

## **Australia-Japan Geometry, Analysis and their Applications**

**University of Adelaide  
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Global analysis relies on combining ideas from the complementary areas of geometry and analysis. This workshop brought together researchers from Australia and Japan with interests in these areas with the aim of building capacity both in interdisciplinary pure research and in applications.

### **Report**

The Australia-Japan Geometry Analysis and their Applications workshop gathered a diverse group of mathematicians primarily from Australia and Japan in Adelaide to build research links in the area of geometry and analysis.

Geometry and analysis are highly complementary fields of inquiry. Geometrical information is vital to performing analysis on manifolds, such as studying the long-time solutions to evolution equations. These evolution equations can then be used to analyse the behaviour of solutions to related linear and non-linear PDE. On the other hand, techniques from analysis often prove useful in geometry. For example geometric considerations in gauge theory can be characterised by non-linear PDE.

The workshop kicked off with a pair of morning talks by eminent mathematicians — Mikio Furuta from the University of Tokyo and Peter Bouwknegt from the Australian National University. Furuta discussed inequalities in Topological Quantum Field Theory. Bouwknegt introduced the audience to the idea of T-duality as a geometric version of harmonic analysis.

The next four days were full days of talks that alternated between Japanese and Australian speakers, on topics ranging from geometry and topology, analysis and differential equations, operator algebras, and mathematical physics. All speakers made significant efforts to frame their talks in a way that could be understood by a wide range of mathematicians with backgrounds in geometry and analysis. This effort meant that participants of the workshop were able to appreciate the research and results from other areas.

Due to the diverse backgrounds of the participants an important part of this workshop was the open problem session that provided an informal forum for participants to get to know the areas represented. We began with a round of introductions, so that everyone got an idea of each other's backgrounds and interests. There were several short presentations on open problems, which the participants had

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encountered in their research. The hope was to get others interested in these unsolved problems, and to share some ideas for solving them. This turned out to be a very successful session with discussions on a problem presented by Guo Chuan Thiang leading to progress in his problem that has subsequently been published on arxiv (<http://arxiv.org/abs/1510.04785>).

### Organising Committee

- Dr Melissa Tacy (University of Adelaide) (Chair)
- Dr David Baraglia (University of Adelaide)
- Professor Alan Carey (Australian National University)
- Professor Tsuyoshi Kato (Kyoto University)
- Dr Guo Chuan Thiang (University of Adelaide)
- Professor Mathai Varghese (University of Adelaide)

### Organisers' opinion of success

Overall the organisers were very pleased with the success of this workshop. Given the wide range of backgrounds among the participants one of the primary challenges for this workshop was to ensure that ideas were communicated across these fields. That this was successfully achieved was in no small part due to the hard work put in by our speakers to make their talks accessible to wider audiences than a usual disciplinary conference. Their efforts were greatly appreciated. A number of participants commented, in the evaluation forms, on the quality of the talks. The open problem session was well attended and the attendees participated actively.

On the organisational side we were also very pleased with how the social program interacted with the mathematical one, in particular the icebreaker and the conference dinner. The icebreaker was held at lunch on the first day directly before the open problem session. This event achieved its objective which was to break down the barriers between participants, many of whom did not already know each other, before the open problem session. This led to the atmosphere at the open problem session being relaxed and informal which contributed in large part to its success. The workshop dinner was held at the Riverside Restaurant at InterContinental Adelaide, and was attended by Adelaide's Deputy Vice Chancellor (Research) who gave the after-dinner speech. In addition to celebrating the workshop and the links between Australian and Japanese mathematics, the dinner was also an occasion to celebrate the 70th birthday of Oxford mathematician and long-time Adelaide visitor Dr Keith Hannabuss.

Given the low number of women in the fields represented and in Australian mathematics in general we felt that we successfully attracted a representative number of women to the workshop. To improve the numbers of female participants at this and similar event would require significant improvement at a higher level of the number of women involved in mathematics in Australia.

### Program

The program can still be found at <http://www.iga.adelaide.edu.au/workshops/WorkshopOct2015/schedule.html>