2D Lineshape of a Fano Model

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We present the analytical expression of the 2D lineshape of a Fano system coupled to a Markovian bath. We discuss its most prominent features as well as the physical parameters of the system that can be accessed.

The Fano profile occurs when a discrete excited state interacts with a continuum set of excited states. Both set of states are reachable by photoexcitation so that the population in the continuum results from the sum of two pathways - one direct and one indirect via the discrete state - that can interfere constructively or destructively and lead to an asymmetric resonance profile. The profile is ubiquitous and has been successful in describing atomic physics spectra and more recently nanostructured devices where relaxation and dephasing are important. The prospect of analyzing nanostructured, dissipative Fano systems with 2D spectroscopy opens the door to understand in detail the dissipative processes that occur in a continuum. To this end we present the closed-form solution of the 2D lineshape of a Fano model in the wideband approximation coupled to a Markovian bath (Fig 1.). We discuss the different contributions from each of the Feynman pathways and outline the physical parameters that are only accessible by 2D spectroscopy.
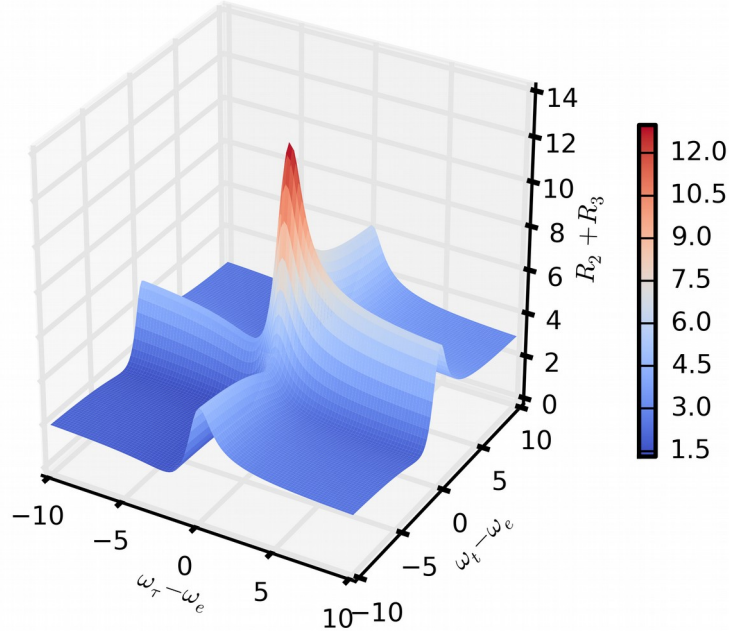

Figure 1. Absolute magnitude of the rephasing pathways of a Fano model.

[1] Fano Phys. Rev. 124, 1866 (1961)
[2] D. Finkelstein-Shapiro et al. Phys. Rev. Lett 115, 113006 (2015)