

# A Half-Century of Astronomy Outreach: Reflections, and Lessons Learned

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## Abstract

I reflect on my half-century of experience in astronomy outreach in Canada and beyond, on the organizations in which I have served, and on the factors that have contributed to success in outreach. One factor is partnership that builds on the strengths of two or more individuals or organizations, such as the pro-am partnership in Canada during International Year of Astronomy. Challenges remain: the lack of a science “culture” in Canada; the lack of funding for outreach; the low priority of outreach in many parts of the professional community; and the difficulties in reaching new and diverse audiences—especially underserved ones. For success, there is a strong need for astronomy outreachers to seek high-impact, high-leverage strategies, to make themselves aware of “best practices” in outreach, to make training part of their outreach activities, and to strive constantly for improvement by evaluating and/or reflecting on the results. I attribute my own modest successes to my mentors and role models, to the help of colleagues, students, and partner organizations and their members—not the least being the RASC—and to the sheer enjoyment of communicating astronomy to diverse audiences. This article is based on a presentation given to the Canadian Astronomical Society on 2012 June 6, on the occasion of my receiving the inaugural Qilak Award, for my work in communicating astronomy to the public.

## Introduction

In June 2012, I was honoured to receive the inaugural Qilak Award from the Canadian Astronomical Society (CASCA: [www.casca.ca](http://www.casca.ca)) at their meeting in Calgary, for my work in communicating astronomy to the public (Figure 1). That was a month of reflection for me: it was the 50<sup>th</sup> anniversary of my graduation (and award of the RASC Gold Medal: Figure 1), as well as my 50<sup>th</sup> wedding anniversary. I’ve been an RASC member for over 50 years. For my Qilak Award lecture, I therefore chose to reflect on my half-century of astronomy outreach, and my observations and lessons learned. This article



Figure 1 — The author, then and now. Left: receiving the RASC Gold Medal from Ruth Northcott in 1962. Right: with the CASCA Qilak Award in 2012.

is based on that lecture. The slides of my award presentation are at: [www.astro.utoronto.ca/~percy/qilak.pdf](http://www.astro.utoronto.ca/~percy/qilak.pdf) and on my outreach Web page: [www.astro.utoronto.ca/~percy/EPOindex.htm](http://www.astro.utoronto.ca/~percy/EPOindex.htm)

Why does outreach matter? It’s important to astronomy and astronomers to attract the next generation of astronomers and to promote the excellent work that Canada’s professional and amateur astronomers are doing. We professionals need to be accountable; our salaries and research are publicly funded. We have an obligation to explain to the taxpayers what we are doing, and why it’s interesting and relevant. I believe that we also have an obligation to inform and inspire the community in general, including teachers and their students. There is a special need to reach people from communities that are under-represented in science and technology, and develop their interest in and comfort with those subjects. And astronomy outreach is satisfying—as knows anyone who has shown the rings of Saturn, or explained about black holes.

## In the Beginning

I landed on Canadian shores in 1946 and spent my first few years in Toronto’s Cabbagetown slum; I was not born with a silver spoon in my mouth! I then moved to the suburb of Downsview a.k.a. “the sticks.” I entered high school as a shy, nerdy kid, two years younger than my classmates. I somehow graduated as president of the student council, lead singer in the school musical, as well as a scholarship student. How did I accomplish this transformation? Encouragement at home, of course, but also *an excellent public school, teachers, and mentors*. Those of us involved in education should never forget the potential that we have to positively affect students’ lives.

I was an undergraduate and then a graduate student in the Department of Astronomy, University of Toronto. There, I was influenced by role models who valued teaching and outreach as well as research: Don Fernie, Jack Heard, Helen Hogg, Don MacRae, and Ruth Northcott—all of whom also played significant roles in the RASC. If departments openly and actively value teaching and outreach, it is more likely that

their students—especially their graduate students—will do so as well. As a graduate student, I had the opportunity to give school and public programs at the David Dunlap Observatory (DDO). Graduate students are still a cornerstone of my department's outreach activities, as they should be everywhere.

Like many graduates in my time, I took a detour into teacher's college and high-school teaching; I became "Mr. Percy." I've continued to support school science ever since, even after returning to professional astronomy. More to the point: I received a year of teacher training—which raises one of the great mysteries of academic life: why don't *all* university instructors receive initial or continuing training in teaching? After all, teaching is half their job!

## Embarking on a Career

I was fortunate to get a faculty position at the University of Toronto's new Erindale Campus (now the University of Toronto Mississauga: UTM: [www.utm.utoronto.ca](http://www.utm.utoronto.ca)). As a founding faculty member, I got to help develop campus-wide outreach programs. In 1969, our geophysicists were responsible for studying the magnetic properties of lunar rocks returned by *Apollo 11*. Thousands of people lined up to see the Moon rocks. Because we didn't have alumni, we created an "instant alumni" by forming partnerships with the community to organize public lectures, host the Peel Science Fair, and create enrichment programs for local schoolchildren. Most of all, I worked with faculty from many other disciplines, and these interdisciplinary connections have enriched my life and my career ever since.

My first "bosses" were important role models. Principal J. Tuzo Wilson was an eminent geophysicist and science communicator; on "retirement," he became director of the Ontario Science Centre. Dean Peter Robinson was a chemist, educator, and textbook author. Principals, deans, and department chairs can set a strong example by encouraging and supporting outreach, especially if they do it themselves.

## Impacting the School System

The most powerful way to create public understanding and appreciation of astronomy is to ensure that it is present, and well taught, in the school curriculum, and I have been doing this for over 40 years. Initially, I simply responded to the curriculum but, starting in the 1980s, I found out how the Ministry of Education developed the curriculum, and got involved. By the 1990s, we made sure that astronomy was firmly rooted in the elementary and secondary school curriculum. We were aware of an impending curriculum revision, and we were proactive in offering our services to the Ministry. Since then, I have been a reviewer for the astronomy sections of the Ontario science curriculum.

That doesn't ensure that astronomy will be taught, or well taught. Textbooks help both students and teachers, and I have spent much time reviewing and even co-writing (Andrews *et al.* 1988) school science textbooks.

Teachers need additional support, through resources and professional development, to enable them to cover the curriculum—especially as few of them have any background in astronomy or astronomy teaching. My most enjoyable and effective partner in this respect has been the Science Teachers Association of Ontario (STAO: [www.stao.org](http://www.stao.org)). I have contributed to their journal *Crucible* and presented at their 3-day conferences for 40 years, and was Honorary President during their 1990 centennial year; that was also the RASC's centennial year. At their 2009 (International Year of Astronomy: IYA2009) conference, there were two-dozen astronomy/space sessions. One of my personal IYA2009 projects was to partner with STAO to produce on-line resources for the grade 6 and 9 astronomy curriculum, with support from the National Research Council, the Dunlap Institute, and the Canadian Office of the Thirty-Metre Telescope Project ([stao.ca/res/2/astronomy-2.php](http://stao.ca/res/2/astronomy-2.php)).

If you want to have an impact on school astronomy, get to know the science people in your ministry of education, the publishers of textbooks and other resources, and the local science teacher's association. School boards can also be an effective partner, though they are occasionally "a tough nut to crack." Maintain an active email list of science and math teachers who are interested, connected, or influential.

## Other Organizations

If I join a scientific or educational organization, I tend to get involved, rather than just be a dues-paying member. These organizations have been an important and enjoyable part of my career and life, both because of what they have accomplished, and because they have brought me such a large and diverse set of colleagues and friends.

The RASC ([www.rasc.ca](http://www.rasc.ca)) is a good example. I joined in 1961, was a member of National Council from 1965 to 1984, and National President in 1978-80. I was Editor of the *Observer's Handbook* from 1970 to 1980 (the first not to die in office!) and a contributor for many more years. I was President of the Toronto Centre in 1970-71, and served several terms as Vice-President (Program), arm-twisting speakers from my various networks of colleagues; also promoting the Centre's public-education programs. I still support the Toronto Centre's public outreach program at the DDO. In 2003, I had the pleasure of successfully co-nominating the RASC for the national Michael Smith Award for excellence in science outreach, and attending the award ceremony in Ottawa. The RASC makes outstanding contributions to the public

awareness, understanding, and appreciation of astronomy, and was an essential partner in the success of IYA2009. I urge my professional colleagues to support them.

My association with the Royal Canadian Institute (RCI: [www.royalcanadianinstitute.org](http://www.royalcanadianinstitute.org)) dates from 1963, when I was an instructor for their summer enrichment program for high school students—a program that later morphed into the famous Shad Valley Program. I again became active in the 1980s, serving as President in 1985-86. The RCI is Canada's oldest continuously functioning scientific society. Nowadays, it is best known for its free Sunday afternoon science lectures for the public. They are videoed and archived and available to viewers anywhere there is an Internet connection. I still provide the RCI with names of potential astronomy speakers; they do the rest. It's an easy way to organize public astronomy lectures: find a group that organizes them and provide them with astronomy speakers. Astronomy always draws a crowd.

The Astronomical Society of the Pacific (ASP: [www.astrosociety.org](http://www.astrosociety.org)) is a world leader in creating and disseminating good astronomy educational resources (and lots of other things). I was active from 1993 to 2001, served as President in 1997-99, and am still on its Advisory Board. If you are looking for well-tested astronomy resources and activities for students or families, don't re-invent the wheel; look on the ASP Web site.

The American Astronomical Society (AAS: [www.aas.org](http://www.aas.org)) is the organization of professional astronomers in the U.S.A. I served two terms on their Education Board. During the second, we worked to establish *Astronomy Education Review* (AER: [aer.aip.org](http://aer.aip.org)), a free on-line journal that is a leader in publishing refereed and non-refereed articles on astronomy education and outreach. It's well worth reading. Another notable project was motivated by the challenges to the teaching of evolution in US schools: we realized that there was no resource that explained to teachers how astronomers know that the Universe is very old, and changing. Four of us created a resource that is available on the ASP Web site.

I also served the AAS as Harlow Shapley Visiting Lecturer from 1977 to 2005. This program sends experienced astronomers to smaller institutions, without astronomy facilities, to give presentations to schools and the public, and to meet with college faculty, students, and administrators. We used this program as a model for the CASCA-Westar Lectureship. I inaugurated the CWL in 2002 in North Bay, Ontario, attracting a total of 700 people to school and public presentations. Sadly, the CWL program is now "dormant," and I have urged CASCA to find some way to revive it.

The International Astronomical Union (IAU: [www.iau.org](http://www.iau.org)) is the world organization of professional astronomers. Its mandate is "to promote and safeguard astronomy...and develop it through international cooperation." It is administratively lean, and its funding is provided by national bodies

(the National Research Council, in Canada's case), such that there are no individual membership fees. Any qualified astronomer can be a member. I've served as President of the IAU Commission (interest group) on Variable Stars and, for three decades, was active in the Commission on Astronomy Education and Development, serving as President in 1994-97. I find that, nowadays, many graduate students and other young astronomers are unaware of the value and importance of international astronomy development and the ethical arguments for its promotion. It's obviously not practical for developing countries to invest billions in "big astronomy." But astronomy is part of their culture. It should be part of their education system. It can attract students to careers in science and technology. And eventually, a few astronomers can engage in research, either through international collaboration, or through "small science" projects such as CCD observation of variable stars.

## American Association of Variable Star Observers

I discuss the AAVSO ([www.aavso.org](http://www.aavso.org)) separately because, since 1985, it has had a major impact on my research on variable stars and stellar evolution, as well as my education and outreach activities. I have known about the AAVSO since the 1960s, because of the AAVSO Director's *Variable Star Notes* in the *JRASC*. The AAVSO was founded in 1911. I have recently been immersed in its 2011 centennial activities; as editor of the *Journal of the AAVSO*, I have edited its 600-page centennial issue. The AAVSO is the most significant organization through which skilled amateur astronomers can contribute to astronomical research. It's the epitome of "citizen science."

The AAVSO plays a particularly important role in the student research that I supervise (Percy 2008). It's a win-win-win situation. By analyzing archival AAVSO data on variable stars, my students develop and integrate skills in science, math, and computing. Useful science gets done. And, because we present the results at AAVSO meetings, and usually publish the results in the *JAAVSO*, AAVSO observers get motivating feedback on how their work contributes to science and education.

In 1987, I was a founding mentor for the University of Toronto Mentorship Program, which enables outstanding senior-high-school students to work on research projects at the university. These students are comparable, in ability, with undergraduates, and dozens of them have completed and published variable-star projects with me, mostly using AAVSO data. They are also an untapped resource for astronomy outreach, in their schools and to the public. In 2012, there were 200 participants in this program, in departments across the university. Sadly, my university has just eliminated this program, on the grounds that it is overly time-consuming for faculty (though not in my case!), and not effective as a recruitment tool.

Around 1990, I and my late colleague and friend, AAVSO Director Janet Mattei, independently realized that the observation and analysis of variable stars could be an excellent tool for science and math education. In my case, I had visited many small colleges where astronomy instructors were looking for simple lab and observing activities that would engage students and develop their research skills. With a \$300K grant from the U.S. National Science Foundation (NSF), we developed *Hands-On Astrophysics*, a set of resources that could develop and integrate students' science skills by doing real science, with real data. HOA has since morphed into the more-powerful on-line *Variable Star Astronomy* ([www.aavso.org/vsa](http://www.aavso.org/vsa)). Its impact is high; it is now part of the preparation program for the U.S. Physics Olympiad, so thousands of talented high-school students are motivated to explore and master this material. The sad thing is that, in Canada, there is little or no funding for science education projects like HOA—nothing comparable with what NSF and NASA have provided in the U.S.

## Institutions

Over the past half-century, I have been associated with three local world-class astronomy education facilities whose stories carry important lessons. I began my outreach experience at the David Dunlap Observatory (DDO: [www.theddo.ca](http://www.theddo.ca)), then part of the University of Toronto. When it was opened in 1935, it housed the second-largest telescope in the world. (The third-largest was located at the Dominion Astrophysical Observatory, in Victoria.) For 50 years, it enjoyed great success in research, student training, and public education. Then, its use declined. Eventually, the DDO lands were sold to a developer, and the proceeds used to endow a Dunlap Institute (DI), based on the university campus. The DI carries the Dunlap name and bequest into the 21<sup>st</sup> century. Its emphasis is on developing state-of-the-art instrumentation, and carrying out challenging observations. Outreach is also a key part of its mandate, and its activities have included organizing the viewing of the 2012 transit of Venus by 6000 people in Varsity Stadium (Reid 2012). Meanwhile, the telescope and buildings at DDO have been preserved, and proposed as heritage sites. The RASC Toronto Centre offers a public education program each Saturday evening in the summer, and professional astronomers, such as myself, support it by giving non-technical talks.

Prior to the 1960s, the DDO was the major centre for outreach in astronomy. In 1968, the McLaughlin Planetarium opened as part of the Royal Ontario Museum (ROM). From then until 1995, it was one of the world's leading planetaria and Ontario's most important astronomy education resource, attracting about 300,000 people each year—and that was before astronomy became compulsory in the school curriculum. The planetarium closed in 1995 in response to uncertainty about the “common sense revolution”: the status and funding of the ROM and other provincial cultural facili-

ties was in doubt. The ROM closed the planetarium in the belief that the site could be used for more lucrative purposes. It could not. It now serves as a storage area. The site has recently been sold to the university, probably for the expansion of its Faculty of Law. The ROM still offers planetarium shows using portable planetariums and has an excellent meteorite collection and exhibit.

The Ontario Science Centre (OSC: [www.ontarioscience-centre.ca](http://www.ontarioscience-centre.ca)) is one of the world's leading science centres, and one of Canada's most popular cultural attractions (though it's sometimes difficult to convince people that science is “cultural”!). It's also Ontario's centre for astronomy education and outreach, with its exhibits, programs, workshops, and planetarium programs for students and teachers. I suspect that, if the McLaughlin Planetarium had been associated with the OSC, rather than with a museum like the ROM, it would not have closed. The OSC is also host to the RASC Toronto Centre, and they partner regularly in organizing star parties and other events. From 1992 to 1998, I was vice-chair of the OSC Board of Trustees. We were busy building Ontario's first OMNIMAX theatre and other projects, when the “common sense revolution” hit. But we persevered and succeeded. The OSC subsequently, through its *Agents of Change* project, added several innovative, interactive galleries, targeting new audiences—not just children. Unlike the ROM and the Art Gallery of Ontario, it has spent its capital funds on exciting new programs and exhibits, not fancy architecture.

## Reaching Audiences, Old and New

International Year of Astronomy (IYA2009) was a resounding success in Canada. There were more than 3,600 events, reaching almost two million people directly, and many more through posters and the media (Hesser *et al.* 2010). I attribute this success to four factors: (i) the leadership by Jim Hesser; (ii) the effective partnership between CASCA, Fédération des astronomes amateurs du Québec (FAAQ; [faaq.org](http://faaq.org)), and the RASC; (iii) the work of hundreds of volunteers from these three organizations; and (iv) support from the Trottier Family Foundation. I definitely think that we outdid IYPhysics 2005 and IYChemistry 2011! IYA2009 was initiated by the IAU, and ultimately celebrated in 148 countries—twice the number of countries that belong to the IAU and/or carry out astronomical research.

In my experience, however, the majority of people who attend astronomy events are “the usual suspects,” especially greying white males like myself. Following on the success of IYA2009, we embarked on *Beyond IYA*—outreach focused on reaching new audiences, especially youth from underserved communities, such as Aboriginal, rural/remote, and inner-city. We were supported by a grant from NSERC's *PromoScience* program, which enabled us to hire a part-time educator, Julie Bolduc-Duval. We were guided by the success in partnering with

Aboriginal communities during IYA, thanks to the work of Jim Hesser, Andy Woodsworth, Cheryl Bartlett, and her colleagues in the Mi'kmaq College Institute at Cape Breton University. BIYA has concentrated on providing “virtual” training and support to parks staff and other educators, across Canada, in English and French; groups and individuals such as myself have explored other avenues.

Astronomers—especially the older generation like myself—have been slow to harness the power of social media in reaching new audiences. That’s one more argument for partnering with students in planning and doing outreach! We also seem to be enamoured with 60-minute lectures, in both our outreach and our university teaching. Attention spans, except perhaps for the die-hards, are actually only a few minutes. This is why engaging three-minute video clips (such as TED: [www.ted.com](http://www.ted.com)) are becoming so popular. We also need to remember that not everyone relates to the more technical topics in astronomy; its interdisciplinary and cultural aspects can connect us with new audiences. And there’s the need to reach those for whom English and French are not a first language. York University has offered public astronomy lectures in other widely spoken voices, and the University of Toronto translated its transit-of-Venus guides into a dozen other languages.

Reaching underserved communities is challenging. One needs to work, patiently and respectfully, with the communities themselves, and with the organizations that serve them. In Toronto, we had some success working with such groups. We also used astronomy’s cultural connections to organize a one-day festival of multicultural astronomy—*One World, One Sky*—at the Ontario Science Centre, in partnership with the RASC Toronto Centre.

My most prolific IYA2009 partnership was with the Toronto Public Library, the world’s busiest public library system. Their 100 branches are rooted in communities across the city, including underserved areas. Since 2009, I have made over 50 presentations in libraries in Toronto, to audiences of all ages. For the children’s presentations, I recruited the help of Robby Costa, who had just graduated from my undergraduate science education program. For BIYA, I extended this program to rural libraries across Ontario. Libraries provide a venue, facilities, publicity, and an audience; just provide an astronomer!

My favourite IYA project brought astronomy to new audiences of tens of thousands of people, around the world: music-lovers. As a long-time follower and supporter of Toronto’s Tafelmusik Baroque Orchestra, and knowing of their creative multimedia programs, I suggested that they develop an astronomy-themed program celebrating Galileo and IYA. The result was *The Galileo Project: Music of the Spheres* ([www.tafelmusik.org/galileo/index.htm](http://www.tafelmusik.org/galileo/index.htm)). This program has received rave reviews, has toured Canada, the US, Mexico, China, Malaysia, Australia, and New Zealand. An excellent DVD is also now available.

We can definitely reach new audiences through astronomy’s interdisciplinary connections, and by linking our astronomical interests to our non-astronomical ones—in this case, music.

Another of my IYA partnerships was with Heritage Toronto ([www.heritagetoronto.org](http://www.heritagetoronto.org)). I have enjoyed and supported their heritage walks program for many years. So, for IYA, I developed a two-hour walking tour of astronomical sites, dating from 1838, in and around the university campus. This walk has attracted over a hundred people each year. It reminds us that there are many people interested in history and heritage. It also reminds us of the importance of our heritage and the need to preserve it. During IYA, we also established a partnership with the University of Toronto Institute for the History and Philosophy of Science and Technology (IHPST). This led to a very exciting and successful collaborative exhibit and symposium, leading up to the June 2012 transit of Venus. It also led to a project to catalogue and conserve the University’s historic astronomical instruments, a project driven by IHPST graduate students ([www.utsic.org](http://www.utsic.org)).

## Building a “Science Culture”

The heart of IYA2009 in Canada was “the Galileo moment”—a personal response to an astronomical observation, idea, or other experience. Canadians need to discover that science is interesting as well as important. Canadians excel as much in science as they do in hockey. Canada lacks a national organization to promote science, and science culture, though various such organizations have come and gone over the decades. We established the Science and Technology Awareness Network (STAN) in 2003. It now has over 380 member organizations, holds an annual networking conference, and maintains a Web site ([www.scienceandtechnologynetwork.ca](http://www.scienceandtechnologynetwork.ca)) with resources for outreach organizations. The driving force behind STAN was Dr. Bonnie Schmidt, President of *Let’s Talk Science*—another important force in science education in Canada.

*Science Rendezvous* ([www.sciencerendezvous.ca](http://www.sciencerendezvous.ca)) is a one-day science festival, patterned on an event in Berlin that draws half a million people to science facilities annually. SR began in Canada at the University of Toronto. I was on the founding committee; the driving force was Professor Dwayne Miller. It is now a national event. This year, there were over 300 events, with over 2500 volunteers, reaching audiences totalling tens of thousands. The RASC Toronto Centre was an enthusiastic participant in 2012. SR brings the public to science settings, to chat with scientists, and experience science hands-on. A similar event began in New York at the same time with a similar-sized audience but a much larger budget!

## Teaching University

The Qilak Award is specifically *not* awarded for contributions to formal education, but I can't resist making some comments about teaching university, and introducing two other organizations in which I am still active. In 2007, I was honoured to receive an inaugural University of Toronto President's Teaching Award, and to become a founding member of the President's Teaching Academy. The PTA strives to raise the profile and effectiveness of teaching, in cooperation with the University's Centre for Teaching Support and Innovation ([www.teaching.utoronto.ca](http://www.teaching.utoronto.ca)). I have a special interest in addressing the unfortunate situation whereby university instructors receive little or no initial or continuing education in teaching.

I'm also a core member of the Centre for Science, Math, and Technology Education (SMT: [www.oise.utoronto.ca/smt/](http://www.oise.utoronto.ca/smt/)) at the Ontario Institute for Studies in Education (OISE/UT). I had approached OISE/UT once or twice in the distant past, about a cross-appointment, but nothing resulted, probably because I am an "amateur" at education research. I finally got in "through the side door" as a result of a collaboration with a graduate student there. In SMT, I have learned more about science education research. In the spirit of subjecting our teaching and outreach to the same critical analysis that we do for our astronomy research, my goal, at SMT, is to connect it more closely to the science and math departments in the rest of the university. I have had limited success. This is a problem across North America: there is too little contact between science departments and those that train schoolteachers and conduct science-education research.

So, I have two messages: (i) there are "best practices" in teaching and outreach; we and our colleagues should learn about them; it will improve our success; and (ii) all teaching and outreach should be subject to assessment and improvement, either through formal education research, or at least through reflection, during and after the experience. See Percy (2002) for further thoughts.

I retired from undergraduate teaching in 2007. Now I teach later-life learners; I have organized and/or taught three different courses in the last year. Later-life learners are a receptive, interactive, enjoyable, significant, and growing audience (Percy and Krstovic 2001). My courses are anywhere from 40 to 250 in size. I also give one-off presentations to groups like Probus ([www.probus.org/canada](http://www.probus.org/canada)), a network of clubs for active retirees, associated with Rotary. I urge you to locate your local later-life learning group, and offer your services. They will do the rest!

## The State of Astronomy Outreach

At the University of Toronto, astronomy outreach is alive and well. Our astronomical "triumvirate" of the Department of Astronomy and Astrophysics (DAA), the Dunlap Institute (DI), and the Canadian Institute for Theoretical Astrophysics (CITA) has an active outreach committee, chaired by Dr. Michael Reid, which organizes events such as the viewing of the transit of Venus (Reid 2012); public lectures by the likes of Mike Brown, Stuart Clark, Vicki Kaspi, and Dava Sobel; monthly tours organized by the graduate students; an outreach Web site ([universe.utoronto.ca](http://universe.utoronto.ca)), as well as activities carried out by individuals such as myself. We are striving to continue to increase our impact, reach, and effectiveness through partnership and coordination. Many of our activities are in partnership with the RASC.

At the university level at U of T, things are less satisfactory. There are many outreach activities going on at the departmental level, but there is minimal institutional support and coordination. This is partly because we do not have a separate Faculty of Science, which is often the natural "home" for science outreach. A few years ago, a bout of coordination resulted in the creation of *Science Rendezvous*. A promising development is the recent appointment of astronomer and science communicator Prof. Ray Jayawardhana as Special Advisor to the President on Science Engagement.

Outreach by CASCA has grown significantly in the last decade, partly as a result of grant support, partly because of growing awareness of the importance of outreach, and partly because of IYA2009 and the success of the CASCA-FAAQ-RASC partnership. But, it's disturbing that two major initiatives—the Web site for teachers and students ([www.cascaeducation.ca](http://www.cascaeducation.ca)) and the CASCA-Westar Visiting Lectureship—are "dormant." Much effort was put into the Web site; it needs promotion, as well as maintenance. And, the CWL brings astronomy to underserved parts of the country.

As for the FAAQ and RASC: their outreach audiences far exceed those of CASCA (unless CASCA's numbers are grossly under-reported). And, FAAQ and RASC members do outreach voluntarily, above and beyond their other astronomical interests, and above and beyond their day jobs. They can benefit from partnership with professionals but, in many ways, they lead the way.

## In Summary

I don't expect to do astronomy outreach for another 50 years, though I am still actively involved in it. I will be happy if Canada's amateur and professional astronomers, and their students, continue and expand our long tradition of communicating the excitement and importance to people of all ages! I hope my reflections will be useful.

## Acknowledgements

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## Rising Stars

### Dr. Linda Strubbe and the Black-Hole Diet



by John Crossen  
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Whether conducting cutting-edge black-hole research or simple public outreach, Dr. Linda Strubbe is making a difference. Some astronomers contribute to science through their discoveries. Others plant the seeds of knowledge that will flower as new scientists and new discoveries tomorrow. Dr. Linda Strubbe does both.

In 2011, Dr. Strubbe graduated from U.C. Berkeley with a Ph.D. in astrophysics. Prior to that she earned her M.A. in astrophysics from the same institution, and her B.A. (with honours) in astrophysics from the California Institute of Technology. She is currently in Toronto doing post-doctoral research in black-hole physics at the Canadian Institute of Theoretical Astrophysics.

During her graduate-school career, Dr. Strubbe was the author and co-author of several papers on aspects of her thesis topic: the process of black holes eating stars. When a star approaches too close to a super-massive black hole in the centre of a galaxy, the black hole's gravity can rip the star apart. The black hole then swallows a fraction of the star's gas, producing a luminous weeks-long flare as bright as a supernova. Studying these flares can teach us how the heaviest black holes and the galactic nuclei that host them grow together, by revealing the



Figure 1 – Dr. Linda Strubbe.

details by which black holes consume gas, and by teaching us about the distribution and motions of stars close to the black hole.

Most recently (2012), Dr. Strubbe was co-author of a paper entitled *PTF10iya: A short-lived, luminous flare from the nuclear region of a star-forming galaxy*. She was part of a team of scientists from California, Israel, the UK, and Canada, led by Dr.

Brad Cenko from U.C. Berkeley. This paper presented the first detection by the Palomar Transient Factory of a black hole eating a star, and showed that the properties of the event were broadly consistent with predictions Strubbe had made in her thesis. She noted, "This was the first candidate discovered due to its optical emission that was found in real time by a survey. Thus it could be followed up at other wavelengths and with a spectrum while the event was still going on."

But there's more to Linda Strubbe than cutting-edge black-hole research. She also has a passionate interest in public-outreach astronomy.