

---

## Photon Thermalization and Bose-Einstein Condensation in a InGaAs Quantum Well Open Microcavity

<sup>1</sup>*Imperial College London, UK,*

<sup>2</sup>*Sheffield University, UK*

Ross Schofield<sup>1</sup>, Ming Fu<sup>1</sup>, Himadri Dhar<sup>1</sup>, Rick Mukherjee<sup>1</sup>, Ian Farrer<sup>2</sup>,  
 Edmund Clark<sup>2</sup>, Jon Heffernan<sup>2</sup>, Florian Mintert<sup>1</sup>, Rob Nyman<sup>1</sup>,

**Rupert Oulton<sup>1</sup>**

**Email: [r.oulton@imperial.ac.uk](mailto:r.oulton@imperial.ac.uk)**

The thermalization of light and its ground state condensation has been extensively explored in dye fill open microcavities. The link between laser action and Bose Einstein condensation of a thermalized photon gas brings a unique way to understand and describe multi-mode interactions and laser mode stability for example. In this talk we present evidence of the thermalization and condensation of light in a semiconductor quantum well open microcavity system. Our device resembles a vertical external cavity surface emitting laser, constructed on GaAs with an InGaAs quantum well emitting near 925 nm, and utilizing a piezo controlled external curved dielectric mirror placed to achieve low cavity mode orders. We identify a region of condensate ground state mode stability that indicates good thermalization and operation in the condensed state. Other regions of operation are associated with multi-mode lasing, allowing us to define the conditions for Bose-Einstein condensation in our device. We comment on performance metrics of our device and evaluate the strength of photon-photon interactions, which we find our stronger interactions than in dye based photon condensates, and could open the possibility of superfluid effects.



**Short Bio:**

**Rupert Oulton is a Professor of Nanophotonics and Deputy Head of the Department of Physics at Imperial College London. Following his Ph.D. in Physics at Imperial, he worked at UC Berkeley, returning to the UK as an EPSRC Fellow and Leverhulme Lecturer.**