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Probing coherent tunneling in semiconductor quantum dots using electromechanical backaction JAMIE GARDNER, AASHISH CLERK, Department of Physics, McGill University — Self-assembled quantum dots have been studied intensely because of their possible applications to quantum information processing. While such dots are difficult to characterize using direct electrical transport measurements, it has recently been shown both theoretically [1] and experimentally [2] that a capacitively coupled AFM cantilever can serve as a sensitive probe of dot charge dynamics and electronic level structure. This sensitivity is based on the fact that the dot, which is tunnel-coupled to electrons in a reservoir, acts as a dissipative bath for the cantilever. Here, we extend previous theoretical work to describe an AFM cantilever coupled to a double quantum dot. Unlike a single-dot, the double-dot system exhibits both incoherent tunneling to the leads and coherent tunneling between the dots. We find that the cantilever's motion is affected by both kinds of tunneling and can yield significant information even in regimes where the total double-dot charge does not fluctuate. Cantilever dynamics can also be used to learn about the strength of dephasing processes in the double-dot. After presenting the theoretical approach to this problem, we will discuss the results in the context of current experimental efforts using InAs dots. These effects should also be accessible in a variety of other quantum dot setups. [1] S. D. Bennett, et al., Phys. Rev. Lett. **104**, 017203 (2010). [2] L. Cockins, et al., Proc. Nat. Acad. Sci. **107**, 9496 (2010).

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