Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Active feedback lock of a Fabry-Perot cavity to the emission of a single quantum dot JOHN LAWALL, MICHAEL METCALFE, GLENN SOLOMON, NIST — Self-assembled quantum dots behave as artificial atoms that are spatially localized in a solid-state environment, with discrete energy levels that can be manipulated by external fields. By embedding them in a semiconductor cavity, the fluorescence can be made strong enough to lock a macroscopic Fabry-Perot cavity to the emission of a single quantum dot. We demonstrate here the ability to lock a cavity to a quantum dot with a mean transmitted photon flux of 4 kHz. For short integration times, the error signal is dominated by shot noise, and at long integration times, it is dominated by cavity drifts. We present an analytic approach to determining the optimum integration time and servo feedback characteristics. We will discuss the prospects for using a Stark shift to invert the situation and lock the emission wavelength of a quantum dot to a stable Fabry-Perot cavity.

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Date submitted: 23 Jan 2009 Electronic form version 1.4