

John Percy's Universe

Toronto's Astronomical Heritage

by John R. Percy

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In addition to the very successful national projects during International Year of Astronomy (IYA2009) in Canada (Hesser *et al.* 2010), astronomers were encouraged to develop their own personal projects, and I have already described some of mine (Percy 2012). As a member of Heritage Toronto and a participant in their heritage walks program, I decided to develop a walking tour of the many astronomically significant sites on and around the University of Toronto (U of T) campus. These date from 1840, though Canada's Aboriginal peoples had been using the sky for practical and ceremonial purposes for untold centuries before. Continuing a partnership begun during IYA2009, I have also given presentation versions of the walk in branches of the Toronto Public Library. The walk and presentation illustrate how astronomy has grown in parallel with the university, the city, and the country.

By 1800, the Copernican/Galilean revolution had taken place, and science and public interest in science were flourishing—in Europe. Toronto (then called York) was a frontier village. Only a handful of people would have known some practical or descriptive astronomy. York became the capital of Upper Canada in 1793. Its population rose from 720 in 1812 to 31,775 in 1851. The Town of York became the City of Toronto in 1834. Upper and Lower Canada became Canada West and East in 1841. By mid-century, Toronto was becoming a major centre for manufacturing, transportation, and finance.

Toronto and Canada Come of Age

In 1840, the British Admiralty established a magnetic observatory in Toronto as part of an international project to understand why compass needles “wandered” on time scales of hours to years. When the project was completed and the cause—solar-terrestrial interactions—was discovered and published, the observatory was dismantled and the instruments taken “home.” But the colonial government wisely decided that the fledgling country should have its own observatory, so the Toronto Magnetic and Meteorological Observatory (TMMO; Figure 1) was built as a national centre for meteorology and timekeeping.

Astronomy also had important applications to surveying; latitude and longitude were determined by observations of the altitudes and transit times of the Sun and stars. A pillar, near TMMO, marks the “official” position of Toronto for surveying purposes. Other positions could be determined, relative to this. Another plaque commemorates TMMO itself.

Sir Sandford Fleming (1827–1915), engineer, surveyor, mapmaker, railway builder, and entrepreneur, was an important figure of the time. He is best known as a vocal and successful proponent of Standard Time. He also developed Canada's first postage stamp (1851) and co-founded the Royal Canadian Institute (RCI, 1849) and the Royal Society of Canada (RSC, 1882). The RCI was an outgrowth of the “mechanics institute” movement as a forum for the public communication and discussion of science and technology. It played an important role in Canadian science in the late 19th century, and is Canada's oldest still-existing scientific society, though its present role is primarily the communication of science to the public¹.

In 1868, a group of eight “laymen” gathered to discuss astronomy. Their “Toronto Astronomical Club” evolved into our beloved RASC, which provides a variety of activities and publications of interest to amateur astronomers and which is especially known for its outreach activities. It was awarded the national *Michael Smith Award* in 2003, for excellence in bringing science to the public.

U of T received its charter in 1827, but the powers-that-be could not decide whether the university should be Anglican or secular. The Anglicans, under Bishop Strachan, established their own Trinity College on a different site, and it was not until 1853 that teaching began, in temporary premises, at the U of T. A permanent building—now University College—was completed in 1859.

In the meantime, the Methodists had established Victoria College in Cobourg in 1836. The founding president was Egerton Ryerson, the “father” of public education in Ontario. In his inaugural address, he stated that “surely the knowledge of the laws of the universe, and the works of God, are of more practical advantage, socially and morally, than the knowledge of Greek and Latin.” Victoria College moved to the U of T in 1892, occupying a building (now known as “old Vic”) that now also hosts the Institute for the History and Philosophy of Science and Technology (IHPST²). Its most famous faculty member was Galileo scholar Stillman Drake (1910–1993). Since IYA2009, IHPST has partnered with the astronomy department in a number of history-of-astronomy projects, including the 2012 Transit of Venus. TMMO purchased a telescope especially to observe the 1881 transit, but it was cloudy—not unusual in Toronto in November!

A group of enterprising IHPST graduate students have created the University of Toronto Scientific Instrument Collection³, dedicated to cataloguing and conserving the university's historical scientific instruments. Our astronomical instruments were catalogued in 2012 as a “Transit of Venus” project.

Entering the 20th Century

As the turn of the century approached, the university grew. Independent professional schools such as medicine (1887), engineering (1906), and education (1907) affiliated with the

university, as did faith-based colleges such as St. Michael's (1881), Victoria (1892), and Trinity (1904). The university was now responsible for providing lecture and laboratory instruction in the sciences for all these students. New buildings were needed, and the TMMO site was prime real estate. One such construction was the Physics Building, including astronomy, which was opened in 1907. It was rebuilt after a disastrous fire in 1977, repurposed (for electrical engineering) and renamed the Sandford Fleming Building.

In 1907, the Meteorological Service moved to 315 Bloor Street, which is now part of the Munk Centre. The telescope dome is still prominent, the transit building less so. It subsequently moved to its present location at 4905 Dufferin Street in 1971. TMMO was to be demolished, but surveying instructor Louis B. Stewart came up with the bright idea of disassembling it, stone by stone, and moving it a few hundred metres to its present site on a hill, just south of Hart House. It is now the Stewart Observatory and is the home of the University of Toronto Student Union.

Clarence Augustus Chant (1865-1956) joined the growing physics department in 1891, and immediately turned to teaching astronomy. He established a separate astronomy department, with its own courses and programs, in 1905. His popular articles and books, and public lectures led eventually to the donation (by Jessie Donald Dunlap) of the David Dunlap Observatory (DDO), which opened in 1935 with the second-largest telescope in the world. The small staff included Helen Sawyer Hogg (1905-1993), Canada's best-known (as a result of her weekly astronomy column in Canada's largest newspaper for over 30 years) and most beloved astronomer.

The Royal Ontario Museum (ROM) opened in 1914, but its roots go back to the work of Egerton Ryerson and the RCI. In the 1950s, it sponsored important studies of the "New Quebec" meteorite impact crater, spurring Canadian interest and expertise in this topic. It now hosts one of the world's best collections of meteorites, especially rare carbonaceous chondrites.

The Post-War Years

The end of WWII brought several developments that had a direct or indirect impact on astronomy. Returning veterans were offered free education, and many chose engineering. At U of T, new buildings were again required, and a temporary campus was created in Ajax to accommodate the overflow.

Electrical engineering flourished, and some engineers with expertise in radar developed an interest in radio astronomy. At the U of T, electrical engineer Jui-Lin (Allen) Yen collaborated with astronomers to carry out the first successful Very Long Baseline Interferometry experiments. These were honoured by the award of the Rumford Medal in 1967. Astronomers Jack Heard and Don MacRae were among the first to use FERUT, the university's Ferranti computer. The University of Toronto Institute for Aerospace Studies (UTIAS) later developed expertise in space astronomy, building *MOST*⁴ (*Microvar-*



Figure 1 – The Stewart Observatory, previously the Toronto Magnetic and Meteorological Observatory (1853), now occupied by the University of Toronto Student Union.

iability and Oscillations of Stars: Canada's "Humble Space Telescope") and more recently a "constellation" of *BRITe*⁵ (*BRITe Target Explorer*) nanosatellites, which can measure the variability of the brightest stars with unprecedented accuracy.

In 1946, J. Tuzo Wilson (1908-1996) became Canada's first Professor of Geophysics, and this became an area of great strength at the U of T. There are now strong programs in earth and planetary science on both its downtown and Scarborough campuses.

The post-war years also created a baby boom that led to an expansion of the school system in the 1950s—with the need to rapidly train thousands of teachers—and the university system in the 1960s. York University began as part of the University of Toronto (1959-65) and then became independent. It has a strong astronomical research group, and excellent public education programs⁶. The U of T created new campuses in Scarborough (1966) and Mississauga (1967), and these and other newly created or expanded campuses across the country provided dozens of new jobs for astronomers—including me.

The Space Age and exciting developments in astronomy fuelled public interest. The U of T and the RASC promoted the creation of the McLaughlin Planetarium (1968-95) as part of the ROM. It was one of the world's major planetariums and also home to the RASC Toronto Centre, until its unfortunate and unnecessary closing in 1995, ostensibly due to the provincial government's "common sense revolution" budget cutbacks. The ROM continues to offer astronomy education programs with small, portable planetaria.

The Ontario Science Centre opened in 1969, as a slightly belated centennial project of the provincial government. It has continued to flourish, often being Canada's most-visited cultural facility. It has excellent astronomy exhibits and programs, a small but powerful planetarium, and has been home to the RASC Toronto Centre⁷ since 1995.

The Modern Era

Astronomy has changed dramatically in the last generation. In the 1970s, the DDO continued to be productive in research (the first black hole in space was co-discovered there in 1971-72) but, by then, astronomers had adopted superb observing sites in Hawaii and Chile. Canada became a partner in the Canada-France-Hawaii Telescope. The U of T built a small but very productive 0.6-m telescope on Cerro Las Campanas in Chile. Sadly, it was later taken over by and moved to Argentina because of cutbacks to science funding in Canada.

Use of the DDO for research and student training declined and, in 2008, the DDO lands were sold by the U of T to a developer and the proceeds used to endow a new Dunlap Institute⁸ on the university campus, carrying the Dunlap name and bequest forward into the 21st century. Astronomical instrumentation, observation, and education and public outreach are the core of its mission. DDO is still operated, effectively and successfully, as a public outreach facility by the RASC Toronto Centre⁹.

An under-appreciated “jewel” in Canada’s science crown is the Canadian Institute for Theoretical Astrophysics¹⁰, a world-class, cost-effective centre, hosted by U of T, for research in theoretical and computational astrophysics. Its former director, Richard Bond, is Canada’s most-honoured astronomer.

Canada was a relatively late player in space astronomy—but recall that we were the third country to have a satellite in space, after the USSR and the USA. Canadian astronomers have been active users of NASA and ESA satellites and their data, but *MOST* is the first Canadian space observatory.

The U of T is also a centre for balloon astronomy—a low-cost way of placing microwave telescopes above 99 percent of the atmosphere. Missions such as BOOMERANG and BLAST¹¹ have provided important information about the cosmic microwave background radiation and about the star-forming gas and dust in the Milky Way.

There are now over 50 faculty and postdoctoral astronomers at the U of T and over 30 graduate students.

As for the teaching of astronomy: in some ways it has changed (technology; the topics we teach: exoplanets, black holes, dark matter, dark energy), and in some ways it is the same. Although we teach courses of up to 1350 students, the courses succeed because the instructor understands pedagogy, can communicate, is enthusiastic, and cares about students. We have major and specialist programs for undergraduates, and one of the best graduate programs in astronomy anywhere. And public outreach is as important to us, as much part of our work, as it was to Chant, a century ago.

References and Resources

The script for my astronomical heritage walk¹² and the slides for the library version of the walk¹³ are available on my Web

site¹⁴. Don Fernie has written an excellent short history of astronomy at the U of T¹⁵ and I have prepared a short history with links to about 40 subtopics¹⁶. Jarrell (1988) is the definitive history of Canadian astronomy to 1988. ★

References

- Hesser, J.E. *et al.* (2010). An Initial Retrospective on the International Year of Astronomy 2009 in Canada. *JRASC*, 104, 51.
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Endnotes

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It’s Not All Sirius

by Ted Dunphy

