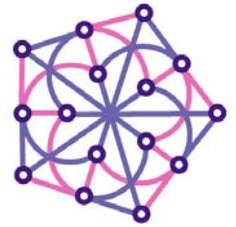


ACADEMIC STAFF RESEARCH GROUPS

Shortcut: Click on hyperlink of title of research group to get to each research group page.



ALGEBRA & DISCRETE MATHEMATICS

Dr T E Hall (Convenor)

Dr D Delbourgo
Dr B Polster
Mr S Teague
Dr I Wanless

ANALYSIS & GEOMETRY

Prof R Bartnik (Convenor)

Dr M Athanassenas
Dr E K W Chu
Dr P Miao
Dr T Oliynyk
Dr B Polster
Assoc Prof A J Pryde

ASTROPHYSICS & GENERAL RELATIVITY

Prof J C Lattanzio (Convenor)

Dr J Andries	Dr M Lugaro
Prof R Bartnik	Dr R A Mardling
Dr L C Brewin	Prof J J Monaghan
Prof P S Cally	Prof L Moresi
Dr Ross Church	Dr T Oliynyk
Dr A Donea	Dr R Stancliffe
Dr D Galloway	Dr A J R Prentice
Dr A W C Lun	Dr D Price

ATMOSPHERIC SCIENCE & GEOPHYSICAL FLUID DYNAMICS

Prof M J Reeder (Convenor)

Dr S R Clarke	Assoc Prof S T Siems
Dr L Davies	Dr R Wardle
Dr M Griffiths	
Dr J M Haynes	
Prof C Jakob	
Prof M Manton	
Assoc Prof M A Page	
Dr J Peter	

COMPUTATIONAL MATHEMATICS

Prof L Moresi (Convenor)

Prof R Bartnik	Dr J Mansour
Dr L C Brewin	Dr R A Mardling
Prof P S Cally	Prof J J Monaghan
Dr F A Capitanio	Assoc Prof M A Page
Dr E K W Chu	Dr D Price
Dr S R Clarke	Prof K Smith-Miles
Dr M Jadamec	Dr T Tian
Prof J C Lattanzio	Dr S Zlotnik

STATISTICS & STOCHASTIC PROCESSES

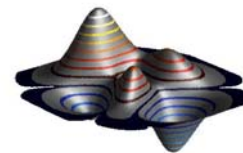
Prof F Klebaner (Convenor)

Dr V Abramov
Dr B Buchmann
Dr K Hamza
Dr B Miller
Dr C Rau
Prof K Smith-Miles
Dr A W Sudbury
Dr T Tian

TERTIARY MATHEMATICS EDUCATION

Assoc Prof C T Varsavsky (Convenor)

Dr A W C Lun



ALGEBRA & DISCRETE MATHEMATICS RESEARCH GROUP
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Dr Daniel Delbourgo daniel.delbourgo@sci.monash.edu.au (03) 9905 4771
Elliptic curves and modular forms; automorphic representations; Iwasawa theory of motives; deformations of Galois representations; Euler systems attached to varieties.

Dr Tom Hall tom.hall@sci.monash.edu.au (03) 9905 4412
(*Convenor of the Research Group*)

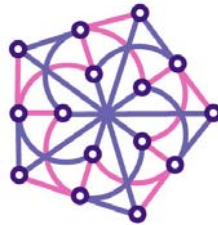
The algebraic theory of semigroups. Inverse semigroups, regular semigroups, e-varieties of regular semigroups. Electronic watermarks for images and communication. Discrete mathematics for electronic communication

Dr Burkard Polster burkard.polster@sci.monash.edu.au (03) 9905 4493
Finite and topological geometry, combinatorial designs, group theory, history of mathematics, classical interpolation theory, computer visualisation, mathematics education and outreach, any kind of fun mathematics.

Mr Simon Teague Simon.Teague@sci.monash.edu.au (03) 9905 4492
Algebra - finite fields, digital security and electronic watermarking.

Dr Ian Wanless ian.wanless@sci.monash.edu.au (03) 9905 4442

Latin squares and other combinatorial matrices, quasigroups, matrix permanents, graph theory (matchings, factorisations, random graphs), enumeration algorithms for combinatorial objects.



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ANALYSIS & GEOMETRY RESEARCH GROUP

Dr Maria Athanassenas maria.athanassenas@sci.monash.edu.au (03) 9905 4462
Partial differential equations, calculus of variations, differential geometry. In particular: existence, regularity and stability of solutions to variational problems; geometric diffusion equations.

Prof Robert Bartnik robert.bartnik@sci.monash.edu.au (03) 9905 4484
(Convenor of the Research Group)
Differential geometry, analysis of partial differential equations, Einstein equations and general relativity : energy and quasi-local energy definitions and properties, numerical solution of Einstein equations, spacetime singularity formation.

Dr Eric Chu
(See Computational Mathematics Research Group)

Dr Pengzi Miao pengzi.miao@sci.monash.edu.au (03) 9905 4492
Differential geometry; with an emphasis on geometric problems motivated by mathematical relativity.

Dr Todd Oliynyk todd.oliynyk@sci.monash.edu.au (03) 9905 4433
Partial differential equations: singular limits of symmetric hyperbolic systems, geometric PDEs and Geometric flows: Ricci flow, renormalization group flow.
(See also Astrophysics & General Relativity Research Group).

Dr Burkard Polster
(See Algebra & Discrete Mathematics Research Group)

A/Prof Alan Pryde alan.pryde@sci.monash.edu.au (03) 9905 4417
Functional analysis, spectral theory, harmonic analysis: theory of functions of almost periodic type, asymptotic behaviour of solutions of evolution equations on semi-groups, multivariable spectral theory, spectra of unbounded functions on locally compact abelian groups.

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ASTROPHYSICS & GENERAL RELATIVITY RESEARCH GROUP

Dr Jesse Andries (03) 9905 4420
Solar physics, magnetohydrodynamics (MHD), MHD waves and spectroscopy, spectral analysis, coronal seismology.

Prof Robert Bartnik
(See also *Analysis & Geometry Research Group*)

Dr Leo Brewin leo.brewin@sci.monash.edu.au (03) 9905 4456
Numerical methods for General Relativity in particular lattice methods such as Smooth Lattice General Relativity. Current projects include: evolution of Teukolsky waves, maximal sliced Oppenheimer- Snyder dust collapse, boundary conditions for lattice methods, ray tracing in curved space times.

Prof Paul Cally paul.cally@sci.monash.edu.au (03) 9905 4471
Solar physics, magnetohydrodynamics, helioseismology, sunspots, tachocline.

Dr Ross Church ross.church@sci.monash.edu.au (03) 9905 4476
Structure, evolution and nucleosynthesis of stars, interacting binary stars, and the dynamics of stellar systems. Current projects include development of a code that combines detailed, live models of the evolution of stars, investigation of the s-process and population studies of gamma-ray burst progenitors.

Dr Alina Donea alina.donea@sci.monash.edu.au (03) 9905 4488
Solar physics: helioseismology, solar flares, solar quakes, suprathermal particles; ultra high-energy cosmic rays, active galactic nuclei (accretion disks and relativistic jets).

Dr Duncan Galloway duncan.galloway@sci.monash.edu.au (03) 9902 0393
The nature and properties of neutron star binaries, investigated via a range of observational techniques including X-ray pulse timing and phase-resolved spectroscopy, analysis of thermonuclear (type I) bursts, and high-resolution X-ray imaging and spectroscopy.

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ASTROPHYSICS & GENERAL RELATIVITY RESEARCH GROUP

Prof John Lattanzio john.lattanzio@sci.monash.edu.au (03) 9905 4428
(Convenor of the Research Group)

Stellar astrophysics; stellar nucleosynthesis, especially red-giants and the thermally pulsing evolutionary phases; chemical formation of the Galaxy and evolution of the Galaxy. Current projects include: a theoretical and observational study of “hot bottom burning” in red giants, making heavy elements in stars, abundance anomalies in red-giants in globular clusters, evolution and nucleosynthesis of Super-AGB stars, chemical evolution of the early Universe and true Population III stars.

Dr Anthony Lun anthony.lun@sci.monash.edu.au (03) 9905 4447

Classical and Numerical General Relativity. Current projects include: Generalised Tolman-Bondi space-times as models of spherical collapse; Perturbations in 1+1+2 formalism; angular momentum of asymptotically flat space times; quasi-normal modes of rotating black holes; runaway solutions of the Einstein Maxwell electro vac space times; formulation of initial-value problems with matter sources in General Relativity; numerical integration of the Robinson-Trautman and the Bondi mass equations; optical appearance of objects falling into black holes.

Dr Maria Lugaro maria.lugaro@sci.monash.edu.au (03) 9905 1640

Study on heavy elements from carbon to lead are produced by nuclear reactions inside stars, in particular, stars which have evolved to the red giant phase and eject most of their material into their surroundings via strong winds, thus affecting the chemical make up of galaxies. Using theoretical stellar models, coupled with large networks of nuclear reactions, calculations are made on the abundances of nuclei produced in giant stars and compare them to spectroscopic observations of stellar abundances and laboratory analysis of exotic meteoritic materials.

Dr Rosemary Mardling rosemary.mardling@sci.monash.edu.au (03) 9905 4506

The dynamical evolution of stellar and planetary systems, dynamical evolution of star clusters; gravitational interactions in the cores of stars clusters (globular clusters, open clusters, and galactic nuclei); tidal capture; the stability of three-body systems and chaos theory; tides in stars and planets; the dynamical and tidal evolution of extra-solar planetary systems; formation of low-mass X-ray binaries; pulsar binaries; planet formation.

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ASTROPHYSICS & GENERAL RELATIVITY RESEARCH GROUP**Prof Joe Monaghan**

(See *Computational Mathematics Research Group*)

Prof Louis Moresi

(See *Computational Mathematics Research Group*)

Dr Todd Oliynyk

todd.oliynyk@sci.monash.edu.au

(03) 9905 4433

General relativity: Newtonian limit, post-Newtonian expansions, Einstein-Yang-Mills, gravitating perfect fluids and elastic bodies.

Dr Richard Stancliffe

richard.stancliffe@sci.monash.edu.au

(03) 9902 0168

Stellar evolution, binary evolution and stellar nucleosynthesis.

Dr Andrew Prentice

andrew.prentice@sci.monash.edu.au

(03) 9905 4499

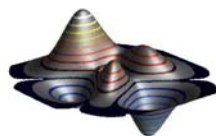
Formation of the solar system: the development of a fully quantitative and mathematical description of the physical and chemical processes responsible for the formation of the planetary systems and the satellite systems of the major planets. Current projects include numerical modelling of the chemical condensation within gas rings and the gravitational accretion of solid planetesimal for planet formation; numerical simulation of supersonic turbulent convection within a protosolar cloud.

Dr Daniel Price

daniel.price@sci.monash.edu.au

(03) 9905 1760

Computational astrophysics, generally involving Magnetohydrodynamics, star formation and the Smoothed Particle Hydrodynamics (SPH) method



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ATMOSPHERIC SCIENCE & GEOPHYSICAL FLUID DYNAMICS RESEARCH GROUP
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Dr Simon Clarke simon.clarke@sci.monash.edu.au (03) 9905 4421
Evolution of non-linear waves and their application to geophysical flows. Topics of research in this field include; effect of shear of finite-amplitude waves, trapping of non-linear internal waves, internal solitary waves with oscillatory tails, dynamics of finite-amplitude interfacial waves, non-linear critical layers, non-linear wave groups.

Dr Laura Davies laura.davies@sci.monash.edu.au (03) 9902 0110
The physical processes of convection and how the representation of convection in numerical models can be improved: idealised modelling experiments, coupling theoretical studies with analysis of observational data and the use of large-scale numerical models and differing characteristics of convection occurring over land from that occurring over the oceans.

Dr Morwenna Griffiths morwenna.griffiths@sci.monash.edu.au (03) 9905 4411
Mesoscale meteorology, frontal dynamics and bushfire behaviour.

Dr John M Haynes John.Haynes@sci.monash.edu.au (03) 9905 4495
Characterisation of the structure of tropical and middle latitude cloud systems and their associated precipitation features; observing clouds and precipitation with millimeter wavelength radar/lidar systems, including the spaceborne CloudSat and CALIPSO platforms; radar multiple scattering. Improving our understanding of global precipitation processes and distribution, particularly light rainfall; development of the CloudSat precipitation retrieval. Using observations of clouds and precipitation to evaluate and improve numerical weather prediction models, and development of radar forward models for this purpose.

Prof Christian Jakob christian.jakob@sci.monash.edu.au (03) 9905 4461
Models of the atmosphere as they are used for Numerical Weather Prediction (NWP), seasonal prediction and climate simulation, in particular the design and validation of cloud and convection parameterization schemes using a variety of data sources and the use of probabilistic forecasts at all time-scales for decision making.

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**ATMOSPHERIC SCIENCE & GEOPHYSICAL FLUID DYNAMICS
RESEARCH GROUP**

Prof Michael Manton michael.manton@sci.monash.edu.au (03) 9905 4495
Air quality observations and analysis; climate observations and analysis; simple climate models and their application to global problems; cloud physics.

A/Prof Michael Page michael.page@sci.monash.edu.au (03) 9905 4486
The dynamics of rotating fluids; high-Reynolds-number flows and boundary-layer theory; flow separation; geophysical fluid dynamics on an f - and β -plane; computational fluid dynamics.

Dr Justin Peter justin.peter@sci.monash.edu.au (03) 9905 4495
Aircraft and radar observations of clouds, in particular the initiation of precipitation in warm cumulus clouds. Aerosol-cloud interactions including the importance of aerosol on cloud microphysics and the impact of clouds on aerosol physics and chemistry, especially the effect of convection on transport, removal and modification of the aerosol size distribution.

Prof Michael Reeder michael.reeder@sci.monash.edu.au (03) 9905 4464
(Convenor of the Research Group)
Tropical meteorology, synoptic meteorology, mesoscale meteorology and bushfires. Current projects include: the initiation and large-scale organisation of tropical convection, the role of boundary layers on the dynamics of fronts, the generation of gravity waves by fronts and convection, non-linear waves and the morning glory, tropical cyclone dynamics, the dynamics of pyro-cumulonimbus and pyro-tornadogenesis, and the dynamics of bushfires.

A/Prof Steven Siems steven.siems@sci.monash.edu.au (03) 9905 4406
Microscale meteorology, cloud – climate interaction. Current projects involve both field observations and numerical simulations of cloud processes and aerosols.

Dr Richard Wardle richard.wardle@sci.monash.edu.au (03) 9905 4411
Dynamical climatology and climate modelling. Current projects include understanding extratropical synoptic activity under different past climate regimes; the dynamics of recent changes in Australian climate; understanding the phase of the climate response.

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COMPUTATIONAL MATHEMATICS RESEARCH GROUP

Prof Robert Bartnik

(See also Analysis & Geometry Research Group)

Dr Leo Brewin

(See Astrophysics & General Relativity research group)

Prof Paul Cally

(See Astrophysics & General Relativity research group)

Dr Fabio A Capitanio fabio.capitanio@sci.monash.edu.au (03) 9905 4468
Plate Tectonics: Numerical Modeling and Geological Observable. Global Plate Motions and Plates Kinematics. Lithosphere Dynamics, Rheology and Large Scale Deformation.

Dr Eric Chu eric.chu@sci.monash.edu.au (03) 9905 4480
Scientific computation, in particular numerical linear algebra, Control system design, Optimization, Operations research, Financial mathematics and their applications

Dr Simon Clarke

(See Atmospheric Science & Geophysical Fluid Dynamics research group)

Dr Margarete Jadamec margarete.jadamec@sci.monash.edu.au (03) 99056818
Plate boundary zones: Subduction zone dynamics, Continental deformation.
Visualization in science: 3D visualization of complex geologic and geophysical systems.
Primary methods: Numerical modeling, analytic modeling, and field mapping.

Prof John Lattanzio

(See Astrophysics & General Relativity Research Group)

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COMPUTATIONAL MATHEMATICS RESEARCH GROUP

Dr John Mansour john.mansour@sci.monash.edu.au (03) 9905 4478
Applied mathematics, with particular interest in computational techniques for fluid dynamics.

Dr R Mardling
(See *Astrophysics & General Relativity Research Group*)

Dr Daniel Price
(See *Astrophysics & General Relativity Research Group*)

Prof Joe Monaghan joe.monaghan@sci.monash.edu.au (03) 9905 4463
The theory of particle methods for the numerical solution of fluid dynamics in astrophysics and geophysical fluid dynamics; star formation, relativistic fluid dynamics; volcanic eruptions and other multi-phase problems; waves breaking on beaches and similar free surface problems; fracture especially the dynamics of landslides, the calving of icebergs, and the collapse of magma chambers; the Mathematics of linked swimming bodies.

Prof Louis Moresi louis.moresi@sci.monash.edu.au (03) 9905 4468
(Convenor of the Research Group)

Geodynamics: Dynamics of Earth and rocky planets including mantle convection, continental deformation, plate tectonics (origin/style/evolution), and heat flow, rheology.

Computational mathematics: Development of new finite element, and finite-element-like-particle methods for solid mechanics/fluid dynamics; Interactive inversion; Realization of novel algorithms in efficient, parallel form.

A/Prof Michael Page
(See *Atmospheric Science & Geophysical Fluid Dynamics Research Group*)

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COMPUTATIONAL MATHEMATICS RESEARCH GROUP

Prof Kate Smith-Miles kate.smith-miles@sci.monash.edu.au (03)9905 3170
Operations Research, particularly combinatorial optimisation solved using meta-heuristic approaches such as neural networks, genetic algorithms, etc.; Data mining, and statistical approaches to pattern recognition; Meta-learning; Automated algorithm selection by understanding the relationships between problem characteristics and algorithm performance in domains such as optimisation, forecasting, and classification.

Dr Tianhai Tian
(See *Statistics & Stochastic Processes Research Group*)

Dr Sergio Zlotnik sergio.zlotnik@sci.monash.edu.au (03)9905 4404
Computational geodynamics, and include plate tectonics, self-consistent lithospheric and mantle dynamics, rock deformation and rheology; numerical approach to previous problems, including application and development of state-of-the-art numerical methods to handle strongly non-linear rheology, multi-phase models, thermo-mechanical coupling.

STATISTICS & STOCHASTIC PROCESSES RESEARCH GROUP

Dr Vyacheslav Abramov vyacheslav.abramov@sci.monash.edu.au (03) 9905 4474
Queuing systems. Applied Probability.

Dr Boris Buchmann boris.buchmann@sci.monash.edu.au (03) 9905 9760
Statistics and fluctuation theory of stochastic processes and time series.

Dr Kais Hamza kais.hamza@sci.monash.edu.au (03) 9905 4453
General theory of stochastic processes. Representation properties for martingales. Markov jump processes. Applications of stochastic processes to modelling of financial markets.

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STATISTICS & STOCHASTIC PROCESSES RESEARCH GROUP

Prof Fima Klebaner fima.klebaner@sci.monash.edu.au (03) 9905 4419
(Convenor of the Research Group)

Stochastic Processes, Applied Probability, Stochastic Calculus, Financial Mathematics, Random Perturbations of Dynamical Systems.

Dr Boris Miller boris.miller@sci.monash.edu.au (03) 9905 5870

Stochastic and deterministic discrete-continuous and hybrid systems, theory of non-linear controls and optimisation. Filtering and estimation in discrete-continuous stochastic systems, control of the observation, design of the experiment. Mathematical modelling; mechanical systems with impulsive controls and impacts; application of mathematical and computational methods to control problems in telecommunications.

Dr Christian Rau christian.rau@sci.monash.edu.au (03) 9905 4404

Multivariate analysis and statistics on manifolds. Spatial statistics and geostatistics. Stochastic geometry. Image analysis.

Prof Kate Smith-Miles

(See Computational Mathematics Research Group)

Dr Aidan Sudbury aidan.sudbury@sci.monash.edu.au (03) 9905 4405

Interacting particle systems: Current projects include: finding critical values for the growth of particle systems. Random Sequential Allocation.

Dr Tianhai Tian tianhai.tian@sci.monash.edu.au (03) 9902 0890

Stochastic and multiscale modelling of biological systems including genetic regulatory networks and cell signalling transduction pathways, stochastic simulation of biochemical reaction systems, computation in financial mathematics, numerical methods for stochastic differential equations, inference methods for estimating model parameters, parallel computing.

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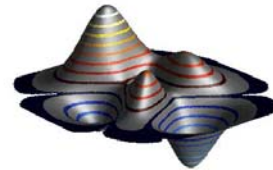
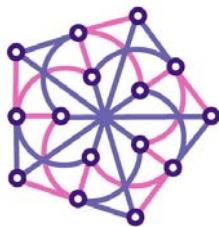
TERTIARY MATHEMATICS EDUCATION GROUP

Dr Anthony Lun

(See Astrophysics & General Relativity Group)

A/Prof Cristina Varsavsky cristina.varsavsky@sci.monash.edu.au (03)9905 4501
(Convenor of the Research Group)

General mathematics; Undergraduate Mathematics Education, in particular the use of educational technology to enhance student learning; Multimedia development.



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