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Level attraction in a driven cavity magnonic system

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Level attraction describes a mode coalescence that can take place in driven open systems. It indicates a development of an instability region in the energy spectrum of the system bounded by exceptional points [1]. This regime has been recently reported in a number of experiments in driven dissipative cavity magnonic systems [2].

Here, we present a framework for describing the mode attraction in a variety of cavity magnonic systems where the interaction between cavity photons and magnons is described in terms of a non-linear relaxation process. We show that the memory function for the photon mode in this approach is expressed through a non-equilibrium susceptibility of the magnonic bath. This allows us to consider a situation in which a bath is driven out of the equilibrium that is necessary to describe the attraction regime. The advantage of this approach is that the susceptibility of the bath can be calculated numerically using first-principle methods.

Using this framework, we demonstrate how mode attraction can appear in driven cavity magnonic systems for certain geometries. This includes non-linear and non-local interactions between cavity photons and magnon modes.

[1] N. R. Bernier et al, Phys. Rev. A 98, 023841 (2018).
[2] Y.-P. Wang and C.-M. Hu, J. Appl. Phys. 127, 130901 (2020).

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