# Towards polariton blockade with fiber-cavity polaritons.

Benjamin Besga[1,2], Cyril Vaneph[3], Andrew Wood[1,2], Nitin Nand[1,2], Thomas Volz[1,2], Jakob Reichel[3], Jean Hare[3], Jérome Estève[3], Andreas Reinhard[4], Javier Miguel-Sànchez[4] , Emre Togan[4], Atac Imamoglu[4]

[1]*Macquarie University NSW 2109 Australia*

[2]*Center of Excellence for Engineered Quantum Systems, School of Physics*

[3]*Laboratoire Kastler Brossel, UMR8552, Université Pierre et Marie Curie (UPMC) - Paris VI, École normale supérieure, 24 rue Lhomond, F-75231 Paris CEDEX 05 - France and*

[4]*Swiss Federal Institute of Technology in Zurich - ETHZ (SWITZERLAND)*

Semiconductor cavity polaritons have established themselves as a test bed for studying fundamental aspects of quantum fluids in a solid-state setting. So far, most of the experiments have relied on fully integrated devices with very little flexibility for in-situ tuning of experimental parameters. Here we report on experiments using semi-integrated fiber micro-cavities for creating confined semiconductor cavity polaritons. The fiber cavities give direct control over the photonic degrees of freedom of the polariton system through the tunability of the cavity length. In the experiment, we observe the formation of cavity polaritons and demonstrate in-situ tuning of the cavity lifetime, coupling and detuning between the exciton and the cavity mode, which in turn means tuning of the polariton energy and lifetime. We observe high cavity quality factors, and thus long polariton lifetimes exceeding 100 picoseconds offering the prospect of creating equilibrated polariton quantum fluids. The fiber cavity system presented here is well suited for the study of strongly confined polariton systems, since the fiber mirror can be designed to give a small cavity waist and thus strong polariton confinement. With a newly fabricated set of fiber mirrors having less than 10 µm radius of curvature, we expect to access the polariton blockade regime opening the door towards single-photon non-linear optics with polaritons.