

The Pacific Institute for the Mathematical Sciences

Background

The Pacific Institute for the Mathematical Sciences (PIMS) was founded in 1996 by a consortium of five universities in Alberta and British Columbia (the University of Alberta, the University of Calgary, the University of British Columbia, Simon Fraser University and the University of Victoria). These were later joined by the University of Washington (USA) and more recently by the University of Regina and the University of Saskatchewan. The current PIMS institutional membership is 8 full members, 3 affiliate members, and 11 educational associates.

The mandate of PIMS is to promote research and applications of the mathematical sciences of the highest international caliber; facilitate the training of highly-qualified personnel at the graduate and postdoctoral level; enrich public awareness of mathematics through outreach; enhance the mathematical training of teachers and students in K-12; and create mathematical partnerships with similar organizations in other countries, with a particular focus on Latin America and the Pacific Rim.

PIMS is unique in several ways, most fundamentally because of its distributed structure. The institute has a site at each of eight major universities in Alberta, British Columbia, Saskatchewan and Washington State. PIMS events are organized at each of these sites, and PIMS researchers are distributed throughout the network. PIMS receives funding from NSERC, the member universities and the provincial governments. Its international events are co-sponsored by funding agencies such as the US National Science Foundation and by international partner institutions.

The central offices and the Director and Deputy Director are at UBC, and there is a PIMS site office and a site director at each of the other seven sites. The role of the site directors is to catalyze local activities and develop synergies, while the PIMS site offices provide administrative assistance for organizing PIMS events locally. PIMS is overseen by a Board of Directors, with membership consisting of the VP Research from each of the member universities, as well as distinguished scientists and representatives from industry. Scientific events are adjudicated by an independent Scientific Review Panel composed of internationally renowned mathematical scientists. For more information about PIMS please see <http://www.pims.math.ca>

As part of its national mandate PIMS works closely with CRM and Fields to support initiatives and help organize events throughout the country. Together the three mathematical institutes in Canada, created major national programs such as MITACS (Mathematics of Information Technology and Complex Systems) and AARMS (Atlantic Association for Research in the Mathematical Sciences). Together with MSRI in Berkeley, it founded BIRS, which is now the premier mathematical research station in North America. The CRM-Fields-PIMS Prize is the most prestigious mathematics award in Canada. Jointly sponsored events include all the regular meetings by the Canadian professional societies CMS, CAIMS and SSC, the CANADAM and CNTA conferences, the initiative on Mathematics of Planet Earth for 2013, and the Seminaire de Mathematiques Superieures in Montreal.

The Impact of PIMS

Since its inception and growth, PIMS has changed the face of research, education, and training of HQP in Canada in the following ways.

- *Leveraged funding:* The PIMS annual budget is approximately \$3.5 million, of which \$1.1 million, i.e. approximately 1/3, is direct funding from NSERC. These funds support the various programs described below. Since PIMS funding of a program is often matched by other sources, the \$3.5 million is further leveraged. Estimates of the total leverage of direct NSERC funding are in the range of 4:1 – 5:1. Provincial funding to PIMS give a very significant added boost to the training of HQP at the PIMS sites, which is particularly significant for researchers with smaller grants and/or junior faculty.
- *Facilitating initiatives:* PIMS programs involve many research activities and initiatives that can only be accomplished at the Institute level. Putting it another way, PIMS enables programmatic activities in the mathematical sciences that are either difficult or impossible to fund through regular NSERC grants. Examples include the Collaborative Research Groups (CRG) and the International Graduate Training Centre in Mathematical Biology (IGTC), both described in more detail below.
- *Supporting aligned fields:* Both pure and applied mathematics are central to many aligned fields, notably Computer Science, Statistics, Physics, and the Engineering and Earth Sciences. PIMS is ecumenical in this regard, and provides funding for research in these fields as well as in the core mathematical sciences.
- *Training of HQP:* A central component of many PIMS programs is the training of HQPs at all levels from MS, through PhD to Postdoctoral Fellows. Between 2006 and 2011, a total of approximately 30 graduate students and 100 postdoctoral fellows have been supported by PIMS.
- *Serving Canada and maintaining critical mass:* PIMS funding is available to all the PIMS member institutions, including smaller ones and those with emerging programs. PIMS programs facilitate networking and engagement in research at the highest level at institutions where the smaller faculty size in a given area makes it difficult to maintain critical mass. This is accomplished through the CRGs, the IGTC, distinguished visitors programs, and postdoctoral fellowships.
- *Global networking:* PIMS is affiliated with CNRS, the French national agency for scientific research, as an *Unité Mixte Internationale*, resulting in 3-5 yearly visitors from France. This is a special mark of distinction, as there are very few institutions in the world enjoying this relationship with the CNRS. PIMS has also built close partnerships with mathematical institutes in Latin America, and was instrumental in creating the Pacific Rim Mathematical Association (PRIMA), a network of mathematical institutes in the region.

Programmatic Overview

PIMS has built an international reputation for excellence and has helped transform the level of mathematical research in Canada. All PIMS programs and support are adjudicated by peer review, either by the Scientific Review Panel of international experts or by the Postdoctoral Fellows Panel. The following is a partial list of current scientific activities:

(1) PIMS *Collaborative Research Groups* develop permanent research and training networks, establishing interdisciplinary links between geographically separate groups of researchers at member universities that often outlast the period of direct funding. PIMS has developed 23 CRGs since its inception, in areas ranging across all the mathematical sciences. This has served as a catalyst for producing mathematical research of the highest quality in Canada and attracting outstanding faculty to PIMS universities. The CRGs organize extensive international thematic activities at the different sites, particularly during the summer.

(2) PIMS funds approximately 25 *Postdoctoral Fellows* annually, allowing Canada to compete effectively in the North American venue. Postdoctoral Fellows are distributed throughout the PIMS sites. Nominations are made by sponsoring faculty and appointments are made through peer review. We attract outstanding young scientists who contribute to PIMS research programs, some of whom later become faculty members at leading Canadian and international universities.

(3) PIMS supports the *International Graduate Training Centre in Mathematical Biology*, an innovative interdisciplinary graduate training program focused on strategic topics of current interest (such as the mathematical modeling of ecosystems and of the spread of disease). Highlights of the program include (i) an annual research summit, where all IGTC students present research and network with their counterparts at other PIMS sites, (ii) research visits where an IGTC student will visit an aligned research group at a different institution, and (iii) high-level graduate courses taught remotely through video technology. Students at PIMS universities obtain common course credits through the Western Deans' protocol.

(4) PIMS organizes international workshops, summer schools and lecture series to train the new generation of mathematical scientists in a broad spectrum of the mathematical sciences: recent topics include number theory, topology, geometric analysis, probability, non-commutative geometry, string theory, quantum computing, math biology, networks, seismic imaging, atmospheric modeling, and environmetrics. In 2010 there were over 60 events sponsored by PIMS involving over 2700 attendees. Of these, 77% were academics, 17% industrial researchers, with smaller percentages of teachers and others. Of the academics, 34% were professors, 10% postdoctoral fellows, 45% graduate students, with smaller percentages of undergraduates and others. Of the attendees, 64% were from Canada, 20% from the rest of North America, and 16% from other parts of the world.

(5) PIMS awards two important scientific prizes every year: the CRM-Fields-PIMS Prize, intended to be the premier award for mathematical research in Canada, and the CAIMS-PIMS Early Career Award, intended for outstanding young applied mathematicians.

(6) PIMS has an active program in industrial and applied mathematics, and runs the *Industrial Problem Solving Workshop* for students, faculty and industry. PIMS has developed focused industrial programs in areas of strategic interest, such as a project on the mathematics of oil exploration based in Calgary. PIMS has also partnered with the IMA in the US and CIMAT in Mexico to organize North American mathematical modeling workshops.

(7) PIMS has an active and highly regarded *Educational Program* that promotes mathematical outreach events in schools throughout Western Canada. These involve students, teachers and parents and seek to convey the excitement of discovery learning that underlies mathematics and its applications. Signature events sponsored by PIMS include *Math Mania* (in Vancouver and Victoria), *Math Camps* (in Alberta and BC), *Taste of Pi* (at SFU), *ELMACON* (at UBC), *Math on the Move* (Saskatchewan), *Math Central* (U.Regina), *Alberta Summer Math Institute* (for talented high school students) as well as a number of math fairs and related activities. The PIMS Education Prize is awarded each year to an exceptional mathematical educator in Western Canada. The outreach magazine *Pi in the Sky* is distributed to thousands of teachers and students throughout the world. PIMS has also developed a partnership with First Nations schools in British Columbia, supported by the provincial and federal governments as well as private donors. The activities under this program include: summer camps for Aboriginal students, teacher-training sessions and mentorship programs involving undergraduate students.