



Department of Physics and Astronomy

WINTER 2013

Message from the Chair



David Venus

It has now been a decade since the retirement of Jim Waddington from the department of Physics and Astronomy, and since the establishment of the Jim Waddington Prize in Physics & Astronomy to recognize the profound influence that he had on a new generation of physicists through his undergraduate teaching. Jim's outstanding accomplishments in experimental nuclear physics made him a national and international leader in his field,

and his exemplary teaching career at McMaster was capped with the 2003 President's Award for Excellence in Instruction.

The more things change, the more they stay the same. Jim remains as active in research as he ever was, but now with a different focus. He and his wife, Sue, have published a popular book that documents their project to rediscover and photograph the original sites of hundreds of scenes painted or drawn by Group of Seven artists. (See: <https://www.gooselane.com/books.php?ean=9780864929082>) And the Prize in Jim's name continues to help introduce students to the fascination of physics and encourage them to consider studying physics and astronomy at McMaster. Every year the Prize is awarded to the student with the best performance in the first year introductory physics course that Jim taught for many years, who subsequently registers in an Honours Physics and Astronomy program.

Looking back over the decade, we can see that the Jim Waddington Prize has contributed to the development of a remarkable group of young scientists working in a wide range of fields. Through your donations, the Prize has also developed from the original single annual award of \$500 to two awards of \$750 in 2013. It has assumed an important role in raising the profile of the department and discipline among first year students, and in recruiting the very strong cohort of students that graduate with an Honours Physics degree every year. This tenth anniversary is an ideal time to celebrate both Jim and the prize winners, and to recommit ourselves to attracting the best students and providing them with outstanding opportunities. Watch your mail and email for details of the events we are planning.

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Alumni - Where are they now?

Travis Williams is a staff associate at the Oak Ridge National Laboratory (ORNL) Neutron Sciences Directorate and holds the prestigious Wigner Fellowship.

Josh McGraw holds an NSERC post-doctoral Fellowship working with **Prof. Karin Jacob**'s research group at the Universität des Saarlandes in Germany.

Michael Horbatsch is a postdoctoral research associate in the Department of Physics and Astronomy at the University of Mississippi.

Graduate Profile



Matilda Backholm

I was born in the midst of the pitch black and cold winter of Finland. I grew up in the centre of Helsinki, a city yet to become a Nordic metropolitan, but spent all of my summers on a small island in the archipelago just off the Finnish western coast. Gutting fish, repairing outboard motors, and building stuff was mixed with watching the midnight sun (almost not) set and running around barefoot in the forest. Understanding the anatomy of fish and the

structure of motors opened my eyes for the natural sciences, although it wasn't before senior high school that I realized I had a deep fascination for the use of mathematics to describe the nature around us.

I began studying mathematics and physics at the University of Helsinki and finished my undergraduate degree a few years later. During my time in Helsinki, I found true love in physics and decided to broaden my horizon by moving abroad and pursuing my masters degree at Aarhus University in Denmark. In Aarhus I became immersed in the thriving experimental environment of the Interdisciplinary Nanoscience Centre (iNANO) and was thrilled to perform state of the art surface science with exciting input from biologists and engineers. I learned how to use physics to mimic nature and became increasingly interested in soft matter physics.

After one and a half years in Denmark and with a M.Sc. degree in the bag, I flew west toward Hamilton and McMaster where the research of Dr. Dalnoki-Veress had captured my attention. The steel city welcomed me with open arms and I've been continuously amazed by the warmth and kindness of the students and staff in the P&A department. The past 2.5 years in Canada turned out to be the most excitingly daunting and terrifying of my life, I have pushed my limits on so many different levels, passed comps and learned how to perform truly inspiring and novel research. I say this with a big smile, as I've had tremendous support along the way by the fantastic members of the KDV group. I find myself poking worms and building equipment, and suddenly that small island back home doesn't seem so far away.

Undergraduate Profile



Michael Birch

I have always known that I am interested in physics. I chose to attend McMaster because of its reputation for research excellence and its small community feel, reminiscent of my hometown. My first year only strengthened my love for physics, but also began to show me the various connections physics has with mathematics. It was these connections that motivated me to enter the Honours Mathematics and Physics program.

Since then I have been actively involved with research focused on mathematical tools used in problems in physics. I started in the summer after first year with novel statistical analyses of experimental nuclear data under the supervision of Dr. Alan Chen and Dr. Balraj Singh. This work continued into my second summer, supplemented by an NSERC USRA. I also began some work on systematic trends in beta-delayed neutron data during that time, which lead to a first place talk at the 2012 CUPC. My work in nuclear data also gave me the opportunity to travel extensively, visiting Vancouver, New York City and Munich, Germany. During my third summer I was again awarded an NSERC USRA and worked with Dr. An-Chang Shi, implementing self-consistent field theory in the context of the effect of protein/lipid interactions on cellular membrane shape. This work is now continuing for my senior undergraduate thesis.

Outside of academics I have been involved with many extra-curricular activities, through which I earned a reputation of responsibility and leadership. This reputation lead to my appointment as the chair of the organizing committee of the CUPC held at McMaster this year. It was an absolute pleasure to show students from across Canada the fantastic facilities we have to offer. Not to mention a welcomed opportunity to present some of my own research from the summer.

Now going into my final semester here at McMaster, I reflect on all of the amazing opportunities this department has offered and all the incredible individuals therein that have contributed to my education. While I still haven't decided where I will be after graduation, I know that McMaster has prepared me for whatever challenges come next.

Postdoc Profile



Dr. Edwin Kermarrec

I have always been very curious about natural phenomena, and I still believe this is my main motivation for pursuing a career in research today. I grew up in a suburb of Paris, France, where I did most of my education. After secondary school, I chose to follow advanced scientific undergraduate studies (classes préparatoires) before pursuing with a Masters in Physics at the Université Denis Diderot (Paris 7). In 2008, I did a summer internship during my Masters at the University of Bristol (UK)

under the guidance of Prof. Nigel Hussey. This was a time of great excitement among the condensed matter community as a new class of superconductors, the iron pnictides, had just been recently discovered. Far from the often-depicted picture where research in academia is a slow and boring activity, I acquired the conviction that it was in fact a domain in perpetual and extraordinary fast evolution with a lot of competition. I remember having stimulating discussions there with other young students, from whom I first heard about frustrated magnetism and neutron scattering. Later on, I came back to France and started my PhD at the Université Paris Sud (Paris 11), supervised by Prof. Philippe Mendels and Fabrice Bert, on the study of new frustrated kagomé magnets investigated by NMR and μ SR local probes. During my final year of PhD, I presented my results at the HFM 2012 international conference, held in Hamilton, on the campus of McMaster University.

I knew I wanted to pursue a postdoc and was excited by the opportunity to learn a different experimental technique, offering a very complementary point of view on quantum magnetism, like inelastic neutron scattering. The internationally renowned group of Prof. Bruce Gaulin was the perfect choice for me. My application was accepted and I joined the Physics and Astronomy Department at McMaster as a postdoctoral fellow in January 2013. I remember that only one week after my arrival, I had to go carry out experiments in OakRidge (TN), where I suddenly became known as the 10 000th user of the Spallation Neutron Source and performed my first inelastic neutron scattering experiment at the same time. Quite an exciting start for a “fresh off the boat” young scientist! Since then, I have performed various experiments both in Canada and abroad, at NIST (Gaithersburg), SNS (OakRidge), APS (Chicago), ISIS (UK) and TRIUMF (Vancouver) facilities. After one year spent in Canada, I am glad to see that not only have I managed to survive winter, but that I have even started to like it! Canada possesses gorgeous natural landscapes, which I began to discover last year, during a short trip on one of the Georgian Bay Islands, Beausoleil. I really hope to continue the adventure and visit an even wilder National Park in the next summer. Being part of the Physics and Astronomy Department at McMaster is a fantastic opportunity to do science, and I am looking forward to the next challenging experiments coming up this year.

Graduate Awards



Dr. Yasuhiro Hasegawa

A recent PhD graduate, Dr. Yasuhiro Hasegawa was awarded the Plaskett Medal for the most outstanding Canadian thesis in astronomy or astrophysics last year. The Canadian Astronomical Society (CASCA) and the Royal Astronomical Society of Canada (RASC) award this honour annually. Yasuhiro accepted his award and presented his research in Vancouver at the CASCA 2013 conference.

Dr. Hasegawa’s thesis research, carried out under the supervision of Dr. Ralph Pudritz, was focused on the theory of planet traps in protoplanetary disks. In recent years enormous numbers of extrasolar planets have been found observationally and the search for a theoretical understanding of the formation of these systems is one of the hottest area of astrophysical research. Dr. Hasegawa’s thesis provides a new way to understand what all of these new data are starting to reveal about how planetary systems form.

Dr. Hasegawa is currently a fellow with the East Asian Core Observatories Association at the Academia Sinica Institute of Astronomy and Astrophysics in Taiwan.

Rachel Ward

Rachel Ward was honoured in 2013 with the Dean’s Award for Excellence in Communicating Graduate Research. Rachel is a PhD student in astrophysics and also devotes her time to communicating astronomy to the public via the Origins 3D theatre (<http://origins.mcmaster.ca/3D-theatre>) and the McCallion Planetarium (<http://www.physics.mcmaster.ca/planetarium/>).



Dr. Kate Ross

The Neutron Scattering Associate of America (NSSA) awarded a recent PhD graduate, Dr. Kate Ross, the 2014 prize for outstanding research. Dr. Ross’s research, under the supervision of Dr. Bruce Gaulin, focused on neutron scattering studies of exotic ground states, ground state selection and spin excitations in XY Pyrochlore Magnets.

The NSSA offers 4 major prizes every two years, for excellence related to neutron scattering. The 4 prizes recognize achievement at different levels of seniority. This is the 1st time a Canadian has been a recipient of any of the NSSA major prizes.

Dr. Ross is now a postdoctoral fellow at Johns Hopkins University and the NIST Center for Neutron Research.

Faculty Awards



Astrophysicist Dr. Christine Wilson has been elected to the Royal Society of Canada (RSC). The RSC exists to promote Canadian research and scholarly activities, to mentor young scholars, to recognize excellence and to advise government, non-governmental organizations and the Canadian public on issues of interest.

Dr. Wilson joined the department of Physics & Astronomy in 1992 and is a world expert on star formation within galaxies. Dr.

Wilson has led major observational campaigns at the world's leading telescope facilities and since 1999 has acted as the Canadian project scientist for the Atacama Large Millimeter/submillimeter Array (ALMA), an international partnership of Europe, North America and East Asia located in Chile.

Dr. Christine Wilson



The Canada Council has awarded Dr. Catherine Kallin a Killam Research Fellowship. A small number of these prestigious fellowships are awarded each year to researchers across all disciplines. The researchers must be well established and have an outstanding reputation in their field. The Killam Fellowship comes with substantial financial support to allow the recipients time to focus on their research goals.

Dr. Catherine Kallin

During the tenure of this fellowship Dr. Kallin's research will concentrate on the theory of unconventional superconductivity in interesting materials, including the cuprates, with high transition temperatures, and strontium ruthenate.



Dr. Kari Dalnoki-Veress

Dr. Dalnoki-Veress was the recipient of two awards in 2013. Firstly, Dr. Dalnoki-Veress was nominated by his students and awarded the McMaster President's award for excellence in graduate supervision in science. This award recognizes supervisors who have made outstanding contributions to graduate education and training.

In addition, Dr. Dalnoki-Veress, together with close collaborator Dr. James Forrest, was awarded the Brockhouse Medal by the

Canadian Association of Physicists (CAP). This medal recognizes exceptional contributions to condensed matter and materials physics. Drs. Dalnoki-Veress and Forrest have been collaborating for 15 years on the physics of soft condensed matter. The award recognizes their "outstanding collaborative work in the physics of macromolecules in thin films, as well as near surfaces as interfaces". This medal is named in honour of Dr. Bertram Brockhouse a celebrated McMaster scientist who earned the Nobel Prize for Physics in 1994.



Dr. Bruce Gaulin

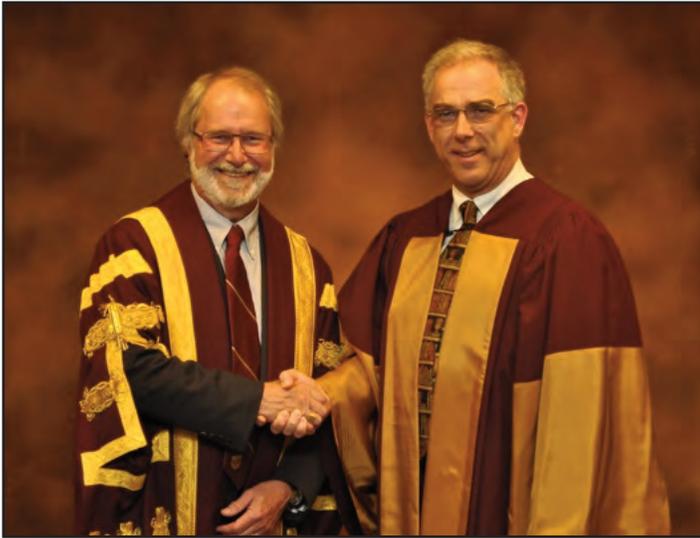
Dr. Bruce Gaulin, experimental condensed matter physicist and director of the Brockhouse Institute for Materials Research, was recently awarded funding by the Ontario Research Fund. This funding supports a major investment by the Canadian Foundation for Innovation (CFI) in Canada's first Small Angle Neutron Scattering (SANS) instrument. This instrument will be used to characterize nanostructures in materials and will provide the Canadian materials science

community with a powerful instrument to probe structures on the nanoscale.

New Honours Astrophysics Program

Starting in 2013 the Department of Physics & Astronomy is pleased to offer a new honours program in Astrophysics. The program has been designed to cover the same core physics as our honours physics program but with the addition of at least one astrophysics course each year. This program adds to our previous specialization in astrophysics by allowing students to graduate with a degree in astrophysics and we've added an exciting new fourth year project-based course in astrophysical data analysis. This new course will teach students the skills of image analysis as well as how to access and analyse large databases of archival data. These skills are transferrable to work in many different disciplines.

Honorary Degrees



2012 Dr. Gary Davis
with McMaster president Dr. Patrick Deane

McMaster Physics & Astronomy alumnus Dr. Gary Davis received an honorary doctorate at the Spring 2012 Convocation. Dr. Davis started his university education at McMaster and went on to complete graduate degrees at Toronto and Oxford before joining the University of Saskatchewan as a professor of physics and engineering physics. From there he moved on to become the director of the Joint Astronomy Centre at the Mauna Kea Observatory in Hawaii. Dr. Davis has played key roles in developing major long wavelength astronomical instruments for both ground- and space-based telescopes. Dr. Davis is a member of the American and Canadian astronomical societies and the Royal Astronomical Society. Dr. Davis has also received a Certificate of Recognition from the European Space Agency and a Group Achievement Award from the Royal Astronomical Society.



2013 Dr. Thomas Mason

McMaster Physics & Astronomy graduate alumnus Dr. Thomas Mason received an honorary doctorate at the Spring 2013 convocation. Dr. Mason is an experimental condensed matter physicist currently serving as director of the Oak Ridge National Laboratory in Tennessee. In his role as director Dr. Mason is responsible for the United States Department of Energy's largest multipurpose science and energy laboratory, with an annual budget of more than \$1 billion. Dr. Mason was elected a Fellow of the American Association for the Advancement of Science in 2001, a Fellow of the American Physical Society in 2007, and was also awarded an honorary doctorate from his undergraduate university, Dalhousie.

HISTReENet: History and Ideas of Science and Technology Research and Education Network

Sarah Symons, Robert Cockcroft
www.physics.mcmaster.ca/HISTReENet/

The field of history of science spans faculties, disciplines, cultures, and ages and is important as it places our modern endeavours in perspective and social context, and sheds light on our approaches and ethics. It can bring to life the names in our textbooks, and provide inspiration for our students. Two departmental members, Sarah Symons and Robert Cockcroft, have created a new University-wide group to explore interesting topics in history of science and surrounding fields: HISTReENet, the History and Ideas of Science and Technology Research and Education Network.

Prior to the creation of HISTReENet, people interested in history of science were spread across departments and faculties, and were sometimes unaware of each others' work. Students had little access to research expertise in these historical areas which would enrich their own understanding of their (modern) fields of study. HISTReENet addresses these problems by creating a network of interested individuals, a forum for exchange of ideas, and a venue for guest speakers.

The Network fosters inter-departmental discussion and research links, and engages students in research and reflective activities. It connects history and philosophy of science and technology researchers across campus via an e-mail list and website, in addition to monthly face-to-face meetings to share ideas, research, and methodologies. Current undergraduate and graduate students are invited to participate, and increase their awareness of the place of science in society by engaging in history and philosophy of science activities related to their own subject areas. Support from the Forward With Integrity Fund is used to invite external researchers to present public talks on topics of interest in history of science.

HISTReENet welcomes all campus members and friends who have interests in history of science – members from all faculties and disciplines, and from all levels (from undergraduate students through to faculty, staff, and emeriti). Details about future meetings can be found at the HISTReENet website (above). To be added to the mailing list please e-mail symonss@mcmaster.ca.

Alumni - Where are they now?

Katharina Fritsch is a postdoctoral fellow with the Helmholtz-Zentrum, in Berlin, Germany.

Brendan Sinnott is a Business Intelligence Quantitative Analyst for the Internet startup kabam.com in San Francisco, California.

McMaster Hosts the 2013 Canadian Undergraduate Physics Conference

Sara Cormier

The Departments of Physics & Astronomy, Engineering Physics and Medical Physics co-hosted the 2013 Canadian Undergraduate Physics Conference (CUPC) in October. This annual conference is the largest undergraduate non-profit physics conference in North America. It provides undergraduate students with the opportunity to share their research experiences with their peers and explore the various study areas in physics. The CUPC consisted of student talks and a poster session, plenary lectures by distinguished physicists, lab tours, a graduate fair, and multiple social events. This year some of these social events included trips to Dundurn Castle, the Hamilton Steam Museum and Webster's Falls.

Since its inception in 1965, the CUPC has always been a student initiative, with the conference planning being carried out by a committee of undergraduate students at the host university. Fourth year Honours Math and Physics student Michael Birch chaired the 2013 CUPC organizing committee at McMaster and, along with a group of dedicated classmates, organized the conference from start to finish. The CUPC has rotated annually between various universities across Canada, from the University of Saskatchewan in 2011, to the University of British Columbia in 2012. The last time McMaster hosted the conference was in 1994. Almost twenty years later McMaster once again hosted this national conference, which showcased the city of Hamilton, strengthened McMaster University's reputation as an extraordinary research facility, and promoted the continued growth of Canadian physics by bringing together the top undergraduate physics students from across the country.

This year, over 160 students from across the country (and even two from Hong Kong) arrived in Hamilton in October for this four-day CUPC. Students visited McMaster campus for student talks, tours of McMaster's impressive research facilities, a Planetarium show, an Origins' 3D Theatre show, a Nuclear Reactor tour and a delicious lunch at The Phoenix. The conference culminated with a banquet dinner at the Sheraton Hotel in

downtown Hamilton and a plenary lecture by Dr. David Griffiths. Dr. Griffiths is a celebrity within the undergraduate physics community, having written incredibly popular and widely used undergraduate textbooks in both Quantum Mechanics and Electrodynamics. Excited students lined up for autographs and pictures.

One major focus of the CUPC is to expose students to the multiple avenues that are available to them for further study in physics. Student talks were organized into multiple categories, ranging from medical and biological physics to astrophysics, with awards given to the best orators in each category. There were eight different talk sections and a poster session. A total of 27 awards were distributed to the top three students in each section. Historically McMaster students have always done very well at the CUPC but this year was especially impressive. McMaster students walked away with 9 awards.

The talk winners were:

First place Astrophysics: **Heather O'Halloran**
First place Quantum Condensed Matter: **Miles Couchman**
First place Biophysics/Soft Matter: **Hannah Dies**
First place Medical Physics: **Peter Hoang**

Second place Particle/Nuclear Physics: **Benjamin Davis-Purcell**
Second place Biophysics/Soft Matter: **Sean Ridout**
Second place Geophysics: **Nikolas Gazo**

Third place Engineering/Applied Physics: **Jason Munro**

And for the poster session:

Third place overall poster: **Obaidullah Khan**

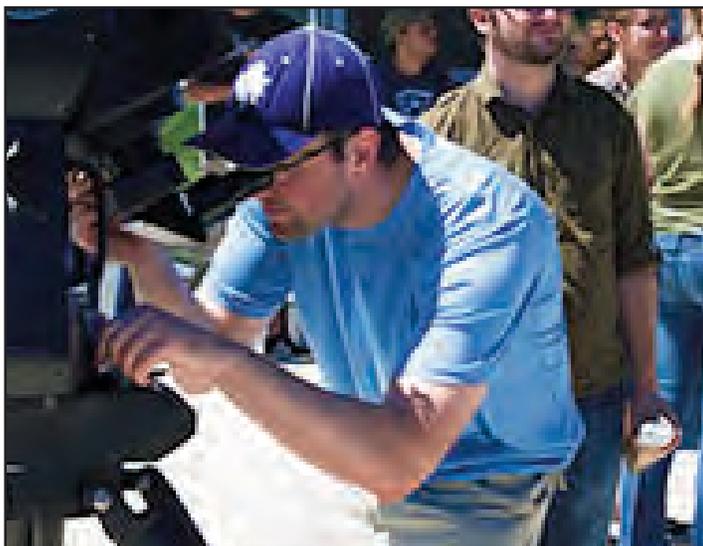
Congratulations to all the winners and to the dedicated 2013 CUPC organizing committee! Students are looking forward to the 2014 CUPC, which will be hosted by Queen's University.



McMaster student attendees of CUPC with invited speaker Dr. David Griffiths

Sidewalk Astronomy

Graduate students in Physics & Astronomy continue to host free public observing sessions with both nighttime observing and daytime solar observing. Details about observing sessions can be found on the sidewalk astronomy site (<http://www.physics.mcmaster.ca/sidewalkastronomy/>) or through social media on facebook, Google+ and twitter. The SPICES program of the School of Graduate studies has financially supported Sidewalk Astronomy. This program helps fund initiatives that “engage, creatively challenge, and intellectually enhance their community.”



Jules and Tom Fest

A two-day conference to celebrate the combined achievements of Tom Timusk and Jules Carbotte was held at McMaster in May of 2013. Drs. Timusk and Carbotte both arrived at McMaster in 1965 and have had enormously successful research careers in condensed matter physics. The conference was focused on celebrating their contributions to our understanding of metals and superconductors.

Both Drs. Timusk and Carbotte have won numerous national and international awards and both maintain active research groups nearly 50 years after arriving at McMaster!



Dr. Tom Timusk



Dr. Jules Carbotte

Graduate Women In Physics and Astronomy



GWIPA Executive

Matilda Backholm

Graduate Women In Physics and Astronomy, or GWIPA as we like to call ourselves, is a society established in July of 2013 within the Department of Physics and Astronomy at McMaster. The core members of the group are graduate students in physics or astronomy who identify as women, but we also encourage undergraduate students (2nd year and up) as well as post doctoral fellows within these fields to participate in our activities. Our main goal is to bridge the gaps between research groups and fields within the department to form new friendships as well as a peer support base. We will act to strengthen the gender diversity of the department and mentor new students into the life as a female graduate student and researcher in a male dominated field.

During the fall of 2013, our executive group was formed (see photo) and together with an enthusiastic group of GWIPA members we have had a few interesting meetings. Most recently, we had the great opportunity to hear the thoughts and advice from our female faculty members over a cup of coffee.

Check out our webpage www.physics.mcmaster.ca/gwipa for photos and more info about our activities and us!

Alumni - Where are they now?

Matt Williams is a postdoctoral fellow with Cliff Burgess, McMaster University.

Prasanna Balasubramanian is a postdoctoral fellow with APCTP and Pohang University of Science and Technology, South Korea.

Philip Ashby is a postdoctoral fellow with Jules Carbotte, McMaster University.

Jonathan Stolle is a postdoctoral fellow at Northeastern University in Boston.

2013 Graduating Class



Back Row: Colin Lewis, Jeremie Choquette, Richard Parg, Samantha Pillsworth, Mohdeep Singh, Max Amann (4th yr Co-op), Alison Kinross, Casey Marjerson (4th yr Co-op), Callum Cymbalski, William Catchpole, Kriston Costa

Front Row: Darren Fernandes, Chris Adkins, Yohan Yee, Scott Culbert (4th yr Co-op), Stephen Smith (4th yr Co-op)

Missing: Julia Ahadie, Richard Alsop, Roidon Chung, Conor Doan, Srdjan Gavranic, Calvin Lobo, Peter Nguyen, Hansul Park, Junaid Qureshi, Michael Somers, Patrick Stewart

Contact Information:

Department of Physics and Astronomy, McMaster University
1280 Main Street West, Hamilton, Ontario L8S 4M1
Phone: 905-525-9140, ext. 24559
Fax: 905-546-1252
email: physics@mcmaster.ca
<http://www.physics.mcmaster.ca/>