AMSI

AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

## Mission Statement

The radical improvement of mathematical sciences capacity and capability in the Australian community through:

- the support of high quality mathematics education for all young Australians
- improving the supply of mathematically well-prepared students entering tertiary education by direct involvement with schools
- the support of mathematical sciences research and its applications including cross-disciplinary areas and public and private sectors
- the enhancement of the undergraduate and postgraduate experience of students in the mathematical sciences and related disciplines

# Track Record 2014

Higher Education
Australian Mathematical Sciences Institute

# The 9th annual AMSI Winter School

## Contemporary Aspects of Cryptography

7–18 July 2014
University of Queensland

Cryptography is the practice and study of techniques for secure communication in the presence of third parties; that is, making codes and breaking codes.

Historically, cryptography has effectively been synonymous with encryption and decryption. Modern cryptography involves sometimes surprising intersections of mathematics, computer science, and electrical engineering.

- **Discover** contemporary cryptography and its modern applications
- **Hear** from eminent national and international lecturers
- **Learn** mathematical tools and techniques used in research in cryptography
- **Understand** key aspects of current research in cryptography
- **Uncover** the link with mathematics, computer science and electrical engineering Build collaborative networks with other PhD students and early career researchers
- **Expand** your skills in the mathematical sciences

**Full travel and accommodation scholarships available!**

AMSI Australian Mathematical Sciences Institute · Australian Government Department of Education · The University Of Queensland Australia

**Apply today: www.amsi.org.au/WS**

---

AMSI
Australian Mathematical Sciences Institute

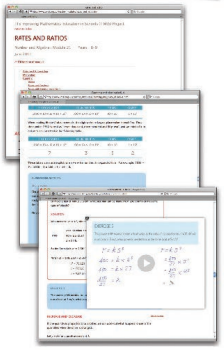
## Professional Development for Teachers of Mathematics

- **Free online resource for teachers**
- **Over 60 mathematics topics from the Australian Curriculum**
- **Written to support teachers in their teaching of mathematics.**

The modules are organised under the strand titles of the Foundation to Year 10 Australian Curriculum

- Number and Algebra
- Measurement and Geometry
- Statistics and Probability

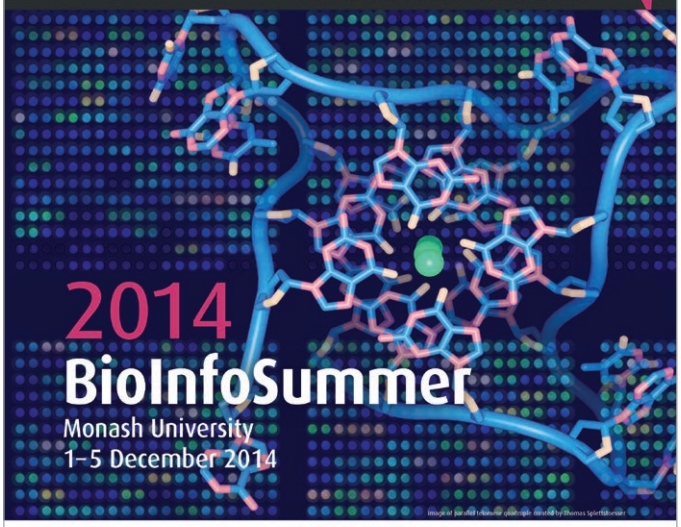
These teacher guides were produced as part of The Improving Mathematics Education in Schools (TIMES) Project 2009–2011, funded by the Australian Government Department of Education, Employment and Workplace Relations.



**Available online at**
**www.amsi.org.au/teachermodules**
They are also available through Scootle: www.scootle.edu.au/ec/p/home

---

Research & Higher Education
Australian Mathematical Sciences Institute



# 2014 BioInfoSummer

Monash University
1–5 December 2014

Bioinformatics is an exciting, fast-moving area analysing and simulating the structures and processes of biological systems. BioInfoSummer introduces students, researchers and others working in related areas to the discipline.

**The program features:**
- Introduction to molecular biosciences and bioinformatics
- Next-generation DNA sequencing and sequence evolution
- High-throughput technology and omics data analysis
- Methods in bioinformatics
- Systems biology

AMSI Australian Mathematical Sciences Institute · Australian Government Department of Education · Monash University · EMBL Australia · AMSIIntern · maxima · Maths of Planet Earth

**Register now: www.amsi.org.au/BIS**

---

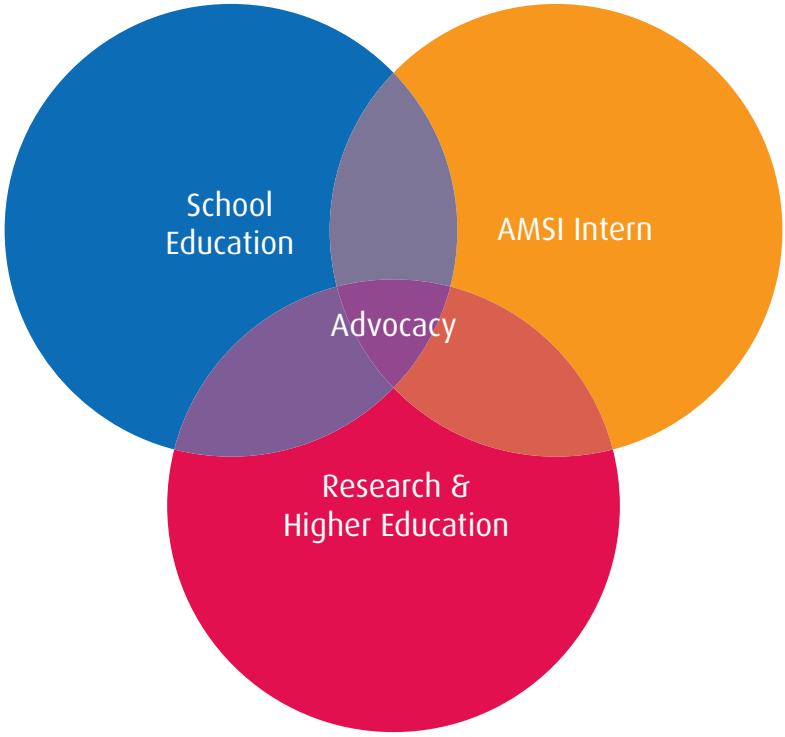
Post Graduate Internships
Build a better, faster future

# Post graduates.... are you ready to take the next step?

Be an AMSIIntern
4–5 months paid industry experience
available at www.AMSIIntern.org.au

AMSIIntern

An Innovative University and Industry Collaboration




# Foreword

## AMSI is Australia's mathematical sciences institute. It is the collaborative venture of the nation's universities, professional societies and government agencies.

AMSI is an important central voice for the mathematical sciences in Australia, facilitating effective communication within the community, successfully advocating for substantially increased government funding and establishing a program of activities that has created significant benefits, both tangible and intangible, for Australia's professional and aspiring mathematical scientists. AMSI has provided initiative and support for activities across research, education and industry.

Access to AMSI activities brings immediate benefits to members in mathematical sciences departments and agencies. This applies especially to early career researchers, postgraduate and honours students, including those from cognate disciplines. AMSI provides members with support for cross-disciplinary research.

AMSI provides an effective and efficient way of delivering mathematical and statistical capability to research, education and industry. It does this in a way that seeks to integrate research, education and industry involvement and to provide a strong base for national innovation.

Above all, AMSI is a unique collaborative venture that provides members with the structure and support that no individual entity alone could provide. It is vitally important for the mathematical sciences in Australia that AMSI continues and expands. This document provides a firm and persuasive case for the ongoing support of its member institutions, agencies and societies.

Prof. Geoff Prince
Director

Dr Ron Sandland
Chair, AMSI Board

# Benefits of AMSI membership

AMSI's efforts are both concerted and economical. AMSI is critically dependent upon the support of its member institutions. Without this support, both financial and via active participation in AMSI's enterprise, the institute would not be able to provide its many services that are of direct benefit to the mathematical sciences.

Benefits to members include:

- Facilitation of **national communication** among the mathematical and statistical community, including ACHMS, AustMS and SSAI.
- **Engagement** with the advocacy agenda including negotiations around the structure of a bid for a research institute and future positioning in the mathematical sciences.
- Support of **research activity** through sponsorship. These include workshops, sponsored lectures, and higher education activities such as the AMSI Summer School, Winter School, Vacation Research Scholarships and BioInfoSummer.
- AMSI's **educational activities** are first class and wide-ranging. Many universities are pressed to contribute to educational initiatives. Having AMSI to direct, facilitate and identify these activities contributes to the fulfillment of the missions of university mathematics departments.
- Facilitation of **research collaborations** with industry through AMSI's internship program, increasing the work-readiness of member universities' PhD cohort.

University Members of AMSI receive a number of direct benefits:

- Workshop funding
- Travel support
- Access to AMSI's internship program
- Maths Ad(d)s and career materials
- Vacation Research Scholarships
- Places in the AMSI Summer and Winter Schools

**Full members** of AMSI are signatories to the Joint Venture Agreement which forms the basis of AMSI's structure and governance. In addition to the above, Full Members also get:

- Priority offer to host the AMSI Summer School and BioInfoSummer
- Priority offer of AMSI Intern bundling offers
- Increased travel allowance
- Input and sign off on the AMSI Business Plan

Government agency, Society and Corporate member benefits are negotiated, and can include provision of short courses, discounted conference and event registration, advertising at AMSI events and in Maths Ad(d)s, and hosting of workshops.

## Members of AMSI

### Full Members *(Joint Venture Partners)*

The Australian National University
La Trobe University
Monash University
RMIT University
The University of Adelaide
The University of Melbourne
The University of New South Wales
The University of Newcastle
The University of Queensland
The University of Sydney
The University of Western Australia

### Associate Members—*Universities*

Charles Sturt University
Curtin University of Technology
Deakin University
Flinders University
Griffith University
James Cook University
Macquarie University
Queensland University of Technology
Swinburne University
The University of Ballarat
The University of Canberra
The University of New England
University of South Australia
University of Southern Queensland
University of Tasmania
University of Technology Sydney
University of Western Sydney
University of Wollongong

### Associate Members—*Societies & Government Agencies*

Australian Bureau of Statistics
Australian Mathematics Trust
Australian Mathematical Society
Australia and New Zealand Industrial and Applied Mathematics
Bureau of Meteorology
CSIRO
Defence Science & Technology Organisation

### AMSI is a member of:

- Australian Mathematical Society (institutional membership)
- Australasian Industrial Research Group (affiliate membership)
- Science and Technology Australia (affiliate membership)
- Australian Science Communicators (corporate membership)

# Performance Summary

AMSI has made, and continues to make, a significant contribution to furthering the interests of the mathematical sciences in Australia. The initiatives and programs outlined in this document are important parts of an overall strategy to enhance the standing and health of mathematics and statistics across the community. We strive to improve the appreciation of policy makers and politicians of the importance of mathematics in a sophisticated economy and community. We continue to make tangible improvements in mathematics education in schools, to equip future generations of Australians with the mathematical literacy and skill base we need, and to guarantee the health of our own and many other related disciplines.

We all reap the benefits of the investment of our members' subscriptions and corporate contributions.

Whilst AMSI has achieved much in its past twelve years, long-term success only comes with sustained effort and it is vitally important that AMSI's work be continued and expanded into the future. A key part of AMSI's ability to leverage its current activities and attract government and industry support comes from the widespread support of its member institutions. We trust that this document identifies the benefits and necessity of a strong AMSI and provides a firm and persuasive case for the ongoing support of its member institutions.

## Key achievements

- **Dynamic advocacy** of the strengths, importance and vital benefits of mathematics and statistics to journalists, university administrators, politicians, public servants and industrialists
- **$17.9M** in government funding and **$5.4M** in commercial revenues and corporate sponsorships generated by **$7.3M** in member subscriptions
- **1558** honours and postgraduate students attended **13** summer schools
- **Over 211** scientific workshops sponsored by AMSI and AMSI/MASCOS
- **372** undergraduate Vacation Research Scholarships
- Leader of the Australian effort for **Mathematics of Planet Earth 2013** in partnership with **16** organisations
- **$750k** invested in a network of Access Grid Rooms in **11** Australian university mathematics & statistics departments
- **87 AMSI internship agreements** since 2008, between member universities and business, industry and government partners with **45%** repeat business
- Partnership with **Enterprise Connect** to place PhD interns over 3 years from 2010-2013
- **Professional Development program** delivered to mathematics teachers in **54** schools nationally
- Over **150,000 ICE-EM Mathematics textbooks** in Australian schools
- 5-year licensing agreement with **Cambridge University Press** to publish the ICE-EM Mathematics Australian Curriculum Edition
- **53% increase in cluster funding** for mathematics and statistics ($17M extra in 2008)
- Established international linkages with **PIMS**, **MITACS** and **AARMS**
- Over **278** international and national distinguished mathematicians sponsored to speak at Australian conferences
- Winner of the 2008 Fast Thinking-Open Universities **Innovation Award for Science**

# Publicity and Advocacy

Dynamic advocacy of the strategic importance, strengths and vital benefits of Australian mathematical sciences is implicit in AMSI's mission. The monetary value of AMSI's contributions to strategic advocacy and communication is substantial and has been indispensable. AMSI will continue with these activities, but the breadth and quality of its services will depend on continued funding from various sources, including membership subscriptions.


## Mathematics of Planet Earth 2013

AMSI partnered with societies and organisations around Australia to promote the role of mathematics and statistics in understanding the challenges of our world. This theme ran throughout 2013, with a major conference, dedicated website, and a variety of other activities to engage a wide audience. See feature on pages 8&9

**www.mathsofplanetearth.org.au**

## Accelerate Australia

Held in February 2013, Accelerate Australia aimed to raise awareness of issues relating to productivity, industry engagement and work-readiness of PhD students in a research-based economy. The event featured a showcase of some exciting past internship projects. Professor Arvind Gupta, CEO and Scientific Director of Mitacs delivered the keynote address.

**www.amsiintern.org.au/accelerate-australia**


## Maths for the future: Keep Australia competitive

This forum, held in February 2012, aimed to publicise both the state of the discipline and its importance to national productivity growth. With an impressive line-up of speakers and extensive media coverage, our discipline's voice was heard loud and clear at a time when policymakers were keen to listen.

**www.amsi.org.au/mathsforthefuture.php**

## Government and Policy

AMSI is recognised as a central voice on issues related to mathematics education, research and workforce supply through written submissions to parliamentary inquiries and attendance at parliamentary hearings. AMSI has been heavily engaged with the Research Workforce Strategy project undertaken by DIISR, and is in regular contact with the Chief Scientist for Australia.

**www.amsi.org.au/publications/amsi-publications**

# Publicity and Advocacy

## National Partnerships and Discipline Support

AMSI partners with CSIRO and the Australian Bureau of Statistics in a number of programs, including Mathematics and Statistics by Email and Mathematics of Planet Earth. AMSI also works with the Bureau of Meteorology, the Australian Mathematical Society, Defence Science and Technology Organisation and the Statistical Society of Australia Inc.

AMSI currently lends support to the National Committee for the Mathematical Sciences' decadal plan and supports the annual meeting of the Australian Council of Heads of Mathematical Sciences (ACHMS), which comprises representatives from all Australian mathematical sciences departments and societies, as well as government agencies and research groups.

CSIRO

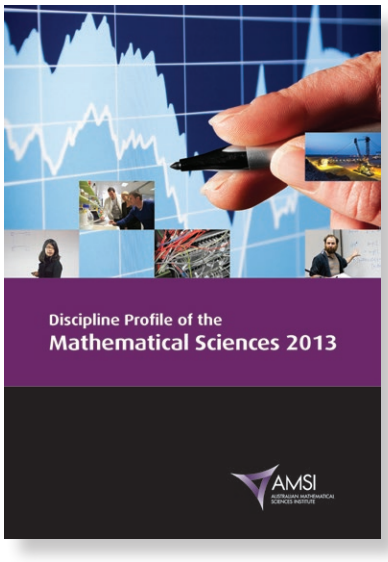
Australian Government
Bureau of Meteorology

Aust MS
Australian Mathematical Society

SSAI
Statistical Society of Australia Inc.

## Public Engagement

AMSI brings mathematics awareness to the Australian community in a number of ways. Public lectures by distinguished speakers are held in conjunction with AMSI's flagship events, conferences and sponsored workshops. AMSI also engages with a broad audience through its social media channels (Facebook and Twitter).




## Discipline Profile of the Mathematical Sciences

The Discipline Profile of the Mathematical Sciences is an annual publication which highlights trends and developments in school education, higher education, research, research training and career prospects in the mathematical sciences. The Discipline profile will be in its third year of publication in 2014 and is available for download from the AMSI website www.amsi.org.au.

## International Linkages

AMSI has strong links with MITACS, which operates a highly successful intern program in Canada. AMSI is a founding member of the Pacific Rim Mathematical Association (PRIMA) and also has links with the Pacific Institute for Mathematical Sciences (PIMS). AMSI maintains strong links with prominent overseas mathematicians involved in school mathematics.

# Our story so far...

**2002:** AMSI established through a $1M grant from the Victorian Government's Science, Technology and Innovation infrastructure grants program.

**2003:** AMSI was a collaborating partner and significant influence in the set up of the Centre of Excellence for Mathematics & Statistics of Complex Systems (MASCOS). Out of an Australian Government grant of $10.9M, $2.2M was jointly administered by AMSI/MASCOS.

**2003:** $7.8M from the Department of Education, Science and Training established the International Centre of Excellence for Education in Mathematics (ICE-EM). This funding supported a range of initiatives aimed at "strengthening education in the discipline of mathematics and its contemporary applications".

**2005:** $750k funding provided through ICE-EM for the installation of Access Grid Rooms in 11 member universities.

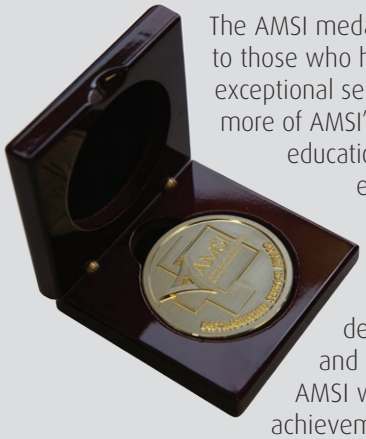
**2006:** AMSI supported the Australian Academy of Science's National Strategic Review of the Mathematical Sciences in Australia.

**2007:** AMSI awarded a $2M Collaborative and Structural Reform (CASR) grant that funded a number of flagship programs in Higher Education, including the Summer and Graduate Schools, and also funded industry collaboration through workshops and the establishment of the internship program.

**2008:** The Carrick Institute of Learning and Teaching (now the Australian Learning and Teaching Council) provided $100k for the year-long project *Mathematics for 21st Century Engineering Students.*

2002 2003 2004 2005 2006 2007 2008

## AMSI Medal for Distinguished Service



The AMSI medal for Distinguished Service is awarded to those who have demonstrated both sustained and exceptional service to AMSI and leadership in one or more of AMSI's portfolio areas of research and higher education, school education and industry engagement or in advocacy for the broad discipline.

The Australian mathematical sciences community owes a considerable debt of gratitude to these far-sighted and dedicated individuals. Without them AMSI would not have its track record of achievement and influence.


Dr Jim Lewis

Professor Garth Gaudry

**2009:** AMSI awarded a $2M grant from the Department of Education, Employment and Workplace Relations (DEEWR) for The Improving Mathematics in Schools (TIMES) project, ICE-EM schools materials, teacher development and careers in mathematics awareness programs.

**2010:** Wide-ranging, transparent, external review of AMSI undertaken. This review led to the revision of AMSI's mission statement and expansion of its Board.

**2012:** AMSI held the national forum *Maths for the future: Keep Australia competitive.*

**2012:** AMSI awarded $750k contract from Education Services Australia to develop electronic resources to support the senior national curriculum for Australia.

**2013:** AMSI leads the Australian effort for the International Year of Mathematics of Planet Earth.

**2013:** AMSI Intern a supplier for the Victorian Department of State Development, Business and Innovation voucher program.

2009 2010 2011 2012 2013 2014

**2010:** Expansion of AMSI's internship program through a $1.7M 3-year partnership with Enterprise Connect, an initiative of the Department of Innovation, Industry, Science and Research (DIISR) allowing the placement of PhD interns over three years.

**2011:** Dr Jim Lewis steps down as Chair of the AMSI Board. Dr Ron Sandland AM picks up the torch.

**2011:** ICE-EM Mathematics textbooks enter their second edition and are distributed through Cambridge University Press.

**2012:** AMSI's Research and Higher Education flagship programs boosted with $2M from the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE – now Department of Education), enabling expansion of the Summer and Winter Schools, Vacation Research Scholarships and BioInfoSummer.

**2013:** AMSI's Schools program boosted with funding from Boeing, The William Buckland Foundation and an AMSPP grant in partnership with Regional Universities Network to deliver professional development to mathematics teachers around Australia.

## www.amsi.org.au/distinguished-service-medal

Ms Jan Thomas


Professor Tony Guttmann

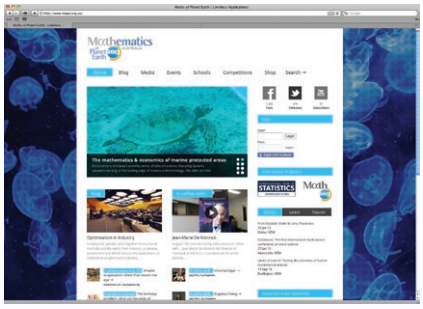
Professor Peter Hall

Professor Peter Taylor

Dr Michael Evans

## Maths of Planet Earth

# What a year!



**67,375** visits to our website from **150** countries

**3235** people attended events around Australia

**24** scientific workshops & public lecture

including a **5** day conference...

with **20** keynote speakers

Mathematics of Planet Earth 2013 AUSTRALIA

**2400** students have enjoyed our classroom resources

**150** photography competition entries received

mope.org.au/photography-competitions


**2731** people receive our MPE Australia newsletter

**57** "Coffees With" ordinary people talking about maths

mope.org.au/category/a-coffee-with

**2290** people have joined us on social media

## with a little help from our friends

AMSI Australian Mathematical Sciences Institute · CSIRO · Maths + Stats by Email · SSAI Statistical Society of Australia Inc. · The Science of Everything COSMOS www.cosmosmagazine.com · Australian museum nature culture discover · aamt

acara Australian Curriculum, Assessment and Reporting Authority · Australian Bureau of Statistics · Aust MS Australian Mathematical Society · ANZIAM · Australian Research Council Centre of Excellence for Mathematics and Statistics of Complex Systems · CARMA

IMAS Institute for Marine and Antarctic Studies | UTAS · Australian Academy of Science · Australian Government Geoscience Australia · ARC Centre of Excellence for Climate System Science · Australian Government Bureau of Meteorology

# Research & Higher Education

The AMSI Research and Higher Education Program has been supporting and building the mathematical sciences research base in Australia since 2002. The program facilitates national and international research collaborations and provides training and support to students and early career researchers.

## Research — Key achievements

**2014** *Mathematics of Planet Earth* (MPE) *Agency-Research Network* established connecting 16 universities and 5 government agencies

**2013** Comprehensive scientific program for the International Year of Mathematics of Planet Earth Australia, funding 24 national events with 3235 attendees

**2012** *Mathematics and Statistics in Industry Study Group* (MISG) partnership with Australian and New Zealand Industrial and Applied Mathematics Society (ANZIAM) builds industry collaborations with mathematicians and statisticians

**2012** National Seminar Series delivered over the *Access Grid Room* (AGR) *Network*

**2009** *Early Career Workshop* established in partnership with the Australian Mathematical Society (AustMS) to build networks for young researchers

**2007** Establishment of the *AGR Network*, providing global access to 201 seminars

**2007** Research-Industry linkages established through $2m funding under the *Collaborative and Structural Reform* (CASR) grant

**2006** *AMSI Travel Fund* launched facilitating national collaboration though 413 travel grants.

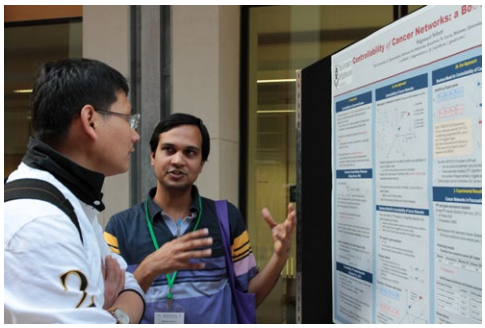
**2005** *Annual AMSI Distinguished Lecture Tour* established

**2004** *AMSI Scientific Workshop Funding* for mathematical sciences research

**2003** Partners in the establishment of the *Centre of Excellence for Mathematics and Statistics of Complex Systems* (MASCOS)

The AMSI Research Program supports Australia's academic community, fostering the critical links between researchers in universities, government agencies and business.

**www.amsi.org.au/Research**



## Facilitating National Collaboration

AMSI is acknowledged for promoting collaborative mathematical research through an internationally recognised program of scientific events.

Annually the *AMSI Scientific Workshop* program awards $120,000 in sponsorship for 25 scientific workshops, international and local conferences and provides $50,000 in travel support for students and researchers from around Australia to attend these events.


The *National Seminar Series* broadcasts specialist lectures from world experts over the AMSI AGR Network. The series runs in collaboration with the AustMS, ANZIAM, Australian and New Zealand Association of Mathematical Physics (ANZAMP), Australian Society for Operations Research (ASOR) and the Statistical Society of Australia Inc. (SSAI).

> *"AMSI Travel Funding offers great support to our young researchers helping them build their experience and networks by supporting them to attend events all around Australia"*
>
> Professor Joe Grotowski, Head of Mathematics, The University of Queensland

The program has funded 211 scientific events and awarded 413 travel grants since inception.

# Research & Higher Education

## Building Industry Linkages

Over a hundred mathematicians and statisticians come together at *Mathematics and Statistics in Industry Study Group* (MISG) to apply their expert knowledge to help solve real world, relevant problems to industry.

In 2014 researchers used mathematical skills to determine optimal cheese brining times for Fonterra and developed an algorithm to more accurately predict travel times across the South East Queensland road network for the Queensland Government.

MISG is an annual collaboration of the ANZIAM and AMSI, currently held at Queensland University of Technology.

## Research Partnerships

AMSI partners with leading research networks across Australia to bring the community together and build innovative strategies in key topic areas.

The *MPE Network* connects 16 universities and 5 government agencies, creating collaboration between agencies and universities and improving student retention in the mathematical sciences.

*"The MPE Network is a great outcome from the International Year of Mathematics of Planet Earth Australia ensuring continued collaboration Australia wide."*

Clinton Foster, Chief Scientist, Geoscience Australia

In 2014 AMSI has partnered with the Mathematical Sciences Institute (MSI) at the Australian National University to increase national participation in the MSI Special Year theme programs.

*"This new partnership provides an exciting opportunity to expand the reach of the MSI Special Year delivering real national benefit."*

Professor Thierry Coulhon, Director of MSI

### Staff

**Simi Henderson**

Program Manager, Research and Higher Education

simi@amsi.org.au

## Bringing International Expertise to Australia

Each year, the *AMSI Scientific Workshop Program* sponsors 50 international experts to visit Australia.

The *AMSI Lecture Tour* and the *Mahler Lecture Tour* that engage and inspire with specialist lectures, outreach events and media interviews. The tours run in partnership with the AustMS, the SSAI and ANZIAM.

## Supporting Australia's Young Researchers

The *Early Career Workshop* provides a forum for young researchers to build their networks and increase their skills. Since 2009 the AustMS-AMSI *Early Career Workshop* has guided 600 young researchers.

At the workshops participants receive advice from experts on a broad range of topics from the secrets behind grant success to how to effectively time manage teaching, research and administrative commitments.

# Research & Higher Education

## Higher Education — Key achievements

**2012** Department of Education invests $2m for the national expansion of the AMSI Higher Education program

**2010** National bioinformatics partnership established with EMBL Australia and BioPlatforms Australia

**2007** $2m CASR grant links students, researchers and industry through events and internships – partnerships with international institutes established

**2007** AGR broadcasts honours courses providing national access to specialists subjects

**2005** Inaugural *AMSI Winter School* providing short courses for PhD students

**2004** Annual *BioInfoSummer* symposium established, linking biologists and statisticians in the cutting edge field of bioinformatics

**2002** Launch of the annual *AMSI Summer School* and *Vacation Research Scholarship* (VRS) program enhancing the skills of 2,000 students to date

The AMSI Higher Education program enhances the student experience by providing research training from national and international experts and builds student networks around Australia.

**www.amsi.org.au/HigherEd**

## Enhancing the student experience

The *AMSI Summer and Winter Schools* bring together students from around Australia to develop their skills. Within the two to four week program students take specialist subjects from experts in the field, meet potential employers, build networks and establish research collaborations. 1,558 students have attended 13 *AMSI Summer Schools* and 275 students have attended 9 *AMSI Winter Schools* since 2002.

*AGR Short Courses* give students another opportunity to deepen their knowledge with condensed courses offered by specialists in the field.

## Training the next generation of researchers

Each year 50 undergraduate students receive Vacation Research Scholarships (VRS). Over six weeks students experience life as a researcher, working closely with a supervisor on real life research problems and present their findings at Big Day In, a national CSIRO conference. A total of 372 students have completed VRS.

The Shared Honours Program is a national program of collaborative teaching over the AGR Network. The program gives students access to a wider range of subjects, increasing opportunities for students with specialist subjects from other universities. 119 shared honours subjects have been delivered.

## Promoting cross-disciplinary collaboration

BioInfoSummer is the major annual bioinformatics event in Australia. This exciting area of interdisciplinary science blends technologies from mathematics, statistics and computing to solve biological problems.

BioInfoSummer is supported by the Australian BioInformatics Network, EMBL Australia and BioPlatforms Australia.

*"In my opinion, this year was the most successful, not just in the large numbers that came along, but in the reach to different fields of science."*

Professor Terry Speed, 2013 recipient of the Prime Minister's Prize for Science

*The annual AMSI vacation schools and scholarships are funded jointly by the Department of Education and AMSI.*

Australian Government
Department of Education

# AMSI Public Lectures

AMSI supports public engagement through a series of exceptional and thought-provoking lectures delivered by inspirational international experts. These lectures foster awareness of the role of the mathematical sciences in all aspects of life.

**Professor Malcolm Sambridge**
The Australian National University


**Simon Singh**
Author, journalist and TV producer

**Professor Simon Levin**
Princeton University


**Professor Stephen Boyd**
Stanford University

**Professor Danny Calegari**
University of Chicago

**Professor Akshay Venkatesh**
Stanford University

**Professor Celia Hoyles**
University of London


**Professor Shing-Tung Yau**
Harvard University

# Schools

## Highlights

- Establishment of the International Centre of Excellence for Education in Mathematics (ICE-EM) in 2004
- Development of mathematics textbooks and teacher resources for school years 5–12
- Provision of face-to-face professional development for mathematics teachers
- Launch of the careers resource Maths: Make your career count under The Improving Mathematics Education in Schools (TIMES) program
- Creation of online resources to support the new national mathematics curriculum
- Production of *Maths Delivers* videos showcasing real-world applications of mathematics

*"AMSI has been outstandingly successful as an advocate for mathematics and mathematics education. The establishment of the International Centre of Excellence for Education in Mathematics...and the associated The Improving Mathematics Education in Schools (TIMES) project have had a significant impact on mathematics education, most notably through its textbooks and teacher materials."*

Independent review of AMSI 2010

## Background

ICE-EM was established in 2004 with the assistance of the Australian Government. Through ICE-EM a sequence of high-quality mathematics texts, teacher resources and professional development for school years 5–10 were developed, being the only program to cover the mathematics curricula of all states at these levels.


With support from BlueScope Steel Pty Ltd and the University of Wollongong, ICE-EM provided texts and teacher professional development to clusters of schools in the Illawarra region.

In 2009 the Department of Education, Employment and Workplace Relations (DEEWR) provided funding for the extension of ICE-EM activities under the TIMES project. This funded an expansion of the teacher professional development program across the country, the development of teacher resource modules for years 5-10, and ***Maths: Make your career count*** – a suite of materials to promote careers in mathematics.

In work by Frank Barrington and Peter Brown, ICE-EM collected and published the only reliable data on national enrolments in mathematics at Year 12 and made a careful state-by-state comparison of Year 12 curricula.

## Teacher Professional Development

AMSI delivers an outreach program to provide professional development for mathematics teachers and is currently funded by Boeing, The William Buckland Foundation, the Victorian Department of Education and Early Childhood Development (DEECD) and the Australian Government through the Australian Maths and Science Partnership Project (AMSPP) with Regional Universities Network (RUN). Under these schemes AMSI works with five clusters of schools in Warialda (NSW), Oakey/Dalby (QLD), Geelong (VIC), Gippsland (VIC) and Yarraville/Footscray (VIC).

The outreach program includes workshops, in-class support, modeled lessons, and program development support targeted for primary teachers and mathematics teachers in secondary schools.

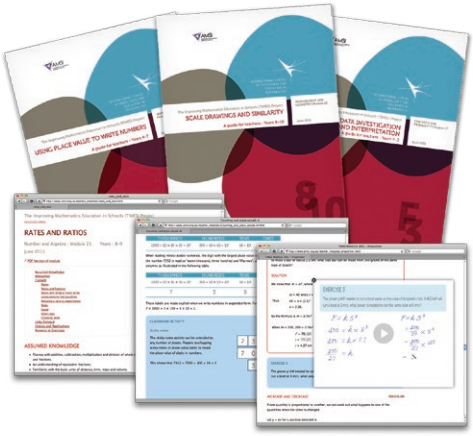
# Schools

## Resources for Teachers

Modules for teachers designed to develop their mathematics content knowledge to support the implementation of the Australian curriculum in mathematics are available online via **www.amsi.org.au/teachermodules** and through the Scootle website of Education Services Australia.

*"The Professional Development Modules are widely used by teacher educators across Australia who regard them as a valuable resource."*

Independent review of AMSI 2010

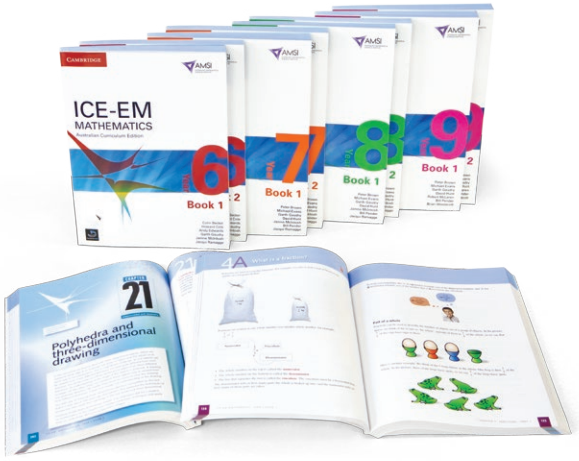


## ICE-EM Mathematics Textbooks

The second edition of the ICE-EM Mathematics series is now available through Cambridge University Press.

This full-colour series has been rewritten and developed for the Australian mathematics curriculum, while retaining the structure, depth and approach of the first edition. It covers all of the required content, as well as additional topics that are relevant and essential for a robust understanding of the subject. Spanning Years 5-10, the series has been developed to provide a coherent and solid development of mathematics ideas to support the transition from Primary to Secondary schooling.

**www.icemaths.org.au**




## Australian Curriculum – Mathematics

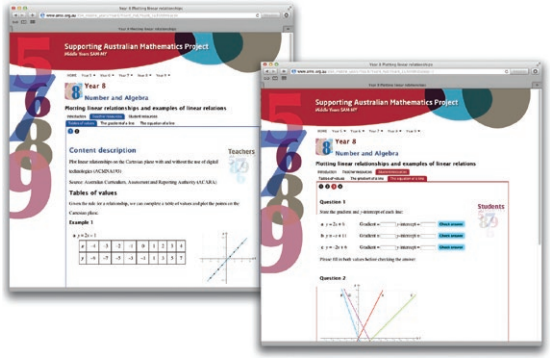
AMSI and ICE-EM has been actively consulted by the Australian Curriculum, Assessment and Reporting Authority (ACARA). Michael Evans has chaired the ACARA senior mathematics panel and is overseeing the implementation of the junior curriculum. Both Michael Evans and Janine McIntosh of AMSI were appointed to the 10-member mathematics P-10 writing team by ACARA. AMSI also provides a valuable conduit between academic mathematicians and ACARA, facilitating consultation between ACARA and members of the Australian Council of Heads of Mathematical Sciences.

AMSI's views on mathematics education have been actively sought by several national reviews and parliamentary inquiries.

# Schools

## Supporting Australian Mathematics

Supporting Australian Mathematics (SAM) is a suite of open-access online resources developed by AMSI in collaboration with Education Services Australia (ESA). The resources are aligned with the Australian Curriculum and help teachers and students to deepen their mathematical content knowledge.



- **SAM Middle Years** consists of 45 packages for teahcers and students explaining concepts from the mathematics curriculum for Years 5 to 9, including interactive student exercises.
  **www.amsi.org.au/SAM-middleyears**
- **SAM Senior Years** consists of 25 modules for teachers on topics from the mathematics curriculum for Years 11 and 12, including interactive animations and screencasts.
  **www.amsi.org.au/SAM-senioryears**

The entire collection of resources – available through AMSI's website and ESA's **Scootle** – provides teachers with focussed and reliable reference material for the Australian Curriculum, equipping them to teach with enthusiasm and engage their students.

*"Any Head of Mathematics or mathematics teacher who really values the mathematical education of our children and the future of our economy should be using these resources."*

Otieno Ogunah, Southern Highlands Christian School, NSW

## Real-Life Applications: *Maths Delivers* Videos

As part of the SAM project, AMSI created four videos which expose students to exciting applications of mathematics: gene mapping, cryptography, braking distance and Google PageRank. Professionally produced by Chrissie McIntyre (**Catalyst**, ABC) and narrated by Lily Serna (**Letters and Numbers**, SBS), these four videos are freely accessible through the SAM website. Each video is accompanied by a comprehensive set of notes that explains in more depth the mathematics underlying these real-life applications.


**www.amsi.org.au/mathsdelivers**

## Formative Assessment: The Improve Program

In conjunction with ESA, AMSI developed material for the Improve program which provides students, teachers and parents with an online learning environment in which to familiarise themselves with NAPLAN-style questions. The aim is to guide students on their approach to the questions and allow them to gain a deeper understanding of the expectations of NAPLAN.

## AMSI Resources available through TES Australia

AMSI was invited to share its online teacher resources on the TES Australia website. This site is the Australian division of TES Connect – the world's largest online network of teachers – which boasts almost 2.7 million registered users and the 100-year heritage of the **Times Educational Supplement**. The TES Australia site provides Australian teachers with free access to over 500,000 resources, lesson plans, worksheets and activities. AMSI became a member of TES Australia in August 2013 and in its first five months has shared 100 resources receiving around 5000 views.

## Our Staff

**Janine McIntosh**
Schools Program Manager
janine@amsi.org.au

**Michael O'Connor**
Schools Outreach Manager
moconnor@amsi.org.au

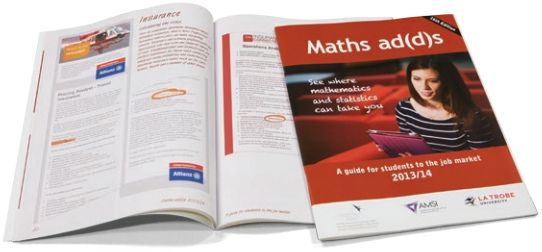
# Careers in the Mathematical Sciences

AMSI is committed to the production of careers resources to promote the study of mathematics at all levels.

## Maths Ad(d)s

This booklet contains job advertisements that have appeared recently in the press or on the Internet to show that a great number and variety of careers are available to prospective university students after graduation if they include mathematics or statistics in their degrees. AMSI automatically provides an annual allocation to members and also to schools and individuals upon request. These are a popular resource for career advisors, open days, careers expos and change of preference events.

**www.amsi.org.au/maths-adds**




## Maths: Make Your Career Count

This package is aimed at students of school age and includes 10 informative and inspirational videos, a booklet of career profiles and a set of posters. The website profiles the full set of 20 career profiles. This series was produced through The Improving Mathematics Education in Schools (TIMES) project and funded by the Australian Government.

**www.mathscareers.org.au**


## Careers afternoon at the AMSI Summer School

The AMSI Summer School features a careers afternoon, which is a great opportunity for employers to showcase graduate and other opportunities directly to honours and postgraduate students of mathematics and statistics, and allows these students a chance to ask questions within an informal environment.

Employers participating in the careers afternoon have included:

- PricewaterhouseCoopers
- Google
- CSIRO
- Commonwealth Bank
- Westpac
- Ernst & Young
- Australian Genome Research Facility
- Department of Defence
- Institute for Marine and Antarctic Studies

## Maths takes you places...

Produced in collaboration with the University of Tasmania's Institute for Marine and Antarctic studies, this suite of posters showcases the diverse and exciting places a degree in mathematics can take you, from Antarctica to Switzerland.

*Mathematics is the language used by the natural world.*

*Maths allows us to make predictions, to both see where we are going and from where we have come.*

Dr Ben Galton-Fenzi, Australian Antarctic Division

# AMSIIntern

An Innovative University and Industry Collaboration

## Highlights

- More than 87 placements made since 2008 across all disciplines
- $2.1M in student stipend payments
- $435K payments for Academic Mentors
- 97% service satisfaction rating from industry partners, with 45% repeat business
- In 2013 AMSI Intern became a supplier of the Victorian government DSDBI R&D Voucher Program
- The fully funded model has increased steadily since 2011 with over 20 placements made

## About AMSI Intern

AMSI Intern is an innovative university and industry collaboration that connects business and other organisations to the vast research expertise in Australia's universities. AMSI Intern links postgraduate students across all disciplines with industry partners through short-term tightly focussed research internships. Each participating postgraduate student is supported by an academic mentor from their own university.

AMSI Intern benefits Australia's research-based economy in three ways:

- **Interns** gain valuable workplace experience
- **Industry partners** obtain flexible and cost-effective access to analytical expertise for problem solving, driving productivity and innovation
- **Academic mentors** develop new research collaborations and track record with industry partners, increasing opportunities for ARC Linkage grants

Since 2008, AMSI has placed more than 87 interns across a wide spectrum of industry and government organisations, including manufacturing, IT, health, transport and resources. The program has a 97% satisfaction rating, with over 45% of industry partners returning for multiple internships.

*"Work-readiness of our PhD students, and the links between industry engagement and national productivity, are critically important... The AMSI Intern program is one such shining example."*

Prof. Ian Chubb, Chief Scientist of Australia

## Staff

**Cate Ballard**

National Program Manager, AMSI Intern

cate@amsiintern.org.au

**www.amsiintern.org.au**

## SME Voucher Program

AMSI Intern is continuing to grow and develop partnerships with universities, research organisations and peak industry bodies. In July 2013, AMSI Intern became an approved supplier of the Victorian Government's Business R&D Voucher Program, which provides access to innovation and R&D funding of up to $25,000 for Victorian small to medium enterprises (SMEs). The voucher program is an initiative of the Department of State Development, Business and Innovation (DSDBI) to promote greater business innovation within Australian SMEs.

## Accelerate Australia forum

AMSI Intern hosted Accelerate Australia on 6 February 2013 at the National Convention Centre in Canberra to promote discussion on productivity, industry engagement and the work-readiness of PhD students in a research-based economy. The event featured high-level speakers from industry, government and research, as well as interactive demonstrations by PhD interns. The keynote speaker was Arvind Gupta, CEO and Scientific Director of Mitacs, who observed that "a key factor in driving innovation in industry is strong engagement with the research community." Mitacs places more than 2000 PhD interns into industry in Canada every year.

*"We need to build Australia's human capacity in a range of research areas by attracting and retaining the most promising research students... The AMSI Intern program shows a great deal of promise as a way to connect researchers in universities with industry to solve problems."*

Prof. Aidan Byrne, CEO, Australian Research Council

## Partnership with Enterprise Connect

AMSI Intern's successful partnership with Enterprise Connect concluded in April 2013. This partnership involved a three-year Commonwealth Government grant that subsidised the placement of PhD interns into SMEs across Australia. As part of this grant each participating postgraduate student recieved pre-placement training.

An Innovative University and Industry Collaboration

AMSIIntern

# Intern stories

## Intern injects new skills into drug project

**Intern:** Milica Ng, University of Melbourne

**Industry partner:** Dr Michael Wilson, Senior Director, Molecular Biology, CSL

**Academic mentor:** Dr Matthew Ritchie, Walter and Eliza Hall Institute

CSL is a leader in the plasma-protein therapeutics industry – manufacturing and marketing a range of plasma-derived and recombinant therapies that are used worldwide in the treatment of coagulation and neurological disorders.

AMSI intern Milica Ng used her diverse skills in computer science, mathematics and engineering to help establish an innovative way to store and analyse biological data collected by CSL. This will strengthen CSL's ability to quickly and reliably select appropriate drug targets for a variety of critical human health conditions.

*"AMSI Intern did an excellent job of sourcing for CSL a highly motivated student who brought a unique skillset that doesn't currently exist in our organisation. We were excited about the high-calibre of student provided by AMSI Intern – as a result we have offered the student full time employment!"*

Michael Wilson, Senior Director, Molecular Biology, CSL


Milica Ng and Dr Matthew Ritchie

CSL™

## Gaming apps used in child diagnosis

**Intern:** Andrew Cookson, Monash University

**Industry partner:** Grace Lethlean, Grey Innovation

**Academic Mentor:** Prof. Kate Smith-Miles, Monash University

"A group of child behavioural psychologists have developed a tablet computer application for assessing how well young children with developmental delay disorders are paying attention to things," says intern Andrew Cookson of Monash University. "The problem is that there are so many variables that it can be difficult to determine whether or not the patient is improving."

"I'm using my knowledge of mathematics and also my background in psychology to make the data more digestible for the psychologists. Data from the program will be used when determining a strategy for the child's progress. The psychologists rely on this information, and they definitely recognise the importance of mathematics in developing this tool."


Andrew Cookson

GREY INNOVATION
TECHNOLOGYCOMMERCIALISATION

AMSIIntern

An Innovative University and Industry Collaboration

## Greener routes drive profits

**Intern:** Yi Chen, Federation University

**Industry partner:** Marcus Denny, Manager, Systems Design Division, VISA Global Logistics

**Academic mentor:** Prof. David Y. Gao, Federation University


The Travelling Salesman Problem is the classic example of a difficult optimisation problem. VISA Global – one of Australia's largest privately owned global freight-forwarding companies – was faced with such a problem. With their online sales soaring, the logistics company needed to find more efficient ways to deliver goods to reduce costs and their carbon footprint.

VISA Global engaged AMSI intern Yi Chen, a PhD student at Federation University, to look for innovative approaches to improving the efficiency of their transport fleet. According to Marcus Denny at VISA Global: "The results of Yi's work were very impressive and provided VISA with a verifiable approach to solving the problem, with potential gains far in advance of what had been hoped at the outset."

*"The internship provided me with a really great opportunity to apply my studies to solve practical real-world problems. And it helped me form clearer career goals."*

Yi Chen, AMSI intern

## Industry Partners

Biarri COMMERCIAL MATHEMATICS

SHOW WORKS Creative Solutions www.showworks.com.au

TERRA FIRMA PIT LIDS™ THE COMPOSITE LID COMPANY

ROUND TABLE BUSINESS/HIGHER EDUCATION

mpower Power with Purpose

GREY INNOVATION TECHNOLOGYCOMMERCIALISATION

NBNCo Bringing broadband to life

CITY OF MELBOURNE

PALMER TECHNOLOGIES

Milspec MANUFACTURING

Integrated Research

Melbourne Storm

TTG Transportation Technology

Taylor Fry

Victoria The Place To Be Department of Transport

APRA

ZEISS We make it visible.

QBE Insurance Group

CSL

VISA VISA GLOBAL LOGISTICS PTY LTD

ADALTA

BASS COAST

VEOLIA WATER

NICTA

DAIRY AUSTRALIA Delivering for the dairy industry

vicroads

CERAMIC FUEL CELLS LIMITED

Aus Pits

planet innovation

Supporting Australian Mathematics

## www.amsi.org.au/SAM-MiddleYears

Middle years 5 to 9

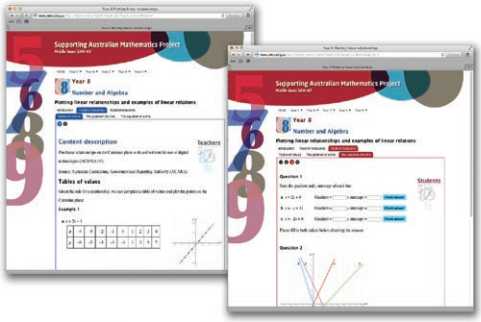
- Free digital resources for teachers and students – Years 5 to 9
- Aligned with Australian Curriculum content
- 45 packages explain concepts from the mathematics curriculum
- Students complete exercises and check their understanding
- Teachers and students deepen their mathematical content knowledge

**Be well prepared**
**Teach mathematics with enthusiasm**
**Engage your students**

*Do you need support material to help you implement the Australian Curriculum: Mathematics?*

Supporting Australian Mathematics (SAM) is a new, free digital resource produced by the Australian Mathematical Sciences Institute (AMSI) in collaboration with Education Services Australia (ESA).

SAM – Middle Years provides teachers with reliable, convenient and succinct reference material for planning and understanding the mathematics they teach, whilst empowering students to read, learn and grow mathematically.



AMSI AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

Education Services Australia

---

Research
Australian Mathematical Sciences Institute

## AMSI AGR National Seminar Series

**Continued in 2014**

In 2013 AMSI, in partnership with the national mathematical organisations AustMS, ANZIAM, SSAI, ANZAMP and ASOR started organizing a nation-wide seminar series over the Access Grid Network. In 2013 and early 2014 this series has already featured numerous eminent experts in their field from Australia and overseas. Speakers included Gene Abrams, Keith Devlin, Jon Borwein, Adrian Baddeley, Martin Savelsbergh, Hugh Possingham, Claus Ringel, Tony Guttmann, Rick Kenyon and Wendelin Werner. The series aims to offer a range of accessible and very high quality seminars for the broader mathematical community in Australia.

To find out more:
**www.amsi.org.au/AGR-national-seminar-series**

For up to date information, feedback and suggestions for speakers, please contact **agr@amsi.org.au**, or contact one of the seminar conveners:

Jonathan Kress (ANZAMP) **j.kress@unsw.edu.au**
Adrian SIMS (AustMS) **asims@uow.edu.au**
Matthew Simpson (ANZIAM) **matthew.simpson@qut.edu.au**
Scott Sisson (SSAI) **scott.sisson@unsw.edu.au**
Paul Gaertner (ASOR) **Paul.Gaertner@dsto.defence.gov.au**

*In collaboration with*

Aust MS · SSAI Statistical Society of Australia Inc. · ANZIAM · ANZAMP · asor

**www.amsi.org.au/AGR-national-seminar-series**

---

Higher Education
Australian Mathematical Sciences Institute

## 2014 AMSI Summer School in the Mathematical Sciences

**6–31 January 2014, Australian National University**

**7 Reasons to Attend:**

- **Learn** from Australia's leading mathematicians and statisticians
- **Choose** from a wide range of courses to suit your specialty
- **Gain** credit towards your degree
- **Meet** future employers at the Careers Afternoon
- **Build** your networks at dinners, BBQs and special events
- **Broaden** and deepen your knowledge base with advanced coursework
- **Discover** the latest subjects in your discipline

**Subjects:**

- BioInformatics - Dr Conrad Burden
- Conformal Field Theory and String Theory – Prof. Peter Bouwknegt & Dr David Ridout
- Differential Geometry - Dr Ben Andrews & Dr Julie Clutterbuck
- Finite Element Method - Dr Bishnu Lamichhane
- High-Dimensional Data – Assoc. Prof. Inge Koch & Dr Samuel Mueller
- Hydrodynamic Stability – Prof. Sergey Suslov
- K Theory - Dr Vigleik Angeltveit
- Statistical Inference – Prof. Alan Welsh and Assoc. Prof. Robert Clark

**Full travel and accommodation scholarships available!**

AMSI · Australian National University · Australian Government Department of Industry, Innovation, Science, Research and Tertiary Education · Aust MS · ANZIAM · Mathematics of Planet Earth 2013 AUSTRALIA

**Apply today: www.amsi.org.au/SS**

---

Higher Education
Australian Mathematical Sciences Institute

**In your 3rd year of maths & stats?**
**Find out what it's like to be a researcher**

## 2013/14 AMSI Vacation Research Scholarships

Get paid to complete a six-week summer research project under the guidance of a supervisor!

**Scholarships:**

- Australia wide
- $450/week for six-weeks
- Present at CSIRO's Big Day In
- Fully funded travel and accommodation
- Open to intending honours and masters students

AMSI · CSIRO · Australian Government Department of Industry, Innovation, Science, Research and Tertiary Education · Mathematics of Planet Earth 2013 AUSTRALIA

**Apply today: www.amsi.org.au/VRS**


www.amsi.org.au

Australian Mathematical Sciences Institute
Building 161
c/- The University of Melbourne
Victoria 3010 Australia

Tel: +61 3 8344 1777
Fax: +61 3 8344 6324
Email: enquiries@amsi.org.au

FEB 2014