A Simple Mode on a Background of Unstable chaotic state

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Abstract

Simple states of predominantly 1p-1h structure embedded into continuum are typical for mesoscopic many-fermion quantum systems. When studied experimentally with the aid of various reactions, such a simple exitation is associated with a specific signal and reveal enhanced cross sections in specific channels at corresponding resonance energy.

Due to the coupling to complicated compound states in the same energy range, the simple mode, being fragmented over many exact stationary states, acquires an internal damping. As a result, the original state dissolves in the background and the exitation function becomes related to the wide average strength distribution of the original "label" smoothly depending on exitation energy.

However, the situation described changes appreciably in the realistic case with background states decaying through many evaporation channels. We consider here the most general case when both simple and background states are coupled to the continuum and have finite lifetimes. The interplay between internal and external dynamics is investigated using a general formalism of the effective non-Hermitian Hamiltonian and looking at the situation both from "inside" (strength functions) and from "outside" (cross sections and delay times). The widths of the intrinsic background states qualitatively modify the strength function of the simple mode restoring its individuality.

One has to project the dynamics of quasistationary intrinsic states with complex eigenenergies back to the real energy axis for determining the observables, such as cross sections and delay times, measured in a scattering experiment. In such a way one tracks the intrinsic dynamics in manifestations of the simple mode in various situations. The restoration of isospin purity and disappearance of the collective strength of giant resonances at high excitation energy are important particular examples.