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Tunable Quantum Phase Transition in a Dissipative Resonant Level[1] D.E. LIU, H. ZHENG, H.T. MEBRAHTU, G. FINKELSTEIN, H.U. BARANGER, Duke University — We show that quantum phase transitions (QPT) exist in a simple dissipative resonant level system. The electromagnetic environment couples both to tunneling processes (characterized by lead resistance Re) and to voltage fluctuations of the gate (characterized by gate resistance Rg). We bosonize this model and map it to a Tomonaga-Luttinger type model. Using a "Coulomb-gas" RG analysis, we relate our dissipative resonant level model to the double barrier problem in a Luttinger liquid. For the symmetric case and Re + Rg $> 2h/e^2$, a Kosterlitz-Thouless QPT separates strong-coupling and weak-coupling phases. Interestingly, in the symmetric case, all relevant couplings between tunneling processes and the environment disappear, leading to perfect transmission at T=0. A second order QPT is also induced by coupling asymmetry for Re + Rg $< 2h/e^2$. The two phases correspond to the resonant level merging with the right lead while the left lead decouples, and vice versa.

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D. E. Liu
Duke University

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