CFEL SCIENCE

SEMINAR

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CFEL-bldg. 99, seminar room IV

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Rotation of quantum impurities in the presence of a many-body environment

The concepts of rotation and angular momentum are ubiquitous across quantum physics, whether one deals with the lifetimes of unstable nuclei, accuracy of atomic clocks, or electronic structure of defect centers in solids. Pioneered by the seminal works of Wigner and Racah, the quantum theory of angular momentum evolved into a powerful machinery, commonly used to classify the states of isolated quantum systems and perturbations to their structure due to electromagnetic or crystalline fields. In “realistic” experiments, however, quantum systems are almost inevitably coupled to a many-particle environment and a field of elementary excitations associated with it, which is capable of fundamentally altering the physics of the system.

We present the first systematic treatment of quantum rotation coupled to a many-particle environment. By using a series of canonical transformations on a generic microscopic Hamiltonian, we single out the conserved quantities of the problem. Using a variational ansatz accounting for an infinite number of many-body excitations, we characterize the spectrum of angular momentum eigenstates and identify the regions of instability, accompanied by emission of angular Cerenkov radiation.

The developed technique can be applied to a wide range of systems described by the angular momentum algebra, from Rydberg atoms immersed into BEC’s, to cold molecules solvated in helium droplets, to ultracold molecular ions.

[1] R. Schmidt and M. Lemeshko, Phys. Rev. Lett. **114**, 203001 (2015).

Host: Nina Rohringer – MPI-PKS