



## Joint PhD Project and Scholarship



### Dynamics and rogue waves in injection-locked broad-area lasers

#### Project description

Semiconductor lasers are high performance devices which are an enabling technology for the modern information society. Their complex dynamics are of strong scientific interest and emerging technological significance. Evidence of “rogue pulses” were found in injection-locked semiconductor lasers in spatial single-mode operation [[PRL 107, 053901 \(2011\)](#)] contributing to the rapidly developing field of extreme events [[J Opt B 18, 063001 \(2016\)](#)]. Recent theoretical work at Strathclyde indicates a new mechanism for rogue waves in spatially extended, injected laser systems [[PRL 116, 043903 \(2016\)](#)]. This project is aimed at promoting the understanding of the complex dynamics of spatially extended, multi-mode systems with an experimental focus. The complex dynamics of injection-locked broad-area vertical-cavity semiconductor lasers (VCSELs) and broad-area edge-emitting semiconductor lasers will be analysed via complexity measures [[Opt Exp 22, 1713 \(2014\)](#)] and contrasted. Both systems will be explored for evidence of coupling between temporal and spatial dynamics and the potential for spatio-temporal rogue waves.

The PhD project will involve:

- design and construction of computer controlled nonlinear laser systems with automated data collection,
- application of cutting-edge, multi-GHz bandwidth, real-time output power time series measurements,
- learning and further researching nonlinear dynamics and high-end data analysis, including complexity measures,
- developing big data handling capabilities,
- writing papers and communicating outcomes of research at national and international conferences.

Macquarie University (Sydney, Australia) and the University of Strathclyde (Glasgow, UK) are inviting applications from **EU citizens** for a Joint PhD in the area of Lasers and Nonlinear dynamics. A Joint PhD enables students to simultaneously enrol in a doctoral degree at two universities and submit a single thesis for joint recognition. Students will be guided by supervisors from each university and spend 20 months on campus at Macquarie University and 22 months at University of Strathclyde, benefitting from the resources and expertise of each partner and the international research collaboration between the groups. One thesis is submitted for joint examination, and upon meeting the requirements of both institutions, a single PhD testamur is issued bearing the crests of both universities. An eligible applicant will need to be successful in a competitive scholarship scheme and will be provided with stipend plus tuition fees, if successful. The applicant must submit an application for admission and a scholarship to both institutions.

Required qualifications and competences: Suitable applicants for this PhD position will have achieved a Master Degree by research or 2-year Master by coursework with a major research component in experimental physics (or related discipline with equivalence) at First Class/High Distinction level or equivalent. Applicants with other research-focused qualifications or a combination of qualifications relevant research experience (e.g., a record of publications) may also be considered.

The successful applicant will have dedication and enthusiasm for experimental research, and will have good communication skills.

The successful applicant will become a member of the Scottish Universities Physics Alliance (SUPA) Graduate School, which offers a wide range of high-quality courses and training activities, and will be required to complete the [Postgraduate Certificate in Researcher Professional Development](#) at Strathclyde. Similar professional development opportunities are provided at Macquarie University.

Further information and contacts:

For further information, please contact Professor Deborah Kane ([deb.kane@mq.edu.au](mailto:deb.kane@mq.edu.au)) and Professor Thorsten Ackemann ([thorsten.ackemann@strath.ac.uk](mailto:thorsten.ackemann@strath.ac.uk)).

Applications for this Joint PhD project close on 27 June 2016. The project is expected to commence on 1 Oct. 2016.