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Strong-field interactions between a nanomagnet and a photonic cavity[1] Ö. O. SOYKAL, M. E. FLATTÉ, Optical Science and Technology Center and Department of Physics and Astronomy, University of Iowa — We analyze the interaction of a nanomagnet (ferromagnetic) with a single mode of a high-Q cavity in a fully quantum treatment and find that exceptionally strong magnetic coupling regime between a magnetic and a photonic system can be achieved. Coupling terms in several THz are predicted to be achievable in a spherical cavity of ~ 1 mm radius with a nanomagnet of ~ 100 nm radius and ferromagnetic resonance frequency of ~ 200 GHz. Since eigenstates of the magnet-photon system are entangled states of spin orientation and photon number over 10^5 of each quanta, initial coherent states of spin and photon number evolve dynamically to produce large oscillations in the microwave output power and the nanomagnet spin orientation with exceptionally long dephasing times. Therefore, this distinguishable large total spin, long coherence times, and high power output of the nanomagnet-cavity system may serve as an efficient means of transferring information between a magnetic and a photonic system.

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