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Spin Current from Quantum Dots embedded in a Microcavity

IVANA DJURIC, CHRIS SEARCH, Stevens Institute of Technology — We examine the spin current generated by quantum dots embedded in an optical microcavity. The dots are connected to leads with zero bias voltage across the dot with one of the Zeeman states lying below the Fermi level of the leads and the other above. The spin current is generated by spin flip transition from the lower to upper Zeeman states induced by Raman transition involving a classical pump field and a quantized cavity mode. In the case when the spin flip transition is accompanied by emission of a photon into the cavity mode, we calculate the spin current and the photon current associated with the photons leaking out of the cavity as well as the shot noise. We show that the photon current is equal to the spin current and that the spin current can be significantly larger than for the case of a classical driving field. The frequency dependent spin (photon) current shot noise show dips (peaks) that are a result of the discrete nature of photons. In the case of absorption of the photon from the cavity mode, we find that the cavity mode and the spin current exhibit bistability as a function of the laser amplitude, which is driving the cavity mode. Even for a single dot, the spin current and the cavity field have a bimodal structure.

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