Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Half-quantum circulation and optical spin Hall effect in a polariton spinor ring condensate[1] GANGQIANG LIU, DAVID SNOKE, University of Pittsburgh, ANDREW DALEY, University of Strathclyde, LOREN PFEIFFER, KENNETH WEST, Princeton University — We have observed half-quantum circulation in a macroscopic polariton spinor condensate in a ring trap. In our experiment, the polaritons come from the strong coupling between photons and electronic excitations (excitons) in quantum wells embedded in a microcavity. The polaritons are repulsively interacting bosons with small effective mass. The ring trap is a combination of a strain-induced harmonic trap and a laser-generated central barrier. By measuring the phase and polarization of the condensate, we find that theres is a phase rotation of π in connection with a polarization rotation of π around a closed path. In addition, the handedness of the circular polarization component, which gives the spin of the polariton, flips from one side of the ring to the other. Such a state is allowed in a ring geometry but is prohibited in a simply-connected geometry. The direction of circulation of the flow around the ring fluctuates randomly between clockwise and counterclockwise; this corresponds to spontaneous breaking of time-reversal symmetry in the system. In contrast, the polarization pattern of the condensate is very stable which is very likely due to the optical spin Hall effect playing a role as the condensate is generated.

[1]This work is supported by the National Science Foundation under grants DMR-1104383 and PHY-1148957. The work at Princeton was partially funded by the Gordon and Betty Moore Foundation as well as the National Science Foundation MRSEC Program (DMR-081986).

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Date submitted: 29 Jan 2015 Electronic form version 1.4