Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Entangled photons from the polariton vacuum in a switchable optical cavity ADRIAN AUER, GUIDO BURKARD, Department of Physics, University of Konstanz, Germany — We study theoretically the entanglement of two-photon states in the ground state of the intersubband (ISB) cavity system, called polariton vacuum. The system is formed by a sequence of quantum wells (QWs) located inside a microcavity and the interaction of cavity photons with ISB excitations inside the QWs leads to the formation of polariton states. In the ultrastrong coupling regime, the polariton vacuum already contains a finite number of photons, of which pairs with opposite in-plane wave vectors are correlated. In an explicit solution for the polariton vacuum, we only consider certain two-photon states by post-selection and analyze them for mode entanglement, i.e. in the momentum degree of freedom. We find an analytical expression for the entanglement using the concurrence [1], which depends on the absolute values of the in-plane wave vectors of the photons. In the limit of large cavities and for photon energies around the ISB resonance in the mid infrared regime, the photons are almost maximally entangled, which is fundamentally important for their possible use in quantum information processing. Furthermore, there exists a continuous set of mode pairs, for which the photons are maximally entangled.

[1] A. Auer and G. Burkard, Phys. Rev. B **85**, 235140 (2012).

Adrian Auer
Department of Physics, University of Konstanz

Date submitted: 08 Nov 2012 Electronic form version 1.4