

Some Astronomy Teaching Resources in Ontario (Emphasis on Grade Nine)

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November 2018

I hope these resources will enable you to achieve the goals of an astronomy and space unit which may be the students' last exposure to this exciting science: to understand the "big ideas" of astronomy (not the trivial "number facts") and to be engaged and excited by them, and by the nature of the universe; to think critically about these and other topics; to appreciate the roles of observation and simulation in astronomy; to appreciate the historical and cultural and societal dimensions of astronomy; to realize that, even in the centre of a city, there is much that can be seen in the sky, and much on the Internet, including awesome images of astronomical objects; to carry out at least one "authentic" scientific activity in astronomy, and at least one *observation*; and to communicate astronomy through print, electronic, or other media. You and your students may be able to "connect" with astronomy by visiting an observatory, science centre, or planetarium, or by inviting an astronomer into your classroom, either physically or virtually.

My outreach webpage, including PDFs of presentations on several topics related to the curriculum, and a whole section of resources for teachers:

<http://www.astro.utoronto.ca/~percy/EPOindex.htm>

My grade nine workshop notes:

<http://www.astro.utoronto.ca/~percy/grade9workshop.htm>

STAO resource for the grade nine astronomy/space unit, developed for International Year of Astronomy 2009, subsequently revised. Highly recommended!

<https://stao.ca/cms/gr-9-astronomy> click on "pathways..."

Amazing Universe: Big Ideas: My popular presentation on "The Amazing Universe", which deals with big, exciting ideas which are curriculum-related, and of interest to grade nine students:

<http://www.astro.utoronto.ca/~percy/amazing.pdf>

Ask an Astronomer: There are several places where you and your students can have your questions answered by astronomers; University of Toronto's is:

askanastronomer@universe.utoronto.ca

<https://universe.utoronto.ca/talks-lectures/ask-an-astronomer/>

Astronomical Society of the Pacific. An excellent source of astronomy education materials, on-line catalogue, on-line quarterly teachers' newsletter (TNL), on-line astronomy activities – much of it developed and tested with NSF or NASA funding.

<http://www.astrosociety.org/publications/universe-in-the-classroom/> (TNL)

<http://www.astrosociety.org/education/educational-resources/> (Excellent!)

Astronomy Clubs. There are (in addition to the RASC Centres mentioned below) astronomy clubs in many cities and towns in Ontario, and across Canada. Many of them have outreach activities for schools – visits, star parties etc. See:

<http://www.skynews.ca/resources/astronomy-clubs/>

Astronomy Picture of the Day: Although not all astronomy is done by NASA, there's no better source of engaging images, especially as the images are so well captioned. Students can look at them as scientists would:

<http://apod.nasa.gov>

BeSpatial Consulting: a variety of programs and resources by a space-specialized educator:

<http://www.bespatial.ca>

Books on Astronomy. Any written by Terence Dickinson, published by Firefly Books, especially *Exploring the Night Sky* and *Extraterrestrials* for young people, and *Night Watch* and *The Universe and Beyond* and *Summer Stargazing* for anyone. Also Dan Falk's *Universe on a T-Shirt* and *In Search of Time*. And Ray Jayawardhana's *The Neutrino Hunters*, and *Strange New Worlds*.

Canada's Amazing Achievements in Astronomy/Space: 1867-2017: the curriculum expects that students should know about Canada's significant contributions to astronomy. Canada's contributions to space are well publicized by the Canadian Space Agency; see below:

<http://www.astro.utoronto.ca/~percy/stao2017.pdf>

Canada Science and Technology Museum. Wide variety of programs for students, teachers, and the public, including planetarium programs, and sky viewing.

<http://cstmuseum.techno-science.ca/en/>

Canadian Astronomical Society, the organization of professional astronomers in Canada, is developing a new education website and programs. Stand by! For now, our twitter account:

@AstroCanada

Canadian Space Agency has information and a web site on Space, including material for students and teachers. Their programs are expanding, perhaps motivated by the forthcoming flight by David Saint-Jacques.

<http://www.asc-csa.gc.ca/eng/educators/default.asp>

Careers in Astronomy and Related Fields: another expectation of the curriculum;

<http://www.utm.utoronto.ca/careers/careers-by-major-astronomy>

Centre for Planetary Science and Exploration, Western University. Free resources and educational workshops. Student programs, podcasts, space camp, public events.

<http://cpsx.uwo.ca/outreach>

Cosmic Connections: Gives presentations and star parties for school classes and other youth groups. A fee is charged. (416) 728-0062. info@cosmicconnections.ca

<http://www.cosmicconnections.ca>

David Dunlap Observatory, Richmond Hill. The future of the DDO is presently unclear. Let's hope that it once again becomes a centre for education and public outreach!

Discover the Universe: a national bilingual source of authoritative astronomy workshops and information for Canadian teachers:

<http://www.discovertheuniverse.ca>

Discovery Planetarium: brings a planetarium to your school (for a fee).

<http://discoveryplanetarium.com>

Dunlap Institute of Astronomy and Astrophysics, University of Toronto, has a strong mandate for outreach, *including speakers and planetarium programs for teachers*. Twitter: @DunlapInstitute

<http://universe.utoronto.ca>

Frequently Asked Questions (and Answers): I keep a list on my website:

<http://www.astro.utoronto.ca/~percy/faq.htm>

Laurentian University, Doran Planetarium, Sudbury. Shows in English and French.

<http://www.laurentian.ca/planetarium>

Let's Talk Science. Award-winning national science outreach program has some astronomy activities for school classes and youth groups.

<http://www.letstalkscience.ca>

Mad Science of Toronto: has a “space spectacular” program for grade 6:

<http://www.toronto.madscience.org>

McMaster University, W.J. McCallion Planetarium, Department of Physics and Astronomy. Planetarium programs.

<http://www.physics.mcmaster.ca/planetarium/>

Natural Sciences and Engineering Research Council of Canada: are currently running a program called “little inventors: inventions for space” to encourage student creativity:

<http://nserc.littleinventors.org>

Ontario Science Centre. Wide variety of curriculum-based programs and exhibits for students, teachers, and the public, including planetarium programs and *OmniMax* films (e.g. *Hubble*, *Journey to Space*).

<http://www.ontariosciencecentre.ca>

Perimeter Institute for Theoretical Physics has a strong program of outreach to students, teachers, and the general public:

<http://www.perimeterinstitute.ca/outreach>

<http://www.resources.perimeterinstitute.ca>

Royal Astronomical Society of Canada has Ontario branches or “Centres” in: Belleville, Ottawa, Kingston, Niagara, Toronto, Hamilton, Kitchener-Waterloo, London, Mississauga, Sarnia, Windsor, and Thunder Bay. Many have programs for schools and the public.

<http://www.rasc.ca/x> where x is the name of the Centre

Twitter: @rasc

Royal Ontario Museum, Education Department, Toronto. Wide variety of curriculum-related programs for students and teachers, using on-site or mobile planetariums. Also has an excellent meteorite collection.

<http://www.rom.on.ca/en/education/school-visits>

Science North, Sudbury. School programs; 3D films, planetarium.

<http://www.sciencenorth.ca>

SkyNews, 203-4920 Dundas Street, Toronto ON M9A 1B7. Astronomy and stargazing from a Canadian perspective; edited by Gary Seronik and published by the Royal Astronomical Society of Canada; the best magazine resource on astronomy for school libraries! And there's lots of useful material on their website.

<http://skynews.ca> Twitter: @SkyNewsMagazine

Space Matters: <http://spacematters.ca>

Starry Night: This planetarium software is widely used in Ontario schools. Use it to predict what you can observe in tonight's sky, or to identify what you observed in last night's sky. Or to simulate daily and yearly sky motions. Or much more.

<http://astronomy.starrynight.com>

The Sun on Line: There are several sites where you can safely access daily images of the sun, to study its varying appearance, and supplement your own real, safe views of the sun; one is:

<http://umbra.nascom.nasa.gov/images/> (click on "continuum")

University of Toronto, Department of Astronomy. Public open house on the first Thursday evening of each month. Occasional free non-technical public lectures at other times. New initiatives to support teachers (TBA).

<http://www.astro.utoronto.ca/astrotours> and

<http://www.universe.utoronto.ca>

Western University, Hume Cronyn Observatory, Department of Physics and Astronomy, London. Summer open houses, with sky viewing; winter programs by appointment. Other activities. The Centre for Planetary Sciences also has extensive outreach activities.

<http://physics.uwo.ca/community/index.html> (Physics/Astronomy)

<http://cpsx.uwo.ca/outreach> (Centre for Planetary Sciences)

York University, Department of Physics and Astronomy, Downsview. Check this site, and the links on it, for the various activities and resources offered.

<http://observatory.info.yorku.ca>

Twitter: @YorkObservatory