

# Starting a dialogue: MQ Photonics Research Centre and Maths & Stats



**MACQUARIE**  
University

**MQ Photonics Seminar, Monday 13 May,  
3 PM in Room 2.300 7WW  
Followed by refreshments**

## 1. Dr Georgy Sofronov

**Title:** Change-point detection problems



In many real applications, observations are taken sequentially over time. The question is whether the data obtained are generated by one or by many different probabilistic mechanisms. The change-point problem arises in fields including bioinformatics, biomedical signal processing, speech and image processing, seismology, industry (fault detection) and financial mathematics. Here we consider various approaches to change-point detection to find estimates of change-points as well as parameters of the process on each segment.

Georgy Sofronov is a Senior Lecturer in Statistics at Macquarie University. His research interests include Markov chain Monte Carlo simulation, the Cross-Entropy method, change-point problem and optimal stopping rules.

## 2. Dr Christopher Lustri

**Title:** Hyper-asymptotics: Summing the Unsummable to see the Invisible



Sir Michael Berry and Chris Howls developed hyper-asymptotic techniques designed to explore behaviour that is invisible to classical asymptotic methods. These techniques involve finding the "sum" of divergent infinite series. Eliminating the sum enabled Berry and Howls to characterise the "leftovers": they could find small exponentials that were hidden behind larger ones. I will summarise these unusual techniques, and will showcase some problems from optics and quantum mechanics which were studied using these methods, including radiation from finer optic waveguides, transition probabilities in two-state quantum systems, and the diffraction of Pearcey beams. Finally, I will outline my approach to explore nonlinear waves in particle systems.

**Bio:** Chris Lustri is currently a Lecturer in Applied Maths at Macquarie University. He is working on "A new asymptotic toolbox for nonlinear discrete systems and particle chains".

