Our Research Plan: Department of Physics and Astronomy

The University of Western Ontario

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Overview

The purpose of this document is to be a roadmap to guide the growth of The University of Western Ontario's Department of Physics and Astronomy in the coming years. The document is built on three pillars.

1. What is unique about our Department relative to our peers, nationally and globally.
2. What are the short and long terms goals of the Department.
3. What resources are required to achieve these goals.

This is a living document and was written collaboratively by the research faculty and will be revisited on a semiannual basis.

Differentiation of Our Department from Our Peer Institutions

We differentiate ourselves from other Physics and Astronomy Departments in two critical ways. First, our Department is uniquely situated at the interface between materials science and medical physics, and the expertise in our Department is networked tightly with both the Schulich School of Medicine & Dentistry and the Faculty of Engineering.

The Department is also uniquely positioned due to our expertise stretching from the largest scales of structure in the universe to the small scale of planetary formation and atmospheres, in particular Earth but also exoplanets. Our team is highly adaptable and collaborations as described in our Goals section allow us to address questions at all scales in the life cycle of a star, including the star's place in the galaxy, the star's struc-

ture, planetary formation and the big questions of the potential habitability of exoplanets and terrestrial atmospheric change.

Many physics and astronomy programs contains large groups of specialists working in a few focussed areas. Our strength at Western is the broad coverage of topics our team gives astrophysics, materials science, medical physics and geophysics. This broadness allows us to quickly form sub-groups collaborating on a particular problem across sub-disciplines. For instance, one of our astronomers is an expert in carbon nano-structures as applied to astronomy. Their expertise was critical in helping solve a problem faced by our carbon film material scientists. Progress in that area helped linkages with medical sciences, resulting in a NSERC CREATE application for broad training in carbon materials.

The following two research questions elaborate on the types of important problems our the members of our Department are thinking about while formulating our research plan.

How can we manipulate the interactions between molecules to develop better materials for use in cutting-edge technology applied to energy storage, electronic devices, or medical advancements?

Our collaborative community of faculty and students in materials and medical physics excel at interdisciplinary research, which encompasses the study of the physics of structures and interactions ranging from the nanoscopic to human-body scale. Together our materials scientists and medical physicists strive for advanced material and device performance in different medical and industrial applications by studying the connections between the underlying structure of materials, their properties, and the meth-

ods of fabrication. Through this synergy, we can aim to manipulate and exploit these structures to achieve advanced function and performance in cutting-edge technology.

This interdisciplinary knowledge translation is illustrated in the examples as follows:

1. **Investigation of carbon-based nanomaterials,** encompassing studies of carbon in space, synthetic materials, and natural carbon resources. This highly interdisciplinary team is also complemented with carbon material expertise in other faculties (Engineering) and science departments (Chemistry).
2. **Demonstrated the translation of basic science into jobs,** for example through the development of an industry-focused, ISO-17025 certified, MRI-compatible-device testing facility, and the design and production of point-of-care MRI systems with Ontario-based industry partners.
3. **Deep connections with Western's Brain and Mind Institute and the Bone and Joint Institute**, through the design and development of new neuro MRI systems and orthopedic MRI systems, growth into the development and application of magnetoencephalography (MEG), and the development and commercial translation of functional data analysis methods and software.

What are the fundamental processes at work in the universe that give birth to galaxies made of stars and planets, and the resulting atmospheres of these bodies?

Research in this area is identified with all aspects of the birth, life, and death of planets and stars. Our department is unique in Canada as we have the expertise to study the formation of stars and their associated planetary systems, the evolution of these sys-

tems through to their "death" and ultimate re-cycling into the universe as *the* fundamental process operating in the Cosmos.

The range of scales studied encompasses individual planets and their atmospheres, through their parent stars, through vast galactic collections of stars, gas and dust, including the supermassive black holes that lurk in their centres. This wide range of expertise on this fundamental cycle allows interdisciplinary approaches, including connections to virtually all other departments in the Faculty of Science and Engineering.

Unique aspects to this group include:

1. **Integration into Western's Centre for Planetary and Space Exploration (CPSX)**, an interdisciplinary entity at Western, bringing together researchers from the Departments of Physics and Astronomy, Earth Sciences, Chemistry, and Biology and the Faculties of Engineering, Law, Medicine, and Social Science. Collaboration with the broader university community interested in space-based research is critical to establishing the necessary collaboration to significantly participate in space missions.
2. **The Meteor Physics Group at Western,** unique in Canada, is the site of the only cooperative agreement between NASA and a Canadian university. The Meteor Physics Group provides real-time measurements of the meteoroid environment to NASA for spaceflight operations. It also provides multi-instrumental meteoroid measurements interpreted through dynamical models as part of longer term development of meteoroid environment models used for spacecraft impact hazard assessment throughout the inner solar system.

3. **Research presence in Canada's far North.** Both atmospheric physicists and astronomers are involved at the Canadian Network for the Detection of Atmospheric Change's PEARL Laboratory in Nunavut, which is also a potential Mars analog site. Department researchers also are involved in analog work at the Haughton Impact Crater in Nunavut. These unique high latitude observatories are critical parts of international programs making long-term measurements of the effect of atmospheric change on global weather and climate.
4. **High impact learning experiences,** and communicating our research to the Canadian public through outreach, principally at Western's Cronyn Observatory. The principal mission of the University is training students and a research-intensive department like ours allows them to supplement their courses with hands-on training. Another important aspect of research is outreach, that is, helping to make the public understand the importance of the science they are funding. Our Department's programs at the Cronyn Observatory touch thousands of visitors who come to the facility every year.

Goals

Short-Term Goals

1. **Immediate: expand Western's world-class materials science program to include computational materials research.** Western is currently competing for a Canada Excellence Research Chair (CERC) in computational materials science. Physics and Astronomy is playing a key role in this initiative. We have led this initiative from its inception and our materials sci-

entists will greatly benefit from a computational materials scientist joining our team.

2. **2018: establish leadership in space instrumentation and Big Data.** We see two immediate growth spaces to expand into for our thematic question of the life cycle of the universe. This goal can be forwarded in two ways. First, we will attempt to expand into Space Instrumentation, that is, working with Canadian industry to develop space hardware for both large missions and smaller projects like the current Cube-Sat opportunity from the Canadian Space Agency. Second, we will begin a program in big data in Astronomy (Astroinformatics) using principles which could tie to the CERC effort discussed previously.
3. **2018: Establishment of a new multi-user Magnetic Resonance Imaging facility.** We will install 2 new small-footprint MRI systems within the Department. These systems will support MRI system development activities, further establish research links with researchers from both the Brain and Mind Institute and the Bone and Joint Institute at Western, and enable new research connections with basic scientists within the Faculty of Science.
4. **2018: Increase our capability to train the next generation of Canadian research in carbon materials through a NSERC CREATE initiative.** This project revolves around our unique departmental expertise in carbon-based nanomaterials, and will be an industry-based CREATE program, in which academic training must be supplemented by internships at participating companies for at least 20% of trainee time, as well as soft-skill training. From an academic standpoint, it is planned to synergize this CRE-

ATE training initiative with the ongoing efforts at SGPS to launch an interdisciplinary Materials Science graduate program at Western without requiring any additional resources from the existing graduate programs, but capitalizing on the existing course offerings from the participating Departments and institutions. If the CREATE application is successful, it is planned that a specialized training stream in Science and Technology of Carbon Materials will be added to the "generalist" stream of the graduate Materials Science program.

3-5 Year Goals

1. **Leaders in energy-efficient water purification.** Clean water is becoming an increasingly expensive commodity to supply for several municipalities in southern Ontario, with the consequence that many parts of Canada have water of substandard quality. We have the expertise to develop more energy-efficient water-purification systems using recent IP in porous carbon-based materials, and currently there is an effort to create a new spinoff company in the area of graphene-based water purification, capitalizing on this intellectual property.
2. Encourage and support at least 2 new **start-up companies** within 5 years. Our Department has had several of these over the past decades. Response to new opportunities has been rapid and ongoing, including the recent BraiNet spinoff and the above mentioned efforts in advanced carbon-based systems for water purification.
3. **Leadership in Large Programs:** although we have a large number of success stories in the contributions in major Canadian programs we need to in-

crease the number of programs we lead rather than participate in. Our department will encourage and support our investigators to lead and drive major new applications. Leading several large programs is a priority, including leadership in Canadian astronomical projects such as described in the Canadian Astronomical Society (CASCA) long-range plan (pdf) and in the atmospheric sciences leading projects described in the Atmospheric-Related Research in Canadian Universities (ARRCU) planning document. We are also planning to lead and host a major National Centre for Excellence application in MRI systems including application development. The NCE will be coupled with an existing industry partner, Synaptive Medical.

4. **Maintaining infrastructure on the cutting-edge of science.** The reality of having a world-class program in experimental physics is that Department infrastructure has to stay competitive with advances in techniques and services within a reasonable budget envelope. Below we identify strategic areas of infrastructure we will be targeting in the coming decade.

   Acquiring new cutting-edge infrastructure for condensed matter physics and materials science and medical physics (e.g. through CFI proposals) is a vital goal to upgrade and extend the capabilities of our multi-user facilities including Western's Nanofabrication Facility, Interface Science Western, the MRI systems development and testing lab, and the Departmental Machine Shop. Specific infrastructures that are much needed include the following.

   - Interface Science Western requires new ion beam lines at the Tandetron Accelerator to enable us to have the capacity to characterize not only materials but also electronic and energy devices. Offering this

characterization will allow us to establish new partnerships with Canadian industry. Advanced characterization of soft and organic matter with these new ion beam lines will enable new interdisciplinary partnerships with the medical research community.

- Our Nanofab laboratory should replace the existing single-beam ion-beam (FIB) system with a modern dual-beam capability. This replacement is critical to our goals of sample preparation for electron microscopy characterization, and fabrication of advanced nanoprobes for near-field optical imaging.
- MRI systems development and testing lab will continue to grow. New CFI and ORF-RE applications are being planned. The device testing capacity within our ISO-17025 certified labs needs to grow in order to encompass all of the testing requirements for new international standards for device development, and in particular to anticipate testing needs for our industry partners for the coming years.
- We have a world-class machine shop and machinists. This facility gives us an important advantage for our research program, which is heavily experimental. It will be essential to obtain new infrastructure and expertise to maintain and upgrade our existing ultra-high vacuum systems. Investment in new equipment within the Machine Shop will also be needed in order to continue to support the MRI systems development activities.

5. Advancement of the **CAMBR** from status as a Centre to an Institute. As an IDI-funded centre, the Centre for Advanced Materials and Biomaterials Re-

search (CAMBR) has served to cement the Materials and Biomaterials community at Western by supporting interdisciplinary summer student awards, facility user grants, and annual workshops. As it develops into an Institute, CAMBR will be poised to take on more of a role in strategic planning in materials research, such as: facilitating larger collaborative grant proposals (CRC, CFI), continuing to sponsor and promote interdisciplinary materials training (e.g., post-doc funding, as well as undergrads), brokering industrial partnerships (i.e. via NSERC RDS), and raising awareness of Western's work in this area both within the university and in the general community. The aim is to have a body that connects all materials researchers at Western to themselves, to end-users, and to the community.

6. **New facility/capacity for the development and application of magnetoencephalography ("MEG") imaging systems.** This represents an expansion of our current medical imaging research and development capacity and would strengthen research connections with the Brain and Mind Institute, as well as strengthen new industrial connections with existing (Synaptive Medical) and future partners.
7. **Development of a *new* research and development activity in the area of environmental electromagnetics.** Our existing capacity in applied electromagnetics, and particularly in the area of large-scale computer simulation grounded with laboratory validation, will be extended to the study and evaluation of electromagnetic exposure in the environment and health sciences. Partners in this new area could include our colleagues at the Lawson Health Research Institute. Examples include the study of occupational and/or

environmental exposure to low frequency electromagnetic fields (workers in power generation facilities, people living near power distribution lines), and study of acute exposure to high-frequency electromagnetic fields (cell-phone use, ambient wi-fi, bluetooth communications). We anticipate that this R&D activity will have strong industrial connection and will attract industry-sponsored projects and support.

Long-Term Goals (5-10 years)

1. **Construction of a Digital Visualization Theatre (Planetarium).** A challenge of growing proportions and importance in data science is the visualization of (sometimes complex) high-definition big data sets, often with many parameters. Consequently, researchers have developed infrastructure that facilitates visualization such as NASA's Hyperwall. As was pointed out in a recent Nature article, planetariums offer an opportunity second-to-none for researchers to communicate with each other about the scientific visualization of data while being immersed in it, leading to new and otherwise unavailable insight. Planetarium visualization tool kits allow easy adaptation from raw data to immersive visualization, and have been applied to topics as diverse as neuronal activity in the brain, CT/MRI scans, hurricanes, global earthquake prediction models, atmospheric circulation patterns and large scale structure of the Universe. Such a facility would be a boost for the interdisciplinary research done in P&A (and other departments/faculties). Note that a cutting-edge planetarium is lacking in Southern Ontario: Toronto does not have a large planetarium and the nearest other planetarium is a small one at McMaster University. Western could fill this planetarium void and become a na-

tional and international leader in research visualization, with little competition in the province.

In addition to research, a planetarium would also offer a unique training facility in data visualization and science communication, and importantly also double as an impressive outreach and recruitment facility where we can showcase Western's diverse research strengths in spectacular high definition, and thus increase the department's research profile. Operating this facility will stimulate collaboration between scientists from many disciplines with computer scientists, communication professionals and specialists from arts and graphics. This initiative would be part of the broader initiative our Department is leading for a Cronyn Science and Technology center, of which the planetarium would be a part of, and whose mandate would be STEM outreach aimed particularly at primary and secondary students.

2. **Bootstrapping Medical Physics:** Currently, we have a NSERC Industrial Research Chair holder, whose award brings a faculty position to Western in the area of design and fabrication of superconducting magnet systems. This new faculty member will enter into a mature and rapidly expanding "science to shovels" initiative, which started with a faculty member doing basic science and is now time-lined to lead to a new factory in London for the production of MRI systems in the next few years. The new faculty member in the long term may be able to attract an additional IRC in this area, and the Department will encourage and support this initiative.
3. **Astrochemistry of exoplanet atmospheres:** The discovery of extrasolar planets is the most rapidly developing area in astrophysics, and one in which

our Department has an established strength through a CRC. The next frontier in this field is the characterization of the atmospheric chemistry and habitability of exoplanets, to be enabled by the upcoming (2-10 years) generation of space-based and extremely large ground-based telescopes.

4. **Establish a Sample-Return Facility at Western:** to handle materials collected in space. An opportunity which is related to Western becoming a leader in space instrumentation is the opportunity to be the only location in Canada capable of handling material collected from spacecraft which return material to Earth, like the recent Stardust sample-return mission. Canada currently is not able to handle material from sample-return missions, like those anticipated to visit Mars in the next decade. This unique, completely robotically-controlled facility would be sought in collaboration with CPSX and the CSA.

Resources Required

What resources are required to meet our goals?

Resources Required to Research Our Short-Term Goals

1. **Immediate: expand Western's world-class materials science program to include computational materials research.** Pursue **CERC** (Computational Materials Science) to support a computational materials scientist focused on materials design and modelling, specifically related to energy applications, which would complement current strengths in nanofabrication and testing. This would bring 5 faculty hires in related areas (2.5 Eng, 2.5 Science). We envision 1.5 of these positions in P&A, with 1 new condensed

matter hire in P&A related to energy applications plus 0.5-1 in computational materials science.

2. **2018: Space instrumentation and Big Data.** Develop two CRC 150 Proposals, one in *Space Instrumentation* and another in *Astroinformatics/Machine Learning*, which could align with the goals of the CERC. The Faculty of Science is urged to seriously consider putting forward these CRC 150 positions.
3. **2018: The establishment of a new multi-user MRI facility** will require space and renovation resources. Any renovation costs would be covered within the associated CFI proposal (already submitted - 2016). Additional space will need to be identified in order to support this facility.

Resources Required to Reach Our 3-5 Year Goals

1. We need to aggressively support faculty members to lead new *major* national and international initiatives. This support includes, most importantly, relief from Departmental teaching and service commitments, which would have to be taken up in part by other members of the Department.
2. **Leaders in energy-efficient water filtration.** We plan to enable this activity through a major department proposal to the Ontario Research Fund Research-Excellence (ORF-RE).
3. **Leadership in Large Programs:** any appropriate mechanism for this might involve additional IRCs or similar opportunities. Target areas include *Functional Materials*, *Space Instrumentation*, and *Medical Imaging*.
4. **Make sure our infrastructure remains cutting-edge.** Current programs such as those from the Canadian Foundation for Innovation, the ORF,

and NSERC will be targeted for funding. Also, partnering with industry will continue for both cash and in-kind support of these initiatives.

5. Advancement of the **CAMBR** from status as a Centre to an Institute: the Department will play a key role in this initiative. The Department will actively participate in the development of this proposal and teaching relief for a members may be appropriate.
6. The new **NCE** in MRI systems and application development would require administrative space and associated resources. Costs for any associated renovations would be identified within the NCE proposal.
7. New facility/capacity for **MEG** (magneto-encephalography). Initial development of MEG capability is expected to be conducted within existing laboratory space in the department. A CFI application is planned to leverage this activity and expand it to a new level, and that application would have space and renovation resources required. Renovation costs would be anticipated within the application. Space will need to be identified to support this. An NSERC CRD application would be developed along with the CFI, in order to provide operational costs for the R&D activities.
8. The additional new research area of environmental electromagnetics will require space for personnel and associated activities. It is anticipated that new CFI and/or NSERC CRD proposals will be produced to support this research area.

Resources Required to Reach Our Long-Term Goals (5-10 years)

1. **Science Centre and Planetarium.** The construction of a Science and Technology Centre at Cronyn Observatory, including a planetarium, is a ma-

jor infrastructure project. We have begun discussions with the relevant players at Western; our current status is given in the Appendix.

2. **Bootstrapping Medical Physics:** Our current NSERC Industrial Research Chair brings a faculty position to Western in the area of building superconducting magnetics. We anticipate that within 10 years, the new hire will themselves be successful in attracting an NSERC IRC, and with that another associated new position. To support this goal, the Department will require the resources to support the future hire, including associated laboratory space and startup costs.
3. **Astrochemistry of exoplanet atmospheres:** We will leverage Canada's leading role in the Thirty Metre Telescope project, and our nearer-term space instrumentation initiative, to establish Western and the CPSX as a world-leading centre for exoplanet atmospheric research.
4. **Establish a Sample-Return Facility at Western:** We have already put considerable effort into the design of such a facility and envision a unique, completely robotically-controlled facility. This initiative will be sought in collaboration with CPSX and the Canadian Space Agency.

Summary

The recent report Investing In Canada's Future: Strengthening the Foundations of Canadian Research (the "Naylor report") states under *A Case for Scientific Inquiry*:

> ... Research is essential to the health, prosperity, and security of Canadians and to our efforts to foster a creative, inclusive, and vibrant society. Our universities, colleges, and research institutions are responsible for providing the right environment and tools not only to perform this research at the highest levels of excel-

lence, but also to inspire, teach, and shape each new generation of students through research-led education.

Our Department differentiates itself not just by its expertise in materials science, medical physics, astrophysics, and geophysics, but in its ability to combine its skills in these areas to address big questions like the study of the cosmos from galaxies to atmospheres and manipulation of molecules to develop new materials for medical applications. We are strongly positioned to train students desiring a STEM education and to link this education to the world beyond university.

Appendix

Detailed Overview of the Department

The Department of Physics and Astronomy at Western has 31 primary faculty and more than 50 graduate students. Another 20 faculty are involved in teaching and/or supervision of students in our graduate program. We also have 6 emeriti professors with membership in SGPS, most of whom are supervising students. Our department teaches over 2300 undergraduates per year, the highest number in the Faculty of Science. Students obtain degrees in programs including physics, medical physics, and astronomy/astrophysics.

We are housed in the Physics and Astronomy Building (PAB), which is the second-oldest building on Campus, dating from 1924. The building has recently been completely renovated. We now have more efficient use of available space, a better organization of the building, and more and better research space. Most importantly, the building is designed in a way that encourages collaboration and communication among all members of the Department. From a practical perspective, building services have been mod-

ernized and upgraded, and all of the exterior windows replaced. The new laboratory spaces were designed in consultation with the faculty and staff members who use the space.

Research and Scholarly Development Facilities

In the summer of 2009 our first-year labs moved out of PAB and into the Materials Science Addition (MSA). Our labs occupy one floor of this new building, while the Chemistry first-year labs and Chemistry research labs occupy the other three floors. As with the PAB renovations, members of the Department were heavily involved in the design of the new labs from the outset, and we are very happy with the result.

Several faculty have additional research facilities off-campus. Brown operates an array of cameras, radars, and infrasound detectors for meteor detection. Hocking operates a network of radar systems around the world for making measurements of atmospheric dynamics. Sica is involved in the Polar Environment Research Laboratory, located in Eureka, Nunavut. In 2010 the Faculty of Science helped move Sica's London lidar facility (the Purple Crow Lidar) from the now-closed Delaware Observatory to the Western's Environmental Sciences Facility. Research facilities at Western that are available to members of the Department include the Nanofabrication Laboratory, a well-equipped user facility operated by the Faculty of Science and housed in the Physics and Astronomy Building. Surface Science Western is an independent research facility within the Faculty of Science, currently located in the Western Science Center. The Western Science Center also houses a Tandetron accelerator that is used for ion-beam research. Western is a node of SharcNet, a high-performance computing facility that is used by several of our faculty. Individual researchers in the Department of course have their own facilities and equipment, much of which is made available to other researchers on request.

The department has a fully equipped machine shop staffed by two highly skilled machinists, plus a student shop that can be used by faculty, staff, and students. We also have a wood shop, and departmental staff provide electronics and computer support.

External Infrastructure

The Elginfield Observatory

The Elginfield Observatory is located 30 min North of campus near the town of Lucan. It consists of a 1.22m telescope housed in an Observatory building with a 15m dome, an observers house and surrounding land, mainly wooded. The telescope was used extensively form the founding of the Observatory in 1968/1969 until 2010 when telescope operations ceased. The facility (but not the Observatory) continues to be used mainly by the Physics and Astronomy department, principally by the Meteor Physics Group (Brown, Campbell-Brown and Wiegert). Other departments in the Faculty of Science also use the Observatory grounds, such as Earth Sciences (for seismic work) and Biology (field studies of plants and animals). The Faculty of Engineering has used the facility for rover testing and field testing of the Engineering Baja vehicles while the Department of Psychology uses the grounds for bird studies. A unique aspect of the Observatory building is the Coude room, which is a large, climate-controlled space.

In the immediate future, three additional robotic observatories are planned to be built at Elginfield as part of a CFI project led by S. Metchev. Other existing robotic and/or automated camera systems deployed by the Meteor Physics Group consist of the Canadian Automated Meteor Observatory, all-sky video cameras of the Southern Ontario Meteor Network and testbed cameras from the Australian Desert Fireball network and NASA Meteoroid Environment Office. Together with ongoing remote and in-situ

rover testing led by Earth Sciences and Engineering, Elginfield has become a focus for operations and testing for robotic and autonomous systems.

We propose to update, upgrade and re-orient the facility to capitalize on its unique character as a field site for testing of advanced and autonomous robotic systems. This update would include updating and replacing obsolete user facilities (such as wash-rooms and offices) to more easily permit on-site use and update infrastructure (such as internet and wifi connectivity) to permit teleoperations. Remote monitoring and security plus a dedicated outdoor area for testing (like a Mars yard) and a separate building for storage are sought. We expect partners in this activity would include industry, the Canadian Space Agency and NSERC.

The Cronyn Observatory

The Hume Cronyn Memorial Observatory is currently the focal point for astronomy activities in the greater London community. It is used intensively year-round for astronomy outreach, teaching and training programs that currently host about 6,000 (and increasing) visitors per year, mostly young people. However, the Cronyn Observatory is one of the oldest buildings on campus, and its aging infrastructure makes it increasingly harder to offer our visitors an experience that matches present-day expectations, even in terms of fairly basic needs (e.g. accessibility, basic climate control, decent sanitary provisions, water fountains, etc.). Renovations to bring the Observatory into the 21st century are a necessity for fulfilling Western's goals for public outreach.

We propose to upgrade and expand the Hume Cronyn Memorial Observatory to become a modern, accessible, high-tech, hands-on STEM Centre for Interactive Learning with a state-of-the-art Digital Visualization Theatre (Planetarium). This facility will be a self-sufficient hub for Science Education and Outreach in Southwestern Ontario

that can adequately respond to the enormous and increasing demand for hands-on activities in the STEM fields, with a market of over 400,000 school kids between Windsor and Hamilton alone. Planetariums moreover offer an opportunity second-to-none for *researchers* to communicate with each other about the data while being immersed in it, leading to new and otherwise unavailable scientific insight.

A planetarium with a focus as a STEM Centre for Interactive Learning would boost Western's highly interdisciplinary research, differentiating the Physics and Astronomy Department by providing a facility second-to-none for data visualization and peer-to-peer scientific communication. It would also be a unique recruitment and outreach facility, where we can showcase the Department's (as well as Western's) diverse research strengths and inspire the next generation of scientists.

Environmental Sciences Western Field Station

Environmental Sciences Western is a Faculty of Science field station located approximately 20 minutes from the Physics & Astronomy Building. Environmental research is conducted by groups from departments in the Faculty of Science including Biology, Earth Sciences, and Physics and Astronomy, along with researchers from the Faculty of Engineering and Agriculture and Agri-Food Canada. Primary Department users are W. Hocking, who has a radar system (CLOVAR) for measuring atmospheric winds and R. Sica who has a lidar system (laser radar) which measures composition, temperature, and aerosols.