard for large telescopes in the 20<sup>th</sup> century. This is in keeping with Richard Jarrell's definition of 'large' being telescopes over sixty inches of aperture, while 'very large' considers telescopes over ninety inches of aperture; Richard A. Jarrell, "J. S. Plaskett and the Modern Large Reflecting Telescope," 359, 367-8.

<sup>251</sup> "Tourist Industry Receives Praise," *Colonist*, March 9, 1917, 5.

<sup>252</sup> Despite the mirror not being completed, and the telescope not being operational the engineering of the mounting remained a tourist draw; "Dominion Telescope Searching the Stars," *Daily Colonist*, June 9, 1918, 15.

<sup>253</sup> Two early examples of these publications include Plaskett, "A Great Reflector for Canada,"; Plaskett, "The 72-Inch Reflecting Telescope,"; "Dominion Telescope Marvelous Structure," October 1916, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

<sup>254</sup> Plaskett, "A Great Reflector for Canada," 449.

The construction of the DAO brought amateur and professional astronomy to the province of British Columbia. After the public learned of the decision to locate a 72-inch reflector in Victoria, a local chapter of the Royal Astronomical Society of Canada (RASC) formed in 1914, joining chapters in Ottawa and Toronto. Victorians had attempted to form a chapter in 1908, but were unable to maintain local support. Following the announcement of the DAO that would change. Membership in the new RASC chapter grew quickly, and was even important enough to be mentioned as a special note in the obituary of noted geologist J. Sutton.<sup>255</sup> The Victoria RASC chapter flourished, developing into Canada's third largest by 1916, largely due to the local interest sparked by the DAO.<sup>256</sup> Indeed, the observatory should be given credit for the success of the organization, as Victoria lacked a local university to support the group. In contrast, Vancouver did not develop an independent RASC centre until 1931 despite a larger population and the University of British Columbia (UBC). British Columbia participated in the training of professional astronomers following 1918, through both the DAO and UBC. Historian Richard Jarrell argues that "the proximity of the DAO... certainly contributed to UBC's importance in astronomical education;" only the University of Toronto trained more Canadian astronomers.<sup>257</sup>

The Canadian Astronomy Branch experienced considerable turmoil during and following the construction of the DAO. King passed away in 1916 leaving the chair of Chief Astronomer open. Plaskett and Klotz, two increasingly bitter rivals, emerged as his potential successors. Plaskett, realizing that he was unlikely to be selected, successfully canvassed support for the

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<sup>255</sup> "Astronomical Party Visits Observatory," *Daily Colonist*, October 22, 1916; "Obituary Notes," *Daily Colonist*, May 13, 1914, 7; "Sudden Death of Valued Citizen," *Daily Colonist*, May 10, 1914, 1.

<sup>256</sup> Jarrell, *The Cold Light of Dawn*, 139.

<sup>257</sup> *Ibid.*, 137, 195-7.

directorship of the DAO from American observatory directors.<sup>258</sup> In the spring of 1917 the DAO was organized as a distinct institution within the Astronomy Branch, with Plaskett as director. With this the Victoria telescope gained autonomy over its scientific program from Klotz in Ottawa. Before leaving the DO in Ottawa Plaskett took one last dig at Klotz, relocating all of the instruments related to astrophysics to the DAO. That, along with the removal of staff to the DAO, effectively crippled the ability of Klotz's facility to conduct astrophysics research.<sup>259</sup> The fallout of these events would influence the relations between astronomers in Eastern and Western Canada following the formal opening of the DAO.

With the delivery of the optical components from Brashear and Co. in May 1918, the DAO began nightly operations. Lieutenant-Governor Sir Frank Stillman Barnard and Premier John Oliver formally opened the nearly \$200,000 facility on the evening of 11 June 1918, with the political elite of the city attending.<sup>260</sup> "People have become accustomed to the indefinite postponement of events since the war came," noted the *Colonist* on observing that the delay of the "long-promised 72-inch mirror probably excited much less comment than it would have done in normal times."<sup>261</sup> Despite the delays, and shadow of the war, the opening was a well-attended celebration for Plaskett's efforts. Honoured visitors, including John Brashear, Ambrose Swasey, and Lick director William Campbell toured the new facility, received a welcome by Plaskett, and watched Lieutenant-Governor Barnard declare the facility open before the "great dome

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<sup>258</sup> Jarrell, "The Birth of Canadian Astrophysics," 230, 232.

<sup>259</sup> Jarrell, *The Cold Light of Dawn*, 103-4.

<sup>260</sup> The federal expenditure totaled roughly \$155,000 as the office buildings and residences were incomplete, while BC contributed \$35,000 (\$46,000 is the high estimate) for the road and property. The long list of guests included distinguished political and community members, featuring Lieutenant-Governor Sir Frank Stillman Barnard, Premier John Oliver, Attorney-General J. E. Farris, Minister of Lands T. D. Pattullo, Provincial Secretary J. D. MacLean, Minister of Public Works J. H. King, Finance Minister John Hart, and their wives, Chief Justice MacDonald and other members of the judiciary, editors and proprietors of the *Daily Times* and *Daily Colonist*, the Presidents of the Rotary Club, Natural History Society, and the Astronomical Society; "Giant Telescope Begins Career," *Daily Colonist*, June 12, 1918, 1, 4; Plaskett, "The Dominion Astrophysical Observatory," *PASP*, 39: 90.

<sup>261</sup> "Dominion Telescope Searching the Stars," *Daily Colonist*, June 6, 1918, 15.

rang...with the National Anthem.”<sup>262</sup> In his address Plaskett spoke of the superiority of Victoria as a location, thanking the late McBride for his “sympathy and help,” without which “this Observatory would probably have been situated in Ottawa instead of in Victoria.”<sup>263</sup> John Brashear was less reserved in his address, stating “I want to know that you people here in Victoria and all over Canada will be appreciative of the fact that you have the best telescope, the best astronomer, and the best astronomer’s wife in the whole darned country.”<sup>264</sup> William Campbell noted that Victoria added the fourth major observatory to western North America, calling it an institution of the future and predicting the DAO “will be one of the great observatories of the world.”<sup>265</sup>

As he had initially promised McBride when pitching the instrument in 1914, Plaskett engaged the public with educational outreach initiatives after the facility opened. Plaskett, anticipating these public nights, had incorporated an additional telescope into his design choices, allowing the public to look through the main telescope without disturbing the scientific instrumentation.<sup>266</sup> Visitors were welcome to visit the DAO and use the telescope for two hours each Saturday night, and tour the grounds between 9am and 5pm, except Sundays.<sup>267</sup> Despite a staff of just two astronomers, Plaskett entertained national and international visitors, establishing the reputation of the DAO as a tourist destination.<sup>268</sup> In 1918 journalist W. C. Adkins described the exchange between an astronomer and the crowd during an evening at the DAO in an article

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<sup>262</sup> Giant Telescope Begins Career,” *Daily Colonist*, June 12, 1918, 1.

<sup>263</sup> Ibid, 4.

<sup>264</sup> Ibid.

<sup>265</sup> Ibid.

<sup>266</sup> Plaskett, “Description of Building and Equipment,” 53.

<sup>267</sup> Webb, “Victoria Welcomes the Dominion Astrophysical Observatory,” 180.

<sup>268</sup> “Assistant Observer on Last Lap Home,” *Daily Colonist*, August 26, 1919, 7.

he titled a “Trip to Arcturus,” one of the only accounts of Plaskett’s manner during a public evening:

You would expect a lecture, interesting perhaps but indigestible to a layman. But this man is just talking, chatting you might say, to a roomful of, apparently, neighbors dropped in for a friendly call. Sitting on a convenient step-ladder, he is telling them, in an informal sort of way about the work of the Observatory. Someway you take a liking to this man and listen interestedly... The man is not only immensely interested in his work, he ‘loves’ it. And he wants others to love it as much as he does, and so the crowd does not bore him and, in turn, the crowd is not bored and takes the knowledge he imports... Long after we had left the building I learned that this was Dr. J. S. Plaskett, the eminent Director of the Observatory.<sup>269</sup>

The accessible manner Plaskett displayed during this event dominated the institution’s public image during the 1920s.

Plaskett immediately participated in regional promotion efforts, integrating the DAO into Victoria’s cultural fabric. On 21 June, less than two weeks after the opening ceremony, Plaskett hosted the Joint Convention of the Pacific Northwest Stationers and Printers, Victoria Mayor Albert Todd, and “other prominent citizens” for an evening viewing session.<sup>270</sup> A.B. Howe, the convention president, maintained close connections with Todd through the Pacific Northwest Tourist Association (PNTA), an organization led by Victorian tourism promoter Herbert Cuthbert.<sup>271</sup> “For Cuthbert and the PNTA, tourism was not an industry unto itself,” according to historian Michael Dawson, rather “it was a means to agricultural and industrial development.”<sup>272</sup> Promoting the tourism potential of the DAO simultaneously fed the institution’s local reputation, while allowing boosters to capitalize on the institution’s economic promise. Plaskett continued attending these public events, playing up the importance of the facility. Speaking in the Empress Hotel at the Union of Canadian Municipalities civic conference a month after the formal opening

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<sup>269</sup> W. C. Adkins, “A Trip to Arcturus,” 17.

<sup>270</sup> “Convention From States in Session,” *Daily Colonist*, June 21, 1918, 7.

<sup>271</sup> *Ibid.*; Dawson, *Selling British Columbia*, 42, 44-6.

<sup>272</sup> Dawson, *Selling British Columbia*, 45

of the telescope, he “assured the gathering that [the observatory] was something of which Canadians as a whole might well be proud,” before a motor tour of the delegates stopped at the DAO the following morning.<sup>273</sup> These public appearances, and Plaskett’s many lectures, continued to build support for the new facility among both Victorians and Canadian political and social elites.<sup>274</sup>

The dedication shown by astronomers and politicians during the construction of the DAO, and the excitement displayed by Victorians, foreshadowed the importance of the new facility. Upon its completion the Victoria telescope stood as the world’s largest operating observatory, though the Mt. Wilson reflector would shortly eclipse it. Plaskett maintained efforts to not only build the reputation of his new institution, but contribute to the education of interested Victorians and the residents of surrounding communities. Victorians were confident that the new telescope would contribute to the region’s identity as both a tourist fixture, and an institution of scientific thought, expectations that were realized over the next decade.

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<sup>273</sup> “Big New Observatory Highly Satisfactory,” *Daily Colonist*, July 12, 1918, 4; “Motor Tour Ends Civic Conference,” *Daily Colonist*, July 12, 1918, 7.

<sup>274</sup> “Mars Not Inhabited Dr. Plaskett Believes,” *Daily Colonist* August 2, 1919, 5.

### Chapter 3 - “Something to look at:” Astrophysics, Education, and Public Interest, 1918-1941

In a 1919 address to the Victoria RASC, astronomer R. K. Young declared that the “structure of the universe was the fundamental problem of astronomy.”<sup>275</sup> The astronomical community had been struggling with the problem for centuries. Now, for the first time, scientists had assembled the tools to answer these questions. In what was later termed the ‘great debate’ of astronomy, scientists toiled throughout the interwar period to form a clearer understanding of the universe. DAO astronomers made significant contributions to these efforts through the study of galactic rotation and interstellar calcium. Throughout the 1920s DAO astronomers conducted structured spectrographic surveys of the hottest and brightest stars in the galaxy, known as O and B stars.<sup>276</sup> Victoria’s astronomers focused on binary star systems, involving multiple stars orbiting around each other, with the notable discovery of ‘Plaskett’s Star’ establishing an early reputation of excellence at the DAO.<sup>277</sup> Historian Richard Jarrell argues that prior to the construction of the Victoria Observatory “Canada was a scientific backwater,” as its “astronomical community numbered about a dozen professionals and there was only one observatory of note.”<sup>278</sup> Staff at the new observatory helped reverse this, training a new, if small,

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<sup>275</sup> K.M. Chadwick, “Meetings of the Society: At Victoria,” *JRASC* 13 no. 5. (May-June 1919), 244-246.

<sup>276</sup> O and B are the two hottest and brightest categories of stellar classification. Cecilia Payne-Gaposchkin organized the spectral sequence into a temperature sequence ranging from surface temperatures of over 30,000 degrees Celsius in O stars to 3,500 degrees Celsius in K stars. The accepted classifications include O, B, A, F, G, K, and M with gradations within each category. Within each broad spectral category are sub-classes that indicate the position of a star on the Hertzsprung-Russell diagram, that typically include a digit from 0-9 (hottest to coolest) and a class of I-V in Roman numerals indicating if the star is a main-sequence star or a giant. For example, the Sun is a G2V star, meaning it is a bright main-sequence yellow-dwarf. This classifications system allowed astronomers to quickly identify the type of star they were observing purely from spectral data.

<sup>277</sup> In many ways this was a continuation of the original astrophysics program in Ottawa, with a focus on radial velocities and binary star systems. The interaction between stars in such systems allowed astrophysicists to apply Newton’s and Kepler’s laws to determine the size and mass of distant bodies.

<sup>278</sup> Richard A. Jarrell, “The Reception of Einstein’s theory of Relativity in Canada,” *JRASC* 73, (1979): 358-69.

generation of Canadian astronomers while educating visitors and tourists from across North America in an extensive program of public engagement.

The construction of the DAO transformed Victoria into a destination for visiting astronomers, and boosted the tourism profile of the region.<sup>279</sup> Through successive discoveries and outreach efforts devoted towards educating the local population, the small institution developed into a popular tourism destination, contributing to the intellectual development of the region. Educated Victorians and civic promoters welcomed the new institution as a feature of the city's shifting identity during the 1920s and 30s. The international recognition of discoveries made by the Victoria staff fed local interest, while promoters focused quickly on the new facility as a symbol of modern engineering that would draw tourists to the city. Indeed, thousands of visitors flocked to Victoria see the institution and other local attractions throughout the 1920s, with the Victoria and Island Publicity Bureau (VIPB) repeatedly including the telescope in promotional campaigns.<sup>280</sup> DAO staff also popularized astronomy in the greater Victoria area through public lectures, newspaper columns, and even radio broadcasts.

In 1929 the Great Depression introduced numerous challenges to both promoters and astronomers, as funding reductions, restructuring, and falling annual visitation reduced the prominence the institution had enjoyed in the 1920s. Yet the Depression also offered opportunities, as public works initiatives saw repeated improvement for infrastructure on the observatory grounds. Despite the turmoil of the decade the DAO continued to function as a world-class observatory, and a tourist draw throughout the downturn.

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<sup>279</sup> "Visiting Astronomer," *Daily Colonist*, August 18, 1915.

<sup>280</sup> In 1922 the Victoria and Island Development Association (VIDA) changed its name to the Victoria and Island Publicity Bureau (VIPB).

Although the DAO opened in 1918 with a staff of just two astronomers, J. S. Plaskett and R. K. Young, Victoria's observatory was in a rare group of research institutions.<sup>281</sup> The only two telescopes capable of the work schedule conducted by Victoria's 72-inch reflector with anywhere near the same efficiency were the 60 and 100-inch telescopes located at the Mt. Wilson Observatory of California. The DAO would remain the world's second largest telescope until the 1935 opening of the David Dunlap Observatory in Toronto, a telescope nearly identical to Victoria's reflector, with a primary mirror just two inches larger.<sup>282</sup> After initial tests in May and June of 1918, DAO staff immediately began astrophysical research focused on establishing the radial velocities of the brightest stars in the northern hemisphere, seeking insight on stellar evolution, the nature of binary systems, and their distribution throughout the galaxy.<sup>283</sup> DAO astronomers collaborated with those at the Lick and Mt. Wilson Observatories to organize the early observation program, avoiding redundant research while making important contributions to astrophysics.<sup>284</sup>

The first year of operations saw Plaskett and Young establish a research program while fine-tuning the operation of the new telescope. Between two astronomers and a night assistant, they set out on a three-year observing program of nearly 800 binary stars, coordinating the work

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<sup>281</sup> Jarrell, *The Cold Light of Dawn*, 112.

<sup>282</sup> After leaving the DAO R. K. Young helped engineer the Toronto telescope. He followed Plaskett's design for the Victoria telescope, but the mirror was slightly larger, allowing the new facility to claim the prestige of being the second largest telescope in the world. Like Young other staff members trained in Victoria joined the new facility, and established an observing program based on the astrophysics work conducted in Victoria. For a comprehensive discussion of the David Dunlap Observatory in the context of Canadian Astronomy see Jarrell *The Cold Light of Dawn*.

<sup>283</sup> Radial velocities indicate the apparent motion or speed of a star moving towards or away from the Earth. As binary stars orbit each other, looking at an edge on pair would show one star to be moving towards the observer, while one moved away. This results in shifting spectral lines on the photographic plates due to the influence of the Doppler effect. In this way astronomers could identify 'spectroscopic binary' systems, where two stars were not optically visual, but are identified by their spectral characteristics.

<sup>284</sup> Jarrell, *The Cold Light of Dawn*, 112-13.

with Mt. Wilson.<sup>285</sup> This period also saw continued testing on the telescope's operation to ensure the quality of the mirror. Despite Victoria's low diurnal temperature variation, errors introduced by temperature variations of the mirror were still too great for Plaskett, influencing the focusing performance of the telescope.<sup>286</sup> The astronomers quickly arrived at the solution of packing the edge and bottom of the mirror with cotton felt, and placing a woolen blanket over the mirror during the day.<sup>287</sup> These simple, economical improvements stabilized the mirror's focus, allowing Plaskett and Young to pursue their study of binary stars.

Although the observation program provided structure and direction for the new institution, staffing remained an issue. Plaskett hoped that astronomer William E. Harper would join him in Victoria from the Ottawa staff quickly, but his arrival was delayed until April 1919. The final original staff astronomer, Plaskett's son Harry, arrived from Europe in October 1919 having served in the First World War. "The staff at the Dominion Astrophysical Observatory will be still further increased," Victorians learned from a *Daily Colonist* article on the younger Plaskett's scientific and military career in anticipation of his arrival.<sup>288</sup> Prior to the arrival of the newcomers Plaskett and Young were a productive pair, exposing 1800 photographic plates and measuring 1000 of them by April 1919.<sup>289</sup> The new arrivals were welcome additions to the observatory's scientific endeavors, and by 1921 the four-man staff had obtained 5500 stellar spectra, discovered 140 spectroscopic binaries, and computed the orbits of a further eighteen. Overall they calculated the radial velocities for 594 stars that comprised Victoria's share of the

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<sup>285</sup> Hodgson, *The Heavens Above*, 96.

<sup>286</sup> When experiencing changes in temperature a mirror of ordinary glass would either expand or contract, changing the apparent shape of the optic, and resulting in an out of focus image.

<sup>287</sup> This method actually worked so well that when the dome was opened in the evening to prepare for observing the mirror was often below the outside temperature; Plaskett, "Description of Building and Equipment," 46-7.

<sup>288</sup> "Assistant Observer on Last Lap Home," *Daily Colonist*, August 26, 1919, 7.

<sup>289</sup> Jarrell, *The Cold Light of Dawn*, 113.

measurements.<sup>290</sup> The engineering of the telescope supported the DAO's ambitious research program; an astronomer working in tandem with the night assistant or second observer could reset the telescope on a new target and begin exposing in just two minutes, much faster than contemporary facilities.<sup>291</sup> This efficiency was critical, as each star was observed on five different occasions across the study. "No computing assistance was available and the observers had to measure and reduce all the spectrograms," wrote Plaskett, the four astronomers sharing responsibility for the enormous amount of material generated during the survey.<sup>292</sup>

Publishing these early findings was a somewhat contentious process initially. During the First World War the publication of scientific journals had a low priority, and the Ottawa observatory had developed a substantial backlog of material by 1919. Overseeing the publication process for both observatories, Chief Astronomer Otto Klotz rejected a manuscript produced by the DAO's R.K. Young, sparking a tense exchange over the relative position of the two facilities within the Astronomy Branch.<sup>293</sup> An outraged Plaskett, having secured *de facto* independence for the Victoria facility when appointed Director in 1917, claimed that Klotz was undermining the DAO's standing in the international scientific community.<sup>294</sup> Young's paper was never published, the exchange between Plaskett and his superiors highlighting the professional and institutional priority given to getting research results into print. "Every bit of publicity, favorable notices in scientific journals or popular interviews in the local press were brought to the attention of the people in Ottawa," Hodgson observes, as continued funding for the institution required

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<sup>290</sup> J.S. Plaskett, W. E. Harper, R. K. Young, and H. H. Plaskett, "The Radial Velocities of 594 Stars," *PDAO* 2 (1921): 2-127.

<sup>291</sup> J. S. Plaskett et al, "The Radial Velocities of 594 Stars," 4; K.M. Chadwick, "Meetings of the Society: At Victoria," *JRASC* 13 no. 5 (May-June 1919): 244-246.

<sup>292</sup> Despite being the third author, Young measured the most stars at 254, trailed by Plaskett at 180, Harper at 159, and H. Plaskett at 127; Plaskett et al, "The Radial Velocities of 594 Stars," 6.

<sup>293</sup> Jarrell, *The Cold Light of Dawn*, 113; Hodgson, *The Heavens Above and the Earth Beneath*, 87.

<sup>294</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 87-8; Jarrell, *The Cold Light of Dawn*, 113.

political support. Hodgson describes Plaskett as a “public relations master,” recognizing “the importance of publication not only to the scientific reputation of the Observatory but also to maintaining its position in the consciousness of the Ottawa mandarins.”<sup>295</sup> Plaskett, determined to carve out an independent identity for the Victoria facility, succeeded in having it named ‘The Dominion Astrophysical Observatory,’ rather than the ‘Dominion Observatory (Victoria)’.<sup>296</sup> Plaskett had secured independence for the DAO’s scientific program, and he would ultimately gain control over its academic publications despite still communicating with the Department of the Interior through Klotz.

Anxious to build support among Victoria’s enthusiastic community of amateur astronomers, staff members of the DAO also supported the RASC. The Victoria RASC had curtailed meetings since May 1918 as a result of the Spanish Influenza outbreak, yet still maintained 72 members in 1919.<sup>297</sup> On May 7<sup>th</sup>, 1919, almost exactly a year after the mirror was first installed, Plaskett invited members of the Victoria RASC to a tour of the facility and grounds. The gathering of over one hundred visitors heard lectures on the instrument, and enjoyed views of the moon and Saturn.<sup>298</sup> Plaskett strengthened the ties between amateur and professional astronomers by encouraging staff members to join the RASC. By 1919 Young was appointed President of the Victoria RASC, with Plaskett serving as the Honourary President.<sup>299</sup> Later in 1919 Plaskett held a lecture on “The Progress of Astronomy” at the annual meeting of the RASC.<sup>300</sup> A clear distinction between amateur and professional astronomers had to be

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<sup>295</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 99.

<sup>296</sup> *Ibid.*, 88.

<sup>297</sup> K. M. Chadwick, “Victoria Centre, R.A.S.C.: Secretary’s Report for the Year 1918,” *JRASC* 13, no.3 (March 1919): 138-9.

<sup>298</sup> “Local Astronomers Visit Big Telescope,” *Daily Colonist*, May 7, 1919, 4.

<sup>299</sup> K.M. Chadwick, “Meetings of the Society: At Victoria,” *JRASC* 14, no.1 (January-February, 1920): 31.

<sup>300</sup> “City and District in Brief: Lecture on Astronomy” *Daily Colonist*, December 13, 1919, 6.

maintained, however, and Plaskett followed Klotz's suggestion in establishing the 'Observatory Club' in 1918 as a forum for staff astronomers and visiting professionals to exchange technical data and practice conference presentations.<sup>301</sup> Together, such initiatives contributed to a vibrant institutional culture while promoting connections with the local community.

Perhaps nothing boosted the public profile of the DAO more than the discovery of 'Plaskett's Star' in 1922. The systematic program pursued by Plaskett between 1918 and 1921 yielded early scientific results on binary stars, and with time available he decided to conduct some 'special investigations.' In 1921 Annie Jump Cannon, a woman instrumental in the development of the spectral system used to classify stars, sent Plaskett an observing list of 36 'O class' stars within reach of the DAO.<sup>302</sup> These stars are incredibly rare, representing under a tenth of a percent of stars in the Milky Way, but are enormously bright. Late that year an intrigued Plaskett was drawn to a star known only as B.D. 6° 1309. Within the year Canadians would come to know it as 'Plaskett's Star'. One of Plaskett's tasks was to confirm the star's classification, initially produced with lesser telescopes. Using the resolving and light gathering power of the 72-inch telescope in the production of high-resolution spectrums, Plaskett confirmed that this was the most massive star discovered to date.

Pursuing his inspection, Plaskett determined that B.D. 6° 1309 was in fact a *pair* of 'O class' stars - the hottest and brightest type - orbiting each other, and an interesting pair at that. Plaskett followed this pair until April, 1922 mapping their orbit, determining their mass, and calculating the brightness and distance from Earth. Together, Plaskett estimated, they were at least 139 times as massive as the Sun and 27,000 times as bright, yet completed a compact

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<sup>301</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 112; Jarrell, *The Cold Light of Dawn*, 105.

<sup>302</sup> Plaskett, "The Star of Greatest Known Mass," *JRASC* 16, no.125 (November 1922): 284-5.

Venus-sized orbit in just fourteen and a half days.<sup>303</sup> The discovery of twin stars, each more massive than anything seen before, was heralded as a feat of science and technology. Operating on the leading edge of astrophysics, Plaskett had accumulated unprecedented information on a previously unimportant star. Plaskett produced an accessible description of ‘Plaskett’s Star’ at the request of the *JRASC*, documenting the discovery for the Canadian public. The article deemed a necessity “as in the wide newspaper interest and publicity, entirely unsought by the writer, some erroneous conceptions have probably appeared.”<sup>304</sup> The attention may have been ‘unsought,’ but it was nevertheless welcome in building the reputation of both Plaskett and the institution he headed.

News of Plaskett’s discovery quickly spread beyond the scientific community to readers of national and international newspapers. ‘Plaskett’s Star’ was remarkable in just how unremarkable it was prior to the investigations conducted in Victoria, appearing to be relatively insignificant in comparison to the brighter denizens of the night sky. “Tiny Star Disclosed as Twins 380 Times Bigger Than the Sun” proclaimed the 2 July 1922 *New York Herald* in an overview of the stellar system from a press release prepared by Plaskett.<sup>305</sup> Though these numbers were exaggerated by a factor of two in comparison to Plaskett’s more conservative estimate, the sheer scale of these stars — together over four times as large as any other known stellar mass — generated widespread popular interest.

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<sup>303</sup> This was actually thought to be the low end of the potential mass for the system, as Plaskett estimated “the diameters of these stars are probably about 20 and 18 times the sun... separated by 65 solar diameters.” With the two stars situated in such a tight orbit, an edge on view of the system would result in an eclipse every fourteen days, meaning “the orbit plane must be at least 17° from the line of sight.” As a consequence the true mass was likely higher, with Plaskett estimating 160 solar masses, or “more than four times greater than any previously determined [binary pair].”; Plaskett, “The Star of Greatest Known Mass,” 284, 86, 88.

<sup>304</sup> Plaskett, “The Star of Greatest Known Mass,” 284.

<sup>305</sup> “Tiny Star Disclosed as Twins 380 Times Bigger Than the Sun,” *The New York Herald*, July 2, 1922.

For Canadians the spotlight was as much on Plaskett himself as the discovery. A July 1922 *Ottawa Evening Journal* article titled “Plaskett’s Star,” hailed his “great discovery to astronomy.”<sup>306</sup> Reprinting the article two days later, the *Toronto Globe* applauded his “remarkable observation.”<sup>307</sup> The fame of Plaskett and his stars extended to the United States, the *New York Times* describing the discovery as “one of the most outstanding astronomical achievements of recent years.”<sup>308</sup> The *Boston Globe* also discussed the “two new huge suns,” complete with a biography of Plaskett, noting that the DAO telescope “is big enough to drive [an] auto through.”<sup>309</sup> Plaskett’s dispatches to American newspapers featured few variations. Readers of the *Washington Post* and *Wall Street Journal* were introduced to the size and scale of the system, learning it would take “an airplane traveling 200 miles an hour...30,000,000 years to travel from the earth to the newly discovered suns.”<sup>310</sup> The claim to discovering the largest known star not only produced international comment, but opposition. An article in the *English Mechanic* by O. R. Walkey reprinted in *JRASC* attacked current methods for solving the mass of a star system, happily reminding readers that by his determination the star “Canopus still holds first place.”<sup>311</sup> Opposition notwithstanding, the volume of press generated by Plaskett’s discovery rapidly increased the social and cultural profile of the DAO.

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<sup>306</sup> “Plaskett’s Star,” *Ottawa Evening Journal*, July 12, 1922, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

<sup>307</sup> “New Discovery by Star-Gazer,” *Globe*, July 14, 1922, 18.

<sup>308</sup> “Discovers Twin Suns Far Bigger Than Ours,” *New York Times*, July 24, 1922, 26

<sup>309</sup> “Discover Two New Huge Suns,” *Boston Globe*, August 21, 1922.

<sup>310</sup> “Newly Found Suns Make Pigmy of Sol,” *Washington Post*, July 23, 1922, 3; “Newspaper Specials,” *Wall Street Journal*, July 4, 1922, 3.

<sup>311</sup> Ironically, modern measurements place Plaskett A and B at 54 and 56 solar masses respectively – or approximately 79% of Plaskett’s value of 139 for the system, while Caonopus has been reduced to 10 solar masses, or 12% of Walkey’s value; “A Comparison of Giant Stars,” *JRASC* 16, no. 125 (November, 1922): 312; Scientists also targeted the discovery, on occasion including studies in 1923 and 1928 by astronomers J. Stebbins and P. Gunthnick. Ultimately it took 73 plates collected by Otto Struve in 1948 at the McDonald Observatory Plaskett helped build to topple Plaskett’s measurement, reducing the mass of the system to 100 solar masses from 139; Otto Struve “J. S. Plaskett’s Star of Large Mass, HD 47129,” *Astrophysical Journal* 107, (1948): 327-8, 335.

The discovery of Plaskett's Star was not just a scientific achievement, but a moment of local pride that heralded Victoria's arrival as a scientific centre. While DAO astronomers conducted excellent research during the three operational years prior to this discovery, the accomplishments drew only the interest of the scientific community and that of local astronomy enthusiasts. As the largest discovered star system, and a dynamic one at that, 'Plaskett's Star' transcended these limitations, briefly raising both himself and the institution to near celebrity status. On the strength of Plaskett's discovery a *Current History* article ranked him amongst "Canada's Leaders in Science and Research."<sup>312</sup> Locally, the discovery reached a new level of acclaim after Plaskett visited the Royal Astronomical Society in England, to discuss his work. "Eyes of science on Victoria astronomer," proclaimed an edition of the 1924 *Victoria Daily Times*, arguing "the one event... which has carried the name of Victoria to the remotest parts of the earth was the discovery in 1922 by Dr. J. S. Plaskett."<sup>313</sup> In a boosterist furor the article proclaimed that, "Victoria is proud of her connection with Dr. Plaskett and his discovery, and her citizens will receive a sense of further satisfaction to know in what regard both are held elsewhere throughout Canada."<sup>314</sup> Led by Plaskett, the DAO not only met, but surpassed the expectations of both Victorians and the scientific community. That his research had been "discussed in London" reinforced a grandiose local perception of Victoria within the Empire.

The Victoria observatory received local press for a second major contribution in 1922, when the Astronomy Branch scheduled an eclipse expedition to Australia led by University of

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<sup>312</sup> J. Murray Clark, "Canada's Leaders in Science and Research," *Current History* 20, no.1 (April 1924).

<sup>313</sup> "Eyes of Science on Victoria Astronomer," *Victoria Daily Times*, May 11, 1924, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

<sup>314</sup> "Eyes of Science," *Victoria Daily Times*.

Toronto Astronomer C. A. Chant.<sup>315</sup> R.K. Young of the DAO joined Chant for the trip which provided an opportunity to test Albert Einstein's Theory of Relativity and confirm measurements conducted in 1919 by Sir Arthur Eddington, one of England's preeminent astronomers.<sup>316</sup> Plaskett had introduced Victorians to the concept of Relativity that year in one of the earliest public talks touching on the topic in Canada after Eddington first popularized the theory in English.<sup>317</sup> En route to Australia Chant visited Victoria to meet Young, and later published an account of his entire journey in the *JRASC*, including a flowery description of the cross-Canada trek that highlighted the DAO and a tour of Victoria's attractions, guided by Plaskett and his wife.<sup>318</sup> The Victoria RASC, flourishing in the shadow of the DAO, hosted a luncheon for Chant.<sup>319</sup> The local newspapers covered Chant and Young's expedition, excited by Victoria's representation in the international event, and the implications of any discoveries from the endeavor.<sup>320</sup> The interest was justified. During their 1923 observations in Australia Chant and Young successfully measured the gravitational bending of starlight passing the surface of the Sun, confirming the expectations of Einstein's theory.<sup>321</sup>

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<sup>315</sup> Jarrell and Hodgson agree that C. A. Chant and J. S. Plaskett had a similar, if distinct, influence on the early development of the Canadian astronomy program, with Chant's work centered on developing educational infrastructure for astronomy and astrophysics at the University of Toronto.

<sup>316</sup> The 1922 eclipse observations provided astronomers with the ability to follow up on astronomer Arthur Eddington's 1919 observations that appeared to support Einstein's predictions that the Sun's gravity would bend light passing it, and deflect the appearance of stars from their expected positions. Accuracy remained an issue and subsequent expeditions including 1922 led to further debate on the validity of Eddington's original measurements.

<sup>317</sup> Jarrell, "The Reception of Einstein's Theory of Relativity in Canada," 361; K. M. Chadwick, "Meetings of the Society: At Victoria," *JRASC* 14, (January-February 1920): 31.

<sup>318</sup> C. A. Chant, "An Astronomical Trip to Australia," *JRASC* 16, no.124, (1922): 249-54.

<sup>319</sup> Chant's visit to the observatory was an experience more typical of a tourist than a scientist, focused on the spectacles of the night sky including Jupiter, Saturn, and a "faint star," despite the overcast conditions; Chant, "An Astronomical Trip to Australia," 250-51.

<sup>320</sup> R. S. Babbage, "The Coming Eclipse and the Theory of Relativity," *Daily Colonist*, September 17, 1922, 23.

<sup>321</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 98; C. A. Chant and R. K. Young, "Evidence of the Bending of the Rays of Light of Passing the Sun, Obtained by the Canadian Expedition to Observe the Australian Eclipse," *PDAO* 2, no.15 (1923): 275-85.

‘Plaskett’s Star’ triggered a transition in Plaskett’s research programs from binary stars towards the investigation of galactic structure, as he followed up on R.K. Young’s tentative research regarding ionized calcium lines in stellar spectra.<sup>322</sup> Like the stars Young focused on, the spectra of B.D. 6° 1309 featured both the H and K lines – dark regions of a spectra – associated with ionized calcium. Plaskett determined that the calcium lines in the binary system were stationary relative to the motions of the two stars, and thus isolated from the rapid movement of the system. This led him to propose the existence of a stationary “intervening calcium cloud” between ‘Plaskett’s Star’ and the Earth.<sup>323</sup> Pursuing this initial hypothesis with a survey of O-type stars, Plaskett concluded that a tenuous cloud of calcium hung between the Earth and the observed stars.<sup>324</sup> DAO programs, then, began to shift to include investigations of the general structure of interstellar space, rather than individual star systems. Plaskett’s research drew the attention of scientific luminaries such as Arthur Eddington in London, solidifying the reputation of Canadian astronomy within the British Empire.<sup>325</sup> Meanwhile, as the observation programs matured, DAO astronomers became increasingly involved with the Victoria community.

Honoured for his work between 1918 and 1924, Plaskett became a Fellow of the Royal Society of London, and received honorary Doctorates from the University of Toronto and University of British Columbia.<sup>326</sup> His trips, and increasing popularity, quickly became matters of public record. Following a visit to Europe in 1925, Plaskett returned to give a lecture at the

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<sup>322</sup> Jarrell, *The Cold Light of Dawn*, 114-5.

<sup>323</sup> He also checked his assumptions against the theory of Relativity, showing that the astronomers at the DAO were accommodating modern physics perspectives into their research; Plaskett, “The Star of Greatest Known Mass,” 292.

<sup>324</sup> J. S. Plaskett, “The H and K Lines of Calcium in O-Type Stars,” *Monthly Notice of the Royal Astronomical Society* 84 (December, 1923): 88

<sup>325</sup> “Eyes of Science on Victoria Astronomer,” *Daily Colonist*, May 11, 1924.

<sup>326</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 99; “Distinguished Recipients of First Honorary Degrees Conferred by University of British Columbia,” 1925, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B.C.

Memorial Hall in Victoria. It was so popular large numbers of people were turned away from the hall, which was “crowded to the doors.”<sup>327</sup> That same year the Men’s Canadian Club of Victoria and the Women’s Canadian Club collaborated with the RASC in hosting a Empress Hotel luncheon at which Plaskett discussed his trip, and Royal Society Fellowship in terms that hailed the growing reputation of Canadian science:

In thus telling of the honours which English science accorded me, I can assure you that I considered them not as personal tributes, but as marks of appreciation of the work of our Observatory, in which I include my colleagues, and as symbols of the high standing of Canada in the scientific world. As such I rejoiced exceedingly in them...<sup>328</sup>

It is no surprise that Plaskett ‘rejoiced’ in the honours which reflected the success of an institution that he both built and supervised. Functionally, there was little to separate his reputation from that of the institution, and this contributed to the perhaps exaggerated public profile he enjoyed. Plaskett would go on to garner further distinctions through influential studies on the nature of the Milky-Way galaxy, a central issue in contemporary astrophysics.

Thanks in part to Plaskett’s fame, by 1924 a number of important shifts occurred as the DAO received a long awaited office building, developed new research programs, and underwent staffing changes. Astronomers at the DAO had waited since 1919 for the promised construction of office buildings and observers’ residences on Little Saanich Mountain, the required \$58,000 having been included in the original estimates for the facility.<sup>329</sup> An early 1920s newspaper article commented that the tourist draw of the observatory made it important to finish the new

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<sup>327</sup> “Dr. J. S. Plaskett Gives Lecture on Tour of Europe,” Unlisted Newspaper, September 1925, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B. C.

<sup>328</sup> “Scientist is Honored Here,” Unlisted Newspaper, 1925, Digital News Clipping Archive, Dominion Astrophysical Observatory, Victoria B. C.; J. S. Plaskett, “A Luncheon to Dr. and Mrs. J. S. Plaskett,” *JRASC* 19 (1925): 247-54, 247, 253-4.

<sup>329</sup> “Observatory Plan Will Be Extended,” *Daily Colonist*, May 6, 1919, 7.

buildings quickly.<sup>330</sup> Yet the article also observed that continued investment in the DAO would deprive the University of British Columbia of funding to provide professional training for returning soldiers, and that while the DAO was “undeniably of great value in the cause of science” it was “of less concern to the average man in the street.”<sup>331</sup> Still waiting in 1923, Plaskett successfully lobbied Mackenzie King for an office building, but the residences were not forthcoming.<sup>332</sup> R. K. Young took a teaching position at the University of Toronto in 1924, prompting Plaskett to hire Joseph Pearce, a graduate of the same institution, as a replacement.<sup>333</sup> Pearce arrived just as Plaskett shifted his research interests to examine the structures of the Milky-Way galaxy, a complex topic that required analysis on a far larger scale than ‘Plaskett’s Star,’ but that would help refine the human understanding of the modern universe. It is important to understand the discoveries and investigations made by Plaskett and Pierce as pieces of the far broader field of cosmology that fully emerged during the 1920s.

There are few moments in history that can claim the dramatic leaps of understanding that accompanied the onset of cosmology, or study of the size and scale of the universe, in the 1920s. In 1932 Plaskett observed it “seems hardly necessary to state in this twentieth century that the fundamental problem in the background of all modern astronomical research is the problem of the constitution, the structure, and the motions of the Galaxy.”<sup>334</sup> Plaskett’s work in this field must be considered in the context of foundational research. At the turn of the 20<sup>th</sup> century astronomers presumed that the galaxy comprised the entire universe, and was about 30,000 light

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<sup>330</sup> The Dominion Astrophysical Observatory’s Digital News Clipping Archive suggests this was a mid 1920s article, but the topic, dollar values, and commentary on returning soldiers places its discussion with the *Daily Colonist* May 6, 1919 article “Observatory Plan Will be Extended,” cited above. “Up in the Heavens,” May 8, 192x, Digital News Clipping Archive, The Dominion Astrophysical Observatory, Victoria B. C.

<sup>331</sup> “Up in the Heavens,” May 8, 192x.

<sup>332</sup> Jarrell, *The Cold Light of Dawn*, 114; Hodgson, *The Heavens Above and the Earth Beneath*, 125.

<sup>333</sup> Jarrell, *The Cold Light of Dawn*, 116.

<sup>334</sup> J. S. Plaskett, “The Structure and Rotation of the Galaxy,” *Publications of the Astronomical Society of the Pacific* 44, no.259 (June 1932): 142.

years across.<sup>335</sup> In 1912 Henrietta Swan Leavitt determined Cepheid stars to vary in brightness over a period of up to 90 days, with the length of each star's period being directly proportional to its intrinsic brightness.<sup>336</sup> Put another way, once astronomers determined the distance to one Cepheid, they could calculate the distance to all of them using this period-luminosity relation. In 1918 Mt. Wilson staff astronomer Harlow Shapley had shaken the astronomical community with the assertion that the Solar System was not located at the centre of the Milky-Way Galaxy. Measuring the distance to Cepheid variable stars within the globular star clusters surrounding the Milky-Way, Shapley revealed that the clusters orbit the Milky-Way in a 'halo,' making them useful for delineating the limits of the galactic system.<sup>337</sup> As a consequence of Shapley's research the size of the Milky-Way was increased nearly ten-fold, and the Earth lost its position at the centre of the system.<sup>338</sup> The bold deduction, based on tenuous data, gained both widespread recognition and resistance from the scientific community. Prior to his breakthrough Shapley estimated that the Andromeda Galaxy sat at least 1,000,000 light years distant, but in the aftermath he reduced this figure to a mere 20,000 light years. Although the debate surrounding the spiral nebula would continue, it was the work of Shapley that Plaskett and Pearce began building on in Victoria nearly a decade later during their investigations into the structure and rotation of the Milky-Way.

Edwin Hubble's 1925 paper analyzing the presence of Cepheid variable stars in the Andromeda galaxy resolved many of the questions surrounding the spiral nebulae, transforming the human understanding of the universe and signaling the full arrival of cosmology as a field of

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<sup>335</sup> Bartusiak, *The Day We Found the Universe*, 128-9.

<sup>336</sup> Henrietta S. Leavitt, "1777 Variables in the Magellanic Clouds," *Annals of Harvard College Observatory* 60:87-108; Henrietta S. Leavitt, "Periods of 25 Variable Stars in the Small Magellanic Cloud," *Harvard College Observatory Circular* 173, (1912): 1-3.

<sup>337</sup> Objects in the halo maintain wide, inclined orbits around the galactic centre.

<sup>338</sup> Bartusiak, *The Day We Found the Universe*, 123, 128-9.

modern astronomy.<sup>339</sup> Adopting Shapley's techniques to focus on the identification of Cepheid variables in the Andromeda galaxy, Hubble arrived at a distance of over 1,000,000 light years to that galaxy.<sup>340</sup> The established wisdom that the Milky Way comprised the known universe was shattered, instead revealing that the spiral nebulae were star systems similar in scale to our own galaxy. While Shapley had increased the size of the universe by a factor of ten, Hubble's universe was vast on a scale that staggered the imagination.

Building on the work of Shapley, Plaskett and staff astronomer J. A. Pearce made numerous contributions to growing understandings of the Milky Way as a galaxy. Plaskett was aware of Shapley's work in 1919, even presenting it to a Victoria audience. However, the rigid research program selected for the formative years of the DAO left little room to engage such a broad research question.<sup>341</sup> Between 1924 and 1927 European astronomer Bertil Lindblad theorized that by measuring the radial velocity of stars, astronomers could determine if the Milky Way galaxy rotates.<sup>342</sup> Astronomer Jan Oort followed up with a paper "qualitatively" supporting

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<sup>339</sup> Cosmology in the 1920s formed out of the increasingly clear understandings of the universe provided by James E. Keeler, William Wallace Campbell, Vesto Slipher, Harlow Shapley and Edwin Hubble's research. This is a representative but incomplete list of contributors that span from the seminal work of William Herschel in the late 18<sup>th</sup> century, to Einstein, Hubble and others in the 20<sup>th</sup> century. As noted in the text, the 'great debate' over the nature of spiral nebulae – galaxies – was a hotly contested topic during the 1920s in part due to Adriaan Van Maanen's false detection of visible rotation in these objects. A list of works that contribute to understanding this discussion include Donald E. Osterbrock, *James E. Keeler: Pioneer American Astrophysicist and the Early Development of American Astrophysics*, (Cambridge, Cambridge University Press, 1984), and Robert W. Smith *The Expanding Universe: Astronomy's 'Great Debate' 1900-1931* (Cambridge, Cambridge University Press 1982). For an accessible discussion of Hubble's discoveries and the debate surrounding the spiral nebulae see Marcia Bartusiak, *The Day We Found the Universe*.

<sup>340</sup> Hubble's use of the Hooker 100-inch reflector was important to his success in resolving these faint objects. However, while this sounds like a straightforward process, there is a certain tedium to searching for an object that might not exist. I do not mean to suggest that Hubble's discovery was simple, despite my brief account of his efforts.

<sup>341</sup> Shapley's approach also lay outside the specialization of DAO astronomers. Shapley relied on the direct observation of Cepheid variables to attain distances, while Plaskett's approach used a spectroscopic survey to map stellar motion and infer distance; "Universe Not so Simple as Thought," *Daily Colonist*, December 17, 1919, 12.

<sup>342</sup> Establishing rotation represented a breakthrough for both understanding the motions of our own galaxy and the spiral nebula. This was a central issue of the 'great debate' in astronomy during the 1920s as astronomers attempted to reconcile competing understandings of the 'universe' and the existence of external galaxies; K. O. Wright, "Fifty Years at the Dominion Astrophysical Observatory," 274.

this theory.<sup>343</sup> Plaskett quickly realized that the DAO could supply observational proof for their theories, and traveled to Europe to meet with Oort in 1927.<sup>344</sup> Agreeing that O and B stars were both bright and distant enough to determine if Oort was indeed correct regarding galactic rotation, Plaskett and Pearce embarked on a systematic observation program of the O and B stars visible from northern latitudes that few observatories were capable of matching.<sup>345</sup>

After less than a year studying 250 of these stars, Plaskett and Pearce produced a paper supporting the principle of galactic rotation that provided insight not only into the nature of the Milky Way's rotation, but its overall structure.<sup>346</sup> Describing Plaskett's achievements as "epoch-making," in 1930 the *Ottawa Evening Journal* observed:

As a purely Canadian product Canadians should, and undoubtedly will, be proud of Dr. Plaskett, who has reflected so much glory on his country in his particular branch of science.<sup>347</sup>

Continuing their work, by 1935 Plaskett and Pearce had independently mapped the rotation of interstellar calcium relative to stellar motion, clarifying the modern understanding of our galaxy.<sup>348</sup> Their work confirmed the Sun was nearly 30,000 light years from the centre of a

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<sup>343</sup> J.H. Oort, "Observational Evidence Confirming Lindblad's Hypothesis of a Rotation of the Galactic System," *Bulletin of the Astronomical Institutes of the Netherlands* 3, (April 14, 1927), 280; Robert W. Smith, "Beyond the Big Galaxy: The Structure of the Stellar System 1900-1952," *Journal of the History of Astronomy* 37, (2006): 325-6.

<sup>344</sup> Plaskett made this journey on crutches after an accident at the telescope. Plaskett's eyeglasses bridged an electrical switch on the telescope, and he received an electrical shock that blasted him off the ladder. It took him three months to recover, during which he produced an account of the work of the observatory; Pearce, "Some Recollections," 293; K. O. Wright, "Fifty Years at the Dominion Astrophysical Observatory," 274.

<sup>345</sup> K.O. Wright, "Fifty Years at the Dominion Astrophysical Observatory," 274.

<sup>346</sup> Plaskett and Pearce accomplished this by determining the stars relative motion, or direction of travel compared to the Earth to map the rotation of the galaxy itself.

<sup>347</sup> "A Great Canadian Scientist," *Ottawa Evening Journal*, July 29, 1930, Digital News Clipping Archive, The Dominion Astrophysical Observatory, Victoria B. C.

<sup>348</sup> Their research showed that interstellar gas was uniformly distributed throughout the galaxy, and rotated with the stars in the galactic plane. They had also determined the velocities of over 1,000 O and B stars; J.S. Plaskett and J.A. Pearce, *PDAO* 5, (1933): 167.

galaxy that was over 100,000 light years across, reducing Shapley's estimates considerably.<sup>349</sup> They also determined the mass of the Milky Way, the velocity of the Sun's movements around the centre, and that the galaxy rotates once every 224 million years, while being comparable in size and nature with Andromeda.<sup>350</sup> For Plaskett the discovery was not only a scientific achievement, but a spiritual one. In his address to the Astronomical Society of the Pacific he concluded:

We should now be able to see [the Galaxy], not as an unorganized aggregation of stars and star clouds... but as a great dynamical unit of definite discoidal form rotating in its own plane in a majestic and beautifully ordered way. The Galaxy is a wonderful example of the universal reign of law in the physical world and of the beneficent wisdom and power of the Supreme Ruler of the Universe.<sup>351</sup>

Led by Plaskett, the astronomers at the DAO addressed a decade of debate over the structure and rotation of the Milky Way with unsurpassed observational evidence.

Plaskett and Pearce were celebrated for their studies on galactic structure in their own time, but historians have tended to underestimate their achievements. Robert Smith describes Plaskett's work as an "important" secondary study that merely confirmed Lindblad and Oort's findings.<sup>352</sup> Yet, during his Halley Lecture to the Royal Astronomical Society in London,

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<sup>349</sup> Plaskett and Pearce, "The Distance and Direction to the Gravitational Centre of the Galaxy," 680, 712-13; Wright, "50 Years," 274; Robert W. Smith, "Beyond the Big Galaxy: The Structure of the Stellar System 1900-1952," *Journal of the History of Astronomy* 37, (2006): 329.

<sup>350</sup> Plaskett and Pearce, "The Distance and Direction to the Gravitational Centre of the Galaxy," 711-712; Wright, "50 years," 274.

<sup>351</sup> J.S. Plaskett, "The Structure and Rotation of the Galaxy," *Publications of the Astronomical Society of the Pacific* 44, no.259 (June 1932): 166.

<sup>352</sup> Robert W. Smith, "Beyond the Big Galaxy: The Structure of the Stellar System 1900-1952," *Journal of the History of Astronomy* 37, (2006): 326; Robert W. Smith, *The Expanding Universe: Astronomy's 'Great Debate 1900-1931* (Cambridge: Cambridge University Press, 1982), 158. Outside of Jarrell and Hodgson's studies of Canadian astronomy Plaskett and Pearce receive limited attention for their work on galactic rotation. Otto Struve and Velta Zebergs would agree with Smith's position, only noting the importance of Plaskett and Pearce's study in passing while discussing Oort's research: Otto Struve and Velta Zebergs, *Astronomy of the 20<sup>th</sup> Century* (New York: The Macmillan Company, 1962), 424-5. David Leverington focuses solely on Plaskett and Pearce's evidence regarding the rotation of interstellar dust as confirmation of rotation without treating the extent of their study: David Leverington, *A History of Astronomy From 1890 to Present* (London: Spinger-Verlag Limited, 1995), 216. The

Plaskett's contemporary Arthur Eddington credited the Canadian with conducting a "remarkable investigation" that provided the "most convincing observational evidence [on galactic rotation]." <sup>353</sup> Plaskett and Pearce's research on galactic rotation also resonated in popular publications across North America and the Atlantic. *New York Times* readers learned the galaxy was "spinning like a huge disk," filled with gas and dust, and home to "200 Billion Stars." <sup>354</sup> Readers of the *Times* of London also learned of Plaskett and Pearce's studies through discussions of Eddington's lectures on the topic and the honours Plaskett received for the work. <sup>355</sup> For his efforts Plaskett was awarded the gold medal of the Royal Astronomical Society of London, and delivered the George Darwin Lecture in 1930. Other honours included the Bruce medal of the Astronomical Society of the Pacific, the Flavelle Medal of the Royal Society of Canada, an honorary LL.D from McGill in 1932, and the Henry Draper medal in 1934. Named a Commander of the British Empire in 1935, Plaskett, and to a lesser extent Pearce had emerged as leaders in the field of astrophysics. <sup>356</sup>

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importance of work conducted in Victoria is not wholly over-looked in these general accounts on the history of astronomy. However, while lauding the radial velocity work of Victoria astronomers, John B. Hearnshaw fully ignores Plaskett and Pearce's contributions on galactic rotation focusing only on Oort: John B. Hearnshaw "Spectroscopy," in *Cosmology: Historical, Literary, Philosophical, Religious, and Scientific Perspectives*, ed. Norris S. Hetherington, (New York: Garland Publishing Inc, 1993), 306. A notable exception to this trend is seen in Richard Berendzen, Richard Hart, and Daniel Seeley's *Man Discovers the Galaxies*, which provides a detailed discussion of Plaskett and Pearce's contributions; Richard Berendzen, Richard Hart, and Daniel Seeley, *Man Discovers the Galaxies*, (New York: Science History Publications, 1976), 65-85.

<sup>353</sup> Plaskett and Pearce's study was set apart by the capability of the DAO reflector. The large reflector allowed them to pursue fainter targets while rapidly collecting accurate measurements; A. S. Eddington, "The Rotation of the Galaxy," in *Five Halley Lectures* (Oxford: Clarendon Press, 1936), 7, 11.

<sup>354</sup> "Cosmic Rays From Afar," *New York Times*, November 22, 1936, page xx6, ProQuest Historical Newspapers: The New York Times (1851-2010); "Star Dust and Space," *New York Times*, September 13, 1931 E1; "200 Billion Stars in the Milky Way," *New York Times*, July 2, 1935, 14; Waldemar Kaempffert, "The Week in Science: Taking an Inventory," *New York Times*, December 31, 1933, xx6.

<sup>355</sup> "Rotation of the System of Stars," *The Times*, June 2, 1930, 8; "The Royal Society of Canada," *The Times*, May 28, 1932, 11.

<sup>356</sup> These were only some of the major awards Plaskett received. Jarrell notes he was elected vice-president of the American Astronomical Society and also awarded the Rumford Prize of the American Academy of Arts and Sciences, while Hodgson adds a further LL.D. from Queens University; Jarrell, *The Cold Light of Dawn* 117; Hodgson *The Heavens Above and the Earth Beneath*, 143; "Dr. Plaskett is Awarded High honor," *Victoria Daily Times*, January 14, 1930, Digital News Clipping Archive, Dominion Astrophysical Observatory Victoria B. C.; J. S.

During the 1920s visiting astronomers from Europe and the United States regularly attended scientific gatherings at the DAO, their visits a realization of the hope that Victoria would develop into a scientific centre.<sup>357</sup> Pearce notes that a listing of the famous astronomers who addressed DAO staff “read like a ‘Who’s Who in the International Astronomical Union.’”<sup>358</sup> These astronomers regularly participated in the ‘Seminar Club’ at the DAO, sharing knowledge with the staff, while receiving updates on the work conducted in Victoria.<sup>359</sup> Professor Anton Pannekoek of Leiden spent six months at the DAO offering Plaskett and Pearce insights into the issues of galactic rotation, and the use of calcium to measure differential rotation.<sup>360</sup> Other notable visitors included F. Zwicky of Mt. Wilson, H.D. Curtis of Lick Observatory, who debated Shapley on the scale of the universe in 1920, and Astronomer Royal Sir Frank Dyson.<sup>361</sup> These visits continued throughout the Great Depression, often including sightseeing in the Victoria area.

The public joined scientists’ interest in the DAO, as Victoria developed its reputation as a tourist destination. With the popularity of astronomical discoveries in the 1920s it is no surprise that members of the public wished to look through the instruments that were redefining

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Plaskett, “The George Darwin Lecture 1930,” *The Observatory* 53, (1930): 223-9; “Royal Society of Canada Gives Medals,” *New York Times*, December 12, 1931, 15; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932): 178; “Progress of Science,” *The Science News-Letter* 28, no.767 (December 21, 1935): 388; “Canadians Share in Honors,” *New York Times*, January 1, 1935, 20.

<sup>357</sup> W.E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932): 178-9; W.E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-3; K. M. Chadwick, “Meetings of the Society: At Victoria,” *JRASC* 14, (January-February 1920): 31; C. A. Chant, “An Astronomical Trip to Australia,” *JRASC* 16, no.124 (1922): 249-54.

<sup>358</sup> Pearce, “Some Recollections of the Observatory,” 293.

<sup>359</sup> In all likelihood the ‘Seminar Club’ was a continuation of the ‘Observatory Club;’ W.E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-3.

<sup>360</sup> Pearce, “Some Recollections of the Observatory,” 294.

<sup>361</sup> For full list of visitors consult Harper’s notes in the *JRASC*. For example, 1931 includes, H.D. Babcock, Miss Mary Jyneur and Miss E.E. Sternberg of Mt. Wilson, A.L. Patterson of the Rockefeller Foundation, D.B. Pickering, T.R. Murton and Professor Taylor of Oxford; Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 25, (1931): 371-2; Harper, “Notes from the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-3, 326-7; Pearce, “Some Recollections,” 294-5.

understandings of the universe. Historian David Lowenthal's discussion of the priority of heritage is a useful lens through which to assess visitor interest. By claiming the title of the largest operating telescope for its first six months of operation, the DAO claimed a superlative over other scientific institutions. "Priority can enshrine even a relatively recent heritage" according to Lowenthal, meaning that for Victorians both the construction, and Plaskett's recent discovery of Plaskett's Star allowed the institution to claim priority in public discourse, elevating the cultural status of the institution.<sup>362</sup> While the 100-inch telescope at Mt. Wilson became the world's largest operating telescope in November 1918, time on the instrument was "so valuable" that ordinary visitors were restricted to looking through the 60-inch telescope. The 72-inch Victoria reflector remained the "largest telescope through which the ordinary visitor can look," providing a "gateway to the stars," for tourists and Victorians alike.<sup>363</sup> The Observatory was a 'boundary zone' between scientists and the general public. The physical act of observation could at least temporarily unite scientific elites and visitors in a powerful shared experience of viewing Saturn, Jupiter, or the Moon, underscoring the institution's educational importance.

The DAO inherited an extensive public outreach mandate from the DO in Ottawa. During the summer of 1918 visitors to the DAO could claim an unmatched experience in this regard. "Crowning Little Saanich Mountain is the biggest telescope in all the world," claimed the *Colonist*, with Victoria "brought uncountable millions of miles nearer the constellations of heaven than any other point on this mundane sphere."<sup>364</sup> The DAO opened its doors to the public on Saturday nights, following a tradition established by the Ottawa observatory. Just a month after the official opening Victorians who did not own automobiles could arrange transportation

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<sup>362</sup> David Lowenthal, *The Heritage Crusade and the Spoils of History* (Cambridge University Press, 1968), 174-5.

<sup>363</sup> James Stokley, "You Can Get a Close-up Now of the Most Popular Planet," *The Science News-Letter* 18, no.490 (August 30, 1930): 132-44, 132; Adkins, "A Trip to Arcturus," *Daily Colonist*, August 18, 1918, 17.

<sup>364</sup> W. C. Adkins, "A Trip to Arcturus," *Daily Colonist*, August 18, 1918, 17.

from a local auto service for the price of \$3, round trip.<sup>365</sup> The additional staff joining Plaskett and Young in 1919 proved useful in cultivating public interest and support, delivering public lectures at the DAO, various Victoria gatherings, even traveling to up-island communities to discuss general interest topics. In March 1919 Plaskett delivered a talk on space in Duncan, followed by an observatory visit from Cowichan Valley students that July.<sup>366</sup> Visiting the DAO or up-Island speaking engagements required traveling over the Malahat Drive, a narrow, steep, and dangerous stretch of road connecting Victoria and the Cowichan Valley, but these ventures were deemed worthwhile because of their educational merit. At the request of a local summer school organizer Plaskett delivered a talk on the possible inhabitation of Mars to an audience at a Victoria school in August 1919. “A large number of students and teachers were present and after the lecture they asked many questions arising out of the subject,” marking the event as an effective educational experience.<sup>367</sup> The next day the students visited the DAO to “receive some practical instructions” on astronomy and science.<sup>368</sup>

Plaskett’s public lectures engaged a broad range of topics and audiences, sometimes contextualizing science within theological understandings of creation. Lecturing on the “Wonders of the Starry Universe,” at the Metropolitan Methodist Church in 1920, Plaskett told his audience that “science can only explain the development of the universe, but not its origin. For that we must turn to the Creator.”<sup>369</sup> He delivered at least one other lecture on science and religion at the Christ Church Cathedral in 1933.<sup>370</sup> While it would be convenient to characterize these educational efforts as self-interested pandering to garner local support for the DAO, or an

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<sup>365</sup> “Automobiles for Hire,” *The Daily Colonist*, July 12, 1918, 13.

<sup>366</sup> “Through Space,” *Cowichan Leader*, March 6, 1919; “Fine Outing,” *Cowichan Leader*, July 10, 1919.

<sup>367</sup> “Mars not Inhabited Dr. Plaskett Believes,” *Daily Colonist*, August 2, 1919, 5.

<sup>368</sup> *Ibid.*

<sup>369</sup> “Wonders of Starry Universe Explained,” *Daily Colonist*, November 24, 1920, 4.

<sup>370</sup> W. E. Harper, “Notes from the Dominion Astrophysical Observatory Victoria B. C. *JRASC* 27, (1933): 430.

altruistic effort to better the local community, his intentions appear to sit between these extremes. As a professional astronomer, educator, and administrator Plaskett was adept at managing his reputation and that of his institution to maintain public funding.<sup>371</sup>

Plaskett's mastery of public relations helped introduce Victorians to modern astrophysical discourse, but the challenge of addressing scientific thought with the public was uniformly difficult throughout the 1920s. Individual discoveries within the early research programs conducted by DAO astronomers had meaning within the scientific community, but often failed to bridge the gap between professional and public audiences due to their highly technical language. Writing in terms accessible to a lay audience when describing their work on galactic rotation, Plaskett and Pearce informed Canadians that the solar system orbits the galactic centre at a rate of 275 kilometers per second, some "2,000 times faster than... the Schneider Cup [airplane] races – the fastest man has ever been able to move over the surface of the earth."<sup>372</sup> While Victorians took pride in the local facility, Plaskett observed "the popular conception of the work done with a telescope of this nature was as a rule inaccurate. People imagined that the astronomer spent his time searching the heavens for new stars, planets or comets, but such was far from the case."<sup>373</sup> 'Plaskett's Star' transcended this disconnect; as far as the layperson was concerned Plaskett *had* discovered an astonishing new star. The complex mathematics of the feat were quickly reduced to a palatable form, allowing the public to engage in a previously inaccessible discourse.

Transcending the separation between scientific and public discourse on a local level required education initiatives to engage members of the public, reflecting the importance of the

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<sup>371</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 45, 99,

<sup>372</sup> "Fastest Planes Slow Compared to Far Stars," *Globe*, May 22, 1931, 13.

<sup>373</sup> "Victoria Telescope is Best in World," *Daily Colonist*, December 22, 1918, 19.

early outreach opportunities presented by the facility. Plaskett produced articles for the local newspapers that asserted the value of the DAO's contribution to an international community of scientists while educating the public on how astrophysics represented an exciting departure from traditional astronomical pursuits.<sup>374</sup> To illustrate this point Plaskett asked a lecture audience the value of "a few hundred new stars... among the thousand million already known?"<sup>375</sup> Instead, astrophysics offered expanded understanding of the underlying mechanics and composition of space by studying known objects. This pursuit might lack the novelty of discovering a new planet, but offered far more towards the human understanding of the physical universe. Aside from reinforcing the role of the DAO in modern astrophysics, Plaskett used his public profile to educate Victorians on how astronomers approached their research. During the early 1920s the *Colonist* published a "Talks on Astronomy" column featuring articles produced by DAO astronomers.<sup>376</sup> These efforts proved important in both improving the reputation of the facility among the local population, and increasing the popular understanding of the astronomers' research.

Coupled with the promotional efforts of the VIPB, and increasing visitation to Victoria, the observatory drew both tourists and city residents throughout the 1920s. Astronomer C. S. Beals, who joined the observatory staff in 1927, recalls that during the late 1920s, "cars and buses would come up in swarms."<sup>377</sup> He and Plaskett agreed that as many as three hundred visitors crowded inside the telescope dome on clear Saturday evenings for public viewing.<sup>378</sup>

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<sup>374</sup> "Value of Astronomy Told To Kiwanians," *Daily Colonist*, June 23, 1920, 7.

<sup>375</sup> *Ibid.*

<sup>376</sup> J. S. Plaskett "How to Find Mass of Eclipsing Variable," *Daily Colonist*, October 31, 1920, 16; S.S. Boothroyd, "Star Clusters," *Daily Colonist*, September 3, 1922, 21; Daniel Buchanan, "The Spiral Nebular Hypothesis," *Daily Colonist*, September 17, 1922.

<sup>377</sup> C. S. Beals, "Early Days at the Dominion Astrophysical Observatory," *JRASC* 62, no.6 (1968): 301-2.

<sup>378</sup> J. S. Plaskett, "Reports of the Observatories, 1924-1925: Dominion Astrophysical Observatory Victoria, British Columbia," *Popular Astronomy* 33, no.10 (December 1925): 665-7, 666.

Observing time was split equally between the four principal astronomers, meaning they took Saturday public nights in rotation.<sup>379</sup> “With an excellent road now to the observatory,” Plaskett reported in 1927, “it is becoming an increasing mecca for tourists and last year considerably over 30,000 visited the place.”<sup>380</sup> These were remarkable numbers, especially considering that California’s Lick observatory, the only other facility publishing visitor numbers in *Popular Astronomy*, reported just 10,000 visitors in 1923-1924.<sup>381</sup> The DAO hosted 35,000 visitors in 1928 before peaking at 39,027 in 1929, approaching the onset of the Great Depression.<sup>382</sup> While it is impossible to determine the exact origin of these visitors, their numbers increased dramatically during the tourism season, peaking between July and September. Although visitation declined during the Depression this trend continued, with July and August 1934 hosting 6,922 and 7,567 visitors respectively, while January-June inclusive only featured 4,448.<sup>383</sup> The significance of these numbers cannot be overlooked. In 1923 Victoria received 250,000 tourists annually, climbing to 335,000 in 1926.<sup>384</sup> Rising visitation at the DAO paralleled these increases, although a significant portion of these visits likely derived from local interest. This was an exceptional level of public engagement, considering the small size of the institution and its eight-mile distance from the city.

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<sup>379</sup> Joseph A. Pearce, “Some Recollections of the Observatory (1924-1935),” *JRASC* 62, no.6 (1968): 290.

<sup>380</sup> J. S. Plaskett, “Reports of the Observatories, 1926-1927: Dominion Astrophysical Observatory, Victoria, British Columbia,” *Popular Astronomy* 35, no.10 (December 1927): 571.

<sup>381</sup> Robert G. Aitken, “Reports of the Observatories, 1923-1924: Lick Observatory, University of California Mount Hamilton, California,” *Popular Astronomy* 33, no.1 (January 1925): 32-35.

<sup>382</sup> J. S. Plaskett, “Reports of the Observatories: Dominion Astrophysical Observatory, Victoria British Columbia,” *Popular Astronomy* 37, no.1 (January 1929): 22-4,23; J. S. Plaskett, “Reports of the Observatories, 1928-1929: Dominion Astrophysical Observatory Victoria, British Columbia,” *Popular Astronomy* 38, no.3 (March 1930): 156-8, 58; J. S. Plaskett, “Reports of the Observatories, 1929-1930: Dominion Astrophysical Observatory Victoria, British Columbia,” *Popular Astronomy* 39, no.2 (February, 1931): 87-9, 89; W. E. Harper, “Notes from the Dominion Astrophysical Observatory,” *JRASC* 26, no.213 (April, 1932): 178-9, 178.

<sup>383</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 326-27.

<sup>384</sup> Dawson, *Selling British Columbia*, 62.

The DAO went so far as to arrange private viewings for important public figures as well as visiting scientists. The DAO had repeated visits from Governor Generals, the Lieutenant Governor of British Columbia, and on one occasion Prince Yasuhito Chichibu, the brother of the Japanese Emperor.<sup>385</sup> Their observing sessions disrupted by these visits, the astronomers made the best of it; Beals noted that the staff enjoyed Lieutenant-Governor John William Fordham Johnson's visits "because he had an attractive daughter."<sup>386</sup> Governor General Lord Bessborough's wife, on the other hand, found the explanations of astronomy boring, and staff had to resist the temptation to castigate her.<sup>387</sup> Putting the planets on display for Lady Tweedsmuir, wife of Governor General Lord Tweedsmuir, astronomers noted that she "was a little disappointed and just a little inclined to blame us for it."<sup>388</sup> Yet the presence of such luminaries suggests the importance of the landmark, and its influence as a place of 'high culture' for the local region.

Indeed, impressing visitors was sometimes difficult. The more popular targets like Jupiter or Saturn allowed the astronomers to keep everyone entertained, but stars, the main focus of the professional work done at the DAO, were thought to be quite dull. Some astronomers resorted to chicanery to stimulate interest, intentionally defocusing a star in the eyepiece to provide an impressive if unrealistic image for the crowd.<sup>389</sup> Although senior astronomers frowned on these tactics, visitors expected to be entertained as well as informed. J.A. Pearce recalls that it was "quite fatiguing to handle the 250-300 visitors who, fairly patient but frequently noisy, awaited

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<sup>385</sup> Beals, "Early Days," 302-3.

<sup>386</sup> *Ibid.*, 302.

<sup>387</sup> *Ibid.*, 303.

<sup>388</sup> *Ibid.*

<sup>389</sup> Contrary to the expectations of the crowd, stars remained point sources even through the large telescope. As a result public members expecting to actually 'see' a star were disappointed; Beals, "Early Days," 302.

their turn for a 10-second peep at the object we were describing.”<sup>390</sup> Astronomers also had to deal with the inevitable “cranks who had solved all the mysteries of the universe.”<sup>391</sup> At times the staff would engage with these individuals to the enjoyment of the watching visitors. Particularly frustrating were debates with ‘flat-earth’ men, which left with the astronomer “retir[ing] in a state of confusion.”<sup>392</sup> While amusing, these interactions highlight not only the importance of outreach programs, but the interest in science from Victorians.

DAO astronomers may have wanted to be left alone to conduct their research, but from the outset Victoria’s civic leaders were excited about the institution’s potential contribution to the city’s burgeoning tourism economy. Early 20<sup>th</sup> century tourism advertisements featured “themes of sunshine, beauty, and gardens.”<sup>393</sup> By 1914 promoters had already established a strong connection between climate and the vibrancy of the city, using the rain shadow of the Olympic Mountains to create a unique identity for the region. The scientific criteria surrounding the construction of the DAO fit comfortably with these themes. Upon completion the DAO was regarded as both an ‘engineering marvel’ and a symbol of the ‘climatic superiority’ of Victoria.<sup>394</sup> This trend continued into the 1930s when the DAO’s location was still attributed to the “clear dust free atmosphere” of the city.<sup>395</sup> The Victoria and Island Publicity Bureau (VIPB) and the *Colonist* quickly included in DAO in promotional material designed to attract interest in Victoria. A 1918 edition of the “Follow the Birds” VIPB’s pamphlet featured a picture of the

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<sup>390</sup> Pearce, “Some Recollections,” 290.

<sup>391</sup> Beals, “Early Days,” 302.

<sup>392</sup> In his recollections of the late 1920s and 1930s Beals notes that public visitors held a variety of beliefs or ideas regarding science. As noted above these interactions were often sources of amusement for the visitors, but they also reinforce the importance of the public nights at the DAO; Beals, “Early Days,” 302.

<sup>393</sup> David A. Smith, “Imagining Victoria: Tourism and the English Image of British Columbia’s Capital,” *Pacific Northwest Quarterly* 103, no.2: 67-83, 71.

<sup>394</sup> “A Great Observatory,” *Daily Colonist*, May 13, 1914, 4; “Astronomical Party Visits Observatory,” *Daily Colonist*, October 22, 1916, 17.

<sup>395</sup> Canadian Government Motion Picture Bureau, “Victoria the Sunshine City,” BC Archives Call Number V1988:37/003 item #8.

institution, with numerous listings for the observatory as a destination for ‘drives’ and sightseeing in the region, while noting that the B.C. Electric Railway serviced the site.<sup>396</sup> As members of the public service astronomers welcomed such interest, so important in promoting the Dominion Government’s investment.

During the 1920s the VIPB was increasingly aggressive in promoting Victoria’s identity as an “English outpost on the far edge of North America.”<sup>397</sup> These campaigns contributed to a surge in Victoria tourism numbers, estimated at 370,000 visitors in 1928.<sup>398</sup> As a functioning institution in Victoria the observatory figured prominently in VIPB campaigns, ultimately boosting the cultural influence of the DAO as both a scientific institution and as a destination for the increasing numbers of American automobile tourists. A 1925 VIPB pamphlet lists the “great astrophysical telescope,” among the city’s main attractions.<sup>399</sup> Victoria’s *Returned Soldiers Auto Stand* offered tourists ‘the Magnet Tour’ in the “latest model cars” for a \$7 fee.<sup>400</sup> Advertised as the “most attractive combination motor and water trip in the Pacific Northwest,” the tour included the Malahat Drive, Brentwood, Butchart’s Gardens, and “the Observatory, one of the

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<sup>396</sup> The University of Victoria Library lists the date range of publication as 1916-1918. The pamphlet describes the observatory as “one of the two largest telescopes in the world,” suggesting it was produced after the completion of the 100-inch Hooker telescope at Mt. Wilson in 1917, as it does not mention that the Victoria facility was unfinished. Unfortunately if the pamphlet were produced in 1916 this statement would still be true in relation to the 60-inch at Mt. Wilson, although it would likely mention that the telescope was as of yet incomplete; Victoria and Island Publicity Bureau, “Follow the Birds to Victoria B.C.,” (Victoria B.C. Victoria & Island Development Association: 1918?), Special Collections, University of Victoria, Victoria B.C.

<sup>397</sup> Smith, “Imagining Victoria,” 67.

<sup>398</sup> Dawson, *Selling British Columbia*, 62-3.

<sup>399</sup> It is difficult to verify the date of this source, as it is unlisted on the pamphlet, but it makes reference to the H.M.S. Hood and Repulse stopping at the city in 1924, suggesting it could be the 1928 edition of the pamphlet discussed by Historian Michel Dawson in his monograph on Tourism in British Columbia; Victoria and Island Publicity Bureau, however an notation on the document suggests it was produced in 1925; Victoria and Island Publicity Bureau “Follow the Birds to Victoria: the Capital City of British Columbia,” (Victoria B. C., Victoria & Island Development Association: 1925-8?), Dawson, *Selling British Columbia*, 59

<sup>400</sup> “The Magnet Tour,” *Daily Colonist*, April 17, 1920, 17; “Tourists Take the Magnet Tour,” *Daily Colonist*, April 30, 1920, 13; “Tourists Take the Magnet Tour,” *Daily Colonist*, May 1, 1920, 17; “The Magnet Tour Vancouver Island,” *Western Canadian Motorist*, July 9, 1920, 91.

largest in the world.”<sup>401</sup> The observatory was just one of several factors that helped Victoria develop into a tourism destination, then, but its value lay in boosting the identity of the city as a destination of ‘high culture’ and ‘educational tourism.’<sup>402</sup>

That reputation would persist even during the darkest days of the Great Depression, as tourism to both British Columbia and DAO visitation declined sharply during the first half of the 1930s. Conversely, the 1930s saw numerous public works projects that developed the accessibility of the institution to members of the public. While Plaskett and Pearce pursued their work on galactic rotation, Canada entered the Great Depression on October 29<sup>th</sup> 1929. The Canadian economy contracted dramatically, resulting in widespread unemployment. Historian James Struthers observes that the Canadian government was “hopelessly ill equipped” to address the ensuing unemployment crisis.<sup>403</sup> When Mackenzie King’s Liberal government fell in 1930, new Conservative Prime Minister R. B. Bennett, regarding the downturn as a “seasonal and temporary phenomenon,” responded with increased tariffs and limited unemployment relief.<sup>404</sup> However, unattached and unemployed men from the resource industries quickly migrated to cities, resulting in increased urban unrest. Bennett utilized public works projects including road building and park development to employ these men, and in 1932 he responded to the threat of unrest by establishing Department of National Defence (DND) labour camps.

Despite the turbulence and unrest of the decade the DAO escaped largely unscathed, although some belt-tightening occurred. The first thing to go was the observatory car, soon

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<sup>401</sup> “The Magnet Tour,” *Daily Colonist*, April 17, 1920, 17.

<sup>402</sup> James Stokley, “You Can Get a Close-up Now of the Most Popular Planet,” *The Science News-Letter* 18, no. 490 (August 30, 1930):132-4, 132.; Osterbrock, *Eye on the Sky*, 77-8, 197, 227.

<sup>403</sup> James Struthers, “Canadian Unemployment Policy in the 1930s,” in *Readings in Canadian History: Post-Confederation*, ed. R. Douglas Francis and Donald B. Smith (Toronto: Harcourt Brace, 1994), 409.

<sup>404</sup> Struthers, “Canadian Unemployment Policy in the 1930s,” 410.

followed by housing allowances in 1931.<sup>405</sup> More serious 1932-33 cuts reduced funding for the Victoria observatory from \$25,170 to \$20,600, mainly through salary freezes and a blanket 10 percent public service wage reduction. The institution underwent extensive re-staffing without shedding permanent appointments, but lost summer assistants, and curtailed publications.<sup>406</sup> Jarrell argues the “salaries of the astronomical staff were abysmally low,” but despite the financial hardship “Plaskett and others believed that the work itself was compensation.”<sup>407</sup> Still, the DAO astronomers fared relatively well compared to many during the Depression.

Even as the Great Depression brought constraints for the DAO, unemployment relief policies provided for infrastructure improvements. In 1932 the Dominion Department of Public Works appropriated \$20,000 towards improving the road to the observatory.<sup>408</sup> Harper wondered in jest if “the government feared that some of the members of our staff who have a reputation for speeding might come to grief on the narrow road... or whether it was simply the desire to create work for the unemployed.”<sup>409</sup> In 1934 the Bennett administration allocated a further \$36,000 towards fire suppression equipment.<sup>410</sup> Forest fires regularly compromised observing conditions during the summer months, and a 24 August 1935 bush fire spread across roughly 50 acres of the observatory property, requiring two hundred men to control the burn.<sup>411</sup> The incident sparked further investment from Public Works, permitting the installation of a new water

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<sup>405</sup> Plaskett’s car was arranged as a replacement, but he was not impressed with the outcome; Hodgson *The Heavens Above and the Earth Beneath*, 128.

<sup>406</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 128.

<sup>407</sup> Jarrell, *The Cold Light of Dawn*, 120.

<sup>408</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932): 178.

<sup>409</sup> He also worried that the improved road “prove even more tempting to speedsters,” but the surface remained rough, leading the astronomers to question “from the number of new tires the members of the staff had to purchase, [whether] the road makers were in collusion with the tire dealers”; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932): 178.

<sup>410</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 28, (1934): 327-328, 327.

<sup>411</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932): 326-328, 326.; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-73.

retention tank in 1935.<sup>412</sup> The deforested area also negatively impacted the local ‘seeing,’ exposing the hill to increased air turbulence, so efforts were made to replant the slope with 1,500 spruce and fir seedlings.<sup>413</sup> The BC Forest Branch carried out a far larger effort in 1939, with single unemployed men planting 18,000 seedlings.<sup>414</sup> The 1934 fire was attributed to a ‘hermit’ living in a cave on the back of the mountain. Previously considered something of a “distinction” by the astronomers, they organized a foot patrol to evict him after the fire.<sup>415</sup> Between the various Public Works initiatives the DAO saw far more public investment during the Great Depression than during the preceding decade, but for Beals the ‘hermit’s’ departure announced “that the older era of the Observatory had passed,” as the institution adapted to the changes of the 1930s.<sup>416</sup>

The Depression saw a passing of the ‘old guard’ as the institution adjusted to federal restructuring. Federal legislation mandating retirement for public servants over 65 years old was introduced in 1934, although the 68-year old Plaskett managed to delay his official retirement until 1935, giving way to W. E. Harper as director. In 1936 a reorganization of government departments left the DAO under the administration of the new Department of Mines and Resources.<sup>417</sup> Despite the turmoil of the Great Depression, Canadian astronomy was still

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<sup>412</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-73; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 326-327.

<sup>413</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-73; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 33, (1939): 230-231; Plaskett, “Description of Building and Equipment,” 25; W. E. Harper, “Atmospheric Conditions Suitable for the 72-Inch Reflector,” 178; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 326-327.

<sup>414</sup> For further insight on provincial forest relief projects see Richard A. Rajala, “From ‘On-to-Ottawa’ to ‘Bloody Sunday’: Unemployment Relief and British Columbia Forests, 1935-39, in *Framing Canadian Federalism: Historical Essays in Honour of John T. Saywell*, edited by Dimitry Anastakis and P.E. Bryden (Toronto: University of Toronto Press, 2009), 118-50; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 33, (1939): 230-231; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 33, (1939): 31-32.

<sup>415</sup> The man had established ‘squatter’s rights,’ requiring further legal procedure to evict him, but eventually he was paid to leave the hill; Beals, “Early Days,” 312.

<sup>416</sup> Beals, “Early Days,” 312.

<sup>417</sup> Hodgson, *The Heavens Above and the Earth Beneath*, 129, 31.

expanding. The David Dunlap Observatory, constructed by the University of Toronto in 1935 with funds provided by Jessie Donalda Dunlap, supplanted Victoria's honour of having the world's second largest telescope.<sup>418</sup> Designed in part by R. K. Young, it was the twin of the Victoria telescope in most respects, just two inches wider, conveniently giving Toronto the larger telescope.<sup>419</sup> With most of its staff trained in Victoria, the Toronto reflector largely mirrored the DAO's research program, giving Canada two of the world's three largest reflectors.

W.E. Harper maintained the DAO's public profile during the Great Depression. Beginning in 1928 he harnessed modern technology to the task, hosting monthly radio talks focused on interesting astronomical phenomena, news from other observatories, and astronomy in everyday life on Victoria radio station CFCT.<sup>420</sup> Harper's efforts broke down the complexities of scientific language and were reprinted in the *JRASC* to allow enthusiastic Canadians outside of Victoria, or those without a radio to follow the shows. Having produced 60 separate shows by November 1932, he remained on the air after succeeding Plaskett as the director of the DAO.<sup>421</sup> Jarrell notes the "series continued until at least 1932," but records in the *JRASC* show Harper continuing his talks until February 1938.<sup>422</sup>

Despite Harper's best efforts DAO visitation would inevitably reflect Depression-era circumstances, reflected in reduced annual visitations to the DAO. Historian David Smith argues that "the Great Depression did not hit tourist travel in Victoria as hard as it did many other North

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<sup>418</sup> Jarrell, *The Cold Light of Dawn*, 131.

<sup>419</sup> "Dunlap Observatory Dedicated on Director's 70<sup>th</sup> Birthday," *The Science News-Letter* 28, no.740 (June 15, 1935): 388; Jarrell, *The Cold Light of Dawn*, 132.

<sup>420</sup> W. E. Harper, "Radio Talks on Astronomy Over CFCT, Victoria B.C." *JRASC* 22, (April 1928): 135-42; W. E. Harper, "Radio Talks on Astronomy Over CFCT, Victoria B.C.," *JRASC* 29, (January 1929): 39-42.

<sup>421</sup> W. E. Harper, "Radio Talks Over CFCT Victoria, B. C.," *JRASC* 27, (February 1933): 49-61, 59.

<sup>422</sup> Jarrell, *The Cold Light of Dawn*, 144; W.E. Harper, "Radio Talks Over CFCT, Victoria B.C.," *JRASC* 32, (August, 1938): 317-20.

American tourist towns.”<sup>423</sup> However, shifts in the visitor demographic occurred as foot passenger traffic on Victoria-bound ferries increased while the number of cars declined.<sup>424</sup> These shifts influenced the number of people visiting the DAO; with the Interurban Electric line having closed in 1924 visitation required some form of alternative transportation. In 1930 the count fell to 33,318, nearly 6,000 off the 1929 peak of 39,000.<sup>425</sup> In 1931 the numbers fell further to 24,840, bottoming out along with the economy in 1932 with only 13,259 visitors, or roughly one-third the 1929 peak; Harper rightly termed these numbers “an index of the depression.”<sup>426</sup> The first signs of recovery appeared in 1933 with 15,403 visitors attending the facility between May and October, prompting Harper to wonder if the upturn represented an “index of returning prosperity.”<sup>427</sup> The years 1934 and 1935 saw continued gains, with 17,123 and 21,608 visitors respectively.<sup>428</sup> However, that they were barely half the peak of 1929 indicates the plight Canadians experienced during these years. As the Depression receded the demographics of visitors began to shift with a resurgent tourism industry in Victoria. “An increasingly large number come from California” reported Harper in 1936, as “the auto licenses from that State seem to be as numerous as from all other places combined.”<sup>429</sup> In July 1937, 8,000 visitors toured the DAO. Although astronomers were frustrated with those tourists who “overstay[ed] their allotted two hours on Saturday nights,” they were relieved at the rising public interest.<sup>430</sup>

Public summer school attendance also returned, bringing over 1,200 students from Victoria,

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<sup>423</sup> Smith, “Imagining Victoria” 67-83, 74.

<sup>424</sup> Smith, “Imagining Victoria” 67-83, 74.

<sup>425</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932): 178-9. 178.

<sup>426</sup> Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 26, (1932) 178; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 27, (1933): 214-16, 214.

<sup>427</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 27, (1933): 430.

<sup>428</sup> W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 29, (1935): 72-3, 72.

<sup>429</sup> This observation matches Dawson’s numbers on tourism to Vancouver in 1926 where he notes that automobiles from California were increasing at a higher rate relative to other locations; W. E. Harper, “Notes From the Dominion Astrophysical Observatory,” *JRASC* 30, (1936): 296-98; Dawson, *Selling British Columbia*, 62.

<sup>430</sup> W. E. Harper, “Supplementary Notes From the Dominion Astrophysical Observatory,” *JRASC* 31, (1937): 323-24.

Vancouver, and Bellingham in July 1937.<sup>431</sup> In 1938 the DAO accommodated 23,166 visitors and a reconstructed eyepiece used during public nights provided a better view.<sup>432</sup> Therefore, while the DAO did not recover to the heights of 1929, it remained a successful tourism destination throughout the Great Depression.

While Beals marked the departure of the hermit as the end of the early era of the DAO, the passing of both Plaskett and Harper provides a definite conclusion.<sup>433</sup> Harper's directorship at the DAO was brief. He fell ill in 1938 and never fully recovered, dying in June 1940.<sup>434</sup> Plaskett passed away just a year later in October 1941, with his obituary reprinted in national and international newspapers.<sup>435</sup> The *New York Times* noted that Plaskett "gave [the] world its most accurate information on rotation of the galaxy," calling him "one of the world's outstanding astronomers."<sup>436</sup> J.A. Pearce succeeded Harper as the 'Head Astronomer' as the DAO adjusted to the turmoil of the Second World War, marking a fitting end to the 'early days' of the facility.<sup>437</sup>

During the 1920s and 30s the first generation of astronomers at the DAO produced an astounding volume of scientific material. The majority of this work involved routine spectroscopic studies of binary stars, but the growing reputation of the institution rested on the insights Plaskett provided for interstellar gas, and the rotation and structure of the Milky-Way. As Lowenthal suggests in his discussion of the priority of heritage, the interest of historians in

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<sup>431</sup> Ibid.

<sup>432</sup> W. E. Harper, "Notes From the Dominion Astrophysical Observatory, Victoria B.C." *JRASC* 32, (1938): 267-69.

<sup>433</sup> Plaskett made one final contribution to astronomy following his retirement acting as a consultant for the construction of the McDonald Observatory. Located on Mt. Locke in Texas, the new 82-inch instrument was based on the design of the DAO; Jarrell, *The Cold Light of Dawn*, 120; Jarrell, "J.S. Plaskett and the Modern Large Reflecting Telescope," 379-81.

<sup>434</sup> Hodgson, *The Heavens Above*, 149.

<sup>435</sup> "World-Famous Astronomer, Dr. J.S. Plaskett, Victoria, Dies," *Globe and Mail*, October 18, 1941, 7; "John S. Plaskett, Astronomer, Dead," *New York Times*, October 18, 1941, 19; "Dr. J.S. Plaskett," *The Times*, October 30, 1941, 7.

<sup>436</sup> "John S. Plaskett, Astronomer, Dead," *New York Times*, October 18, 1941, 19.

<sup>437</sup> Hodgson, *The Heavens Above*, 149.

attributing ‘firsts’ or a precedence of contribution is perhaps tangential to understanding the historical significance of that event.<sup>438</sup> The relative historical importance of scientific discovery is difficult to place as it rarely happens in isolation. Plaskett and Pearce’s studies on the structure of the Milky-Way built on the theories of Lindblad, the observations of Oort, the pioneering work of Shapley, and countless other astronomers that developed the methods they applied to their task. Ultimately their work produced a modern conception of the galactic system that resonated with both the scientific and local community.

It is more difficult to quantify the cultural and economic impact of the DAO, but the facility and its staff cultivated an extensive presence through a commitment to public engagement. Interest in the institution was initially driven by the spectacle of the telescope as a feat of modern engineering. The discovery of ‘Plaskett’s Star’ shifted the public profile of the institution by meeting the expectations the public placed on astronomers and establishing the DAO as a leading institution for astrophysical research. These expectations were often based on misguided public perceptions of astronomy, but the local excitement generated by these discoveries nevertheless encouraged exceptional levels of public engagement. The developing reputation of the DAO and the scientific discoveries made by the staff were intrinsically linked, influencing the prominent cultural position that the institution maintained. Over the first two decades of operation the staff at the DAO developed a rapport with the Victoria population by consistently rendering the technical language that dominated astrophysical research into accessible narratives for the layperson. Through the interest generated by the spectacle of the building, and the feats of the staff, the DAO also functioned as a significant tourism destination throughout the 1920s and to a lesser extent during the Great Depression. Visitors included local

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<sup>438</sup> Lowenthal, *The Heritage Crusade*, 174-6.

residents, tourists, political and social elites, underscoring the importance of the DAO as a destination of intellectual tourism.

### Conclusion - “An inspiration towards higher thought for the community”

The success of DAO staff was the product of their hard work and dedication. Astronomer J.A. Pearce recalls the “telescope never had a holiday:” on December 25 1924 he closed the dome at three a.m. and walked “nine miles home.”<sup>439</sup> Through the spirited efforts of the staff the scientific reputation of the DAO grew throughout the 1920s and 30s, and the institution established itself as the central actor in Canadian astronomy. By 1939 Victoria astronomers had observed the sky for an average of 1,257 hours over 194 nights annually in the twenty years since the DAO opened.<sup>440</sup> While the institution weathered the Great Depression without serious interruption of the scientific programme, even benefitting from unemployment relief initiatives, beginning in 1939 the Second World War renewed financial pressure on the federal science budget. Despite these difficulties, observatory staff continued to use the world-class telescope to great effect. In 1941 UBC graduate Andrew McKellar calculated the temperature of molecules in interstellar gas, and by extension the temperature of interstellar space. McKellar’s studies produced a temperature value similar to the Nobel Prize winning studies later conducted in 1964 by American radio astronomers Arno Penzias and Robert W. Wilson at Bell labs, revealing the cosmic microwave background and evidence of the big bang.<sup>441</sup>

Following the Second World War the DAO and Canadian astronomy in general enjoyed a rebirth. In British Columbia the post-secondary system expanded at UBC, the University of

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<sup>439</sup> Pearce, “Some Recollections,” 290-1.

<sup>440</sup> Harper, “Notes from the Dominion Astrophysical Observatory,” *JRASC* 33, no.5, 230; Harper, “Notes from the Dominion Astrophysical Observatory,” *JRASC* 33, 392; Harper, “Notes from the Dominion Astrophysical Observatory,” *JRASC* 34, 158.

<sup>441</sup> The cosmic microwave background is the heat remnant of the big bang. Since the big bang the universe has cooled dramatically, but the background temperatures detected by McKellar, and examined in far greater detail by Penzias, Wilson and other astronomers provide insight into the origins of the Universe, and provided observational support for Hubble’s expanding universe; Jarrell, *The Cold Light of Dawn*, 118-9, 122, Hodgson, *The Heavens Above and the Earth Beneath*, 143.

Victoria (UVic), which opened in 1963, and Simon Fraser University (SFU), established in 1965.<sup>442</sup> Both SFU and UVic quickly developed astronomy programs, complementing the UBC program dating from the 1920s. UVic soon joined UBC as the only institutions offering graduate opportunities in astronomy west of Ontario. With universities training more graduate students the DAO expanded its research capacities, constructing a second forty-eight inch reflector in 1962, dedicated to spectroscopy.<sup>443</sup>

During the 1960s Canadian astronomers attempted to recapture the interest of the 1910s and establish a new national observatory with the proposed 150-inch Queen Elizabeth II telescope. Ultimately their efforts failed due to budgetary concerns and dissension within the Canadian astronomical community.<sup>444</sup> Despite these setbacks the project was reborn a decade later with the 1979 completion of the Canada-France-Hawaii Telescope (CFHT) located on Mauna Kea. The CFHT heralded new directions for the Victoria observatory, and Canadian astronomy, as future telescopes were located on highly desirable observing sites at Hawaii and Chile. Victoria steadily transitioned into a supporting role, grinding and fabricating the mirror for the CFHT.<sup>445</sup>

Turning back to this study's focus on the DAO's foundation and first twenty years of operation, a mixture of scientific curiosity and nationalistic sentiments, rooted in Canada's desire to establish itself as a modern nation, drove the construction of the facility. As the Canadian astronomy program developed, calling for increased investment in the scientific field, the astute

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<sup>442</sup> Barman, *The West Beyond the West*, 319.

<sup>443</sup> Jarrell, *The Cold Light of Dawn*, 153-4, 166, 177-9.

<sup>444</sup> *Ibid.*, 167-8.

<sup>445</sup> BC Archives Vertical Files, 'Observatory,' [1522] (*Times*, February 9, 1979, p.1).

Plaskett marketed the proposed telescope to politicians as a symbol of national superiority.

Richard Jarrell concludes that:

The DAO reflected not just the lobbying efforts of King, Plaskett, and their allies, but also the desire of the government and Parliament to show the world that Canada would take its rightful place in the world of science, just as it had done in the war and in the empire.<sup>446</sup>

As science was the responsibility of the Canadian state efforts to fund the project were as much a statement of national identity as a commitment to science. The telescope itself represented an enormous financial commitment given the competition for resources from the First World War. Victorians eagerly greeted the opportunities presented by the new facility as a symbol of regional prestige. As a city Victoria was searching for an identity, as it fell behind Vancouver in the competition for metropolitan status. Constructing the world's largest telescope fit the city's desire for sophistication, with Plaskett and the VIPB making promotional efforts to generate support for the new institution as a destination for tourists.

George Webb observes that Victorians 'welcomed' both the cultural and economic promise the DAO represented for the provincial capital. As a 2 August 1919, *Seattle Times* article, reprinted in the *Daily Colonist*, stated:

the building which most greatly distinguishes the city and sets upon her the stamp of climatic superiority is the silver-domed astrophysical observatory, wherein is housed the largest telescope in the world.<sup>447</sup>

Desiring to market the city as a 'scientific centre,' promoters quickly incorporated the DAO into their plans, allowing the new facility to reach an increasingly broad audience, and develop a distinct cultural reputation that accompanied the scientific work conducted by astronomers. As

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<sup>446</sup> Jarrell, *The Cold Light of Dawn*, 110.

<sup>447</sup> "City of Attractions that are Unsurpassed," *Daily Colonist*, August 2, 1919, 12.

such this reputation and the promotional language that accompanied it disproportionately represented the interests of wealthy, educated Victorians.

The continued public interest for the DAO was due to both the status of the facility in its early years, and the dramatic discoveries relating to the size and scale of the universe that occurred in the 1920s and 30s. The institution has remained an important nexus for the local and national community over the course of the twentieth century. Continued contributions to science and the facilitation of regional interest through outreach programs have maintained this status despite the construction of larger observatories around the world. Within the span of two decades the Canadian astronomy program had grown from obscurity to boast two major federal institutions, one of them briefly the world's largest functioning observatory. The DAO thus represented the growing cultural importance of scientific inquiry for Canadian society. With construction of the David Dunlap Observatory in 1935 Canada boasted two of the world's three largest telescopes. University programs devoted to scientific pursuits readily emerged, as the Dominion Government consolidated federal science under the umbrella of the National Research Council following the Second World War. It was the establishment of the DAO, however, that heralded Canada's arrival and prominence within the international astronomical community.

To historian Richard Jarrell, astronomy should be regarded as “an important cultural activity that is a measure of the level of civilization of a country,” rather than a fundamental economic or industrial force.<sup>448</sup> “It is in such additions to the cause of pure scientific research that the real progress of a country may be truly judged,” he asserts. Plaskett would have agreed, noting “the degree of civilization of a nation is measured by its support of Astronomy, Canada

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<sup>448</sup> Ibid., 3.

takes high rank and all Canadians should be proud.”<sup>449</sup> In a society driven to examine natural phenomena, the work of Canadian astronomers provided an avenue to understanding the makeup of the natural world. Astrophysics generated excitement in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries through its capacity to understand not only the position of celestial bodies, but their physical and chemical makeup. In a sense, astronomical spectroscopy allowed humans to discover that the Earth was not unique in the universe, sharing the same fundamental chemical and elemental building blocks with other celestial bodies. Through their connections with the international scientific community, and work conducted with national telescopes, Canadian astronomers provided the public with context for astronomical events like comets or eclipses, and contributed to growing understandings of the universe. The resulting cultural awareness of astronomy is seen in the excitement of Victorians for the observatory, driven by the exposure to new discoveries and economic ambition for the tourism industry.

While historians such as Jarrell and Webb have addressed the scientific importance of the DAO, this study has demonstrated the social influence of the facility as a significant institutional presence in Victoria. Victoria newspapers quickly seized on the promise the new facility represented, setting lofty expectations that the city would emerge as a scientific centre. The cultural influence of the institution was governed by both the willingness of astronomers to share their experience, and the local interest from promoters and residents. Completed despite the nation’s preoccupation with the First World War, the DAO lived up to the expectations of astronomers and Victorians. Indeed the city developed into globally recognized centre of astrophysical research, with noted astronomers regularly visiting and studying with the telescope. By 1930 local astronomers had probed the depths of the Copernican question, investigating

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<sup>449</sup> Plaskett, “Description of Building and Equipment,” 103.

humanities' place in the universe through studies of the Milky Way galaxy. Public interest in such discoveries, and the structure itself, led to remarkable rates of public visitation, peaking at 39,000 visitors in 1929 at the eve of the Great Depression. Local interest in the institution remained high throughout the twentieth century. In 1960, over forty years after the facility opened, Ian Street of the *Daily Colonist* predicted that “hundreds soon will flock to Saanich” to visit the DAO, as crowds of up to 500 visitors still attended the telescope on Saturday nights through the summer months.<sup>450</sup>

In 2001 the Centre of the Universe interpretive centre opened on the observatory grounds to further support public awareness initiatives. Though the institution closed in August 2013 at the behest of the Conservative government under Stephen Harper, the cultural legacy of the initial investment in the DAO underscores the important social considerations for public investment in science. This remarkable institution continues to be an important resource for astronomers and the public. Despite recent funding cuts, the efforts of volunteers have maintained public access to the telescope, continuing the educational model introduced by Plaskett nearly 100 years ago, and highlighting the lasting importance of the facility in Victoria.

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<sup>450</sup> Ian Street, *Daily Colonist*, “Big Eye,” March 27, 1960, 14.

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*Journal of the Royal Astronomical Society of Canada, (JRASC)*

*Publications of the Astronomical Society of the Pacific, (PASP)*

*Monthly Notices of the Royal Astronomical Society, (MNRAS)*

*Publications of the Dominion Astrophysical Observatory, (PDAO)*

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