Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Magnetic-Field Modulated Josephson Oscillations in a Planar Semiconductor Microcavity[1] GUOJUN JIN, CHUANYI ZHANG, Nanjing University — An exciton-polariton Josephson junction in a planar semiconductor microcavity is studied by considering an external magnetic field applied normal to its plane [1]. Theoretical results show that there is a competition between the Zeeman energy and the interactions of exciton polaritons, and a critical magnetic field can be determined. Below the critical magnetic field, there are time-independent extrinsic and intrinsic Josephson currents which manifest the dc Josephson effect; while above the critical magnetic field, the ac Josephson effect occurs with the oscillating extrinsic and intrinsic Josephson currents. The oscillation frequency and oscillation amplitude of the Josephson currents are modulated by the magnetic field, and also the spontaneous polarization separation and the macroscopic quantum self-trapping of condensate can be realized under an appropriate magnetic field. The physical origin behind is exposed and the analogy with the Josephson effect in a conventional superconducting Josephson junction is discussed. It is suggested that magnetic fields can be used to facilitate the experimental investigations of the exciton polaritons Josephson effect in semiconductor microcavities.

[1] Chuanyi Zhang and Guojun Jin, Phys. Rev. B 84, 115324 (2011).

[1]This research was supported by the PAPD, NSFC (Nos. 60876065, 11074108) and NBRPC (Nos. 2009CB929504, 2011CB922102).

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Date submitted: 02 Nov 2011 Electronic form version 1.4