Kondo-Fano conductance oscillations in a non-proportionally-coupled dot-cavity device.

Luis G. Dias da Silva  
*Instituto de Física, Universidade de São Paulo*

Caio H. Lewenkopf  
*Instituto de Física, Universidade Federal Fluminense*

Edson Vernek, Gerson Ferreira  
*Instituto de Física, Universidade Federal de Uberlandia*

Sergio E. Ulloa  
*Department of Physics and Astronomy, Ohio University*

The transport properties of nanostructured systems are deeply affected by the geometry of the effective connections to metallic leads. The well-known Meir and Wingreen conductance formula [1] for interacting systems is limited in application to “proportionally coupled” terminals. In this work [2], we extend this formalism to consider non-proportionally-coupled structures, such as the quantum dot (QD)-quantum cavity (QC) geometry recently realized in Ref.[3]. We study an interacting QD connected coherently to tunable electronic cavity modes. The QD and the QC are coupled to the right lead but only the QD is coupled to the left lead. This non-proportionally coupled geometry is shown to exhibit a well defined Kondo effect over a wide range of the QD-QC coupling strength. Owing to quantum interference, changes in the cavity geometry dramatically modify the conductance and the spin configuration of the QD. Our numerical renormalization group calculations show that the cavity modes modulate the effective density of metallic states coupled to the QD, inducing unexpected splittings in the Kondo resonances. Moreover, the calculated conductance through the device exhibits oscillatory Fano-like features at large QD-QC couplings, while maintaining strong spin correlations with the electronic reservoir, in agreement with recent experimental results [3].