Interactions Between Operator Algebras and Dynamical Systems[1]

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University of Wollongong

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Organising Committee

- Dr Murray Elder (University of Newcastle)
- Dr Adam P.W. Sørensen (University of Wollongong)
- Dr Samuel Webster (University of Wollongong)
- Dr Michael Whittaker (University of Wollongong)

Sponsors

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Topics covered

Professor Søren Eilers (University of Copenhagen) gave the lecture series on operator algebras. The running theme of the series was the mutually beneficial connection between symbolic dynamics and C*-algebras. The focus was on C*-algebras associated to shift spaces and how C*-algebraic invariants can be used to distinguish various shift spaces. The first two lectures gave a historical introduction to the subject and provided key examples for understanding the theory. The third lecture described the recent result of Matsumoto and Matui that completely characterizes flow-equivalence of irreducible shifts of finite type in terms of their associated C*-algebras. The final lecture was an overview of important open problems in the area.

The lecture series on dynamics was given by Professor Douglas Lind (University of Washington). Lind is one of the world's leading experts on symbolic dynamics, in fact, he literally wrote the book on symbolic dynamics. His textbook *An Introduction to Symbolic Dynamics and Coding* holds a place on virtually every

[1]Visit http://eis.uow.edu.au/smas/operator-algebra-dynamic-systems/index.html

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dynamicist's bookshelf. The series began with a discussion of various equivalence relations of shifts of finite types, and the invariants used to distinguish between them. From there on the series progressed naturally to more complicated shift spaces, such as spaces with commuting shift maps, algebraic shifts, and algebraic actions of non-commutative groups. The final lecture discussed the connection between von Neumann algebras, a class of operator algebras, and algebraic actions of non-commutative groups. Throughout the lecture series, interesting open problems were pointed out and discussed.

In addition to the lecture series and an introductory talk by Sims (University of Wollongong), there were 13 specialist talks where researchers presented their new results in their own area, but always kept the mixed audience in mind. A few highlights were Froyland's (University of Sydney) discussion of the use of dynamics of transfer operators to study ocean movements; an Huef (University of Otago) describing the equilibrium states of certain C*-dynamical systems; Deeley's (Université Blaise Pascal, Clermont-Ferrand) overview of the homology of Smale spaces; and Carlsen's (Norwegian University of Science and Technology) report on a possible generalization of the Matsumoto–Matui theorem.

Report and feedback

The workshop brought together international and domestic experts in the fields of dynamical systems and operator algebras, thus creating exciting new collaborations across disciplines and providing an introduction to each field for students and postdocs alike.

> The AMSI workshop in operator algebra brought together world-class mathematicians from all four corners of the world. It gave me an opportunity to see how topics in apparently different disciplines fit together and thus make a powerful tool to study analysis and dynamics.
>
> Roozbeh Hazrat (University of Western Sydney)

Dynamical systems were introduced as a mathematical framework for analysing time-dependent physical systems. Operator algebras stem from the quantisation of classical mechanics, and provide an algebraic structure for studying dynamical systems. This deep connection between traditionally separate fields has inspired a highly successful, emerging area of research. The workshop focused on this interplay, and provided a forum to foster new collaborations among domestic and international researchers in each field.

> [The workshop] has led to two new research collaborations/directions for me personally with people I had not met before the workshop.
>
> Aidan Sims (University of Wollongong)

Organisers' opinion of success

The workshop was a resounding success. It introduced young researchers to open problems, created new collaborations for established researchers, and provided new research directions for both groups. With a strong international focus the workshop helped to cement Australia as a world leader in pure mathematics.

The workshop managed to bring together operator algebraists and dynamicists and showcase the interconnectedness of the two fields. The size of the workshop allowed for good mingling in the breaks, which led to many interesting discussions. All the speakers made sure to keep the mixed audience in mind when presenting, something that seems trivial but is not always the case.