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Open quantum systems of atomic nuclei

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Weakly bound and unbound nuclei are complex open quantum systems (OQS) in which the coupling to the scattering continuum is crucial and should be properly treated. A small uncertainty in modeling would change the conclusions of physics. The nuclei around driplines can simultaneously undergo gamma-ray transitions, beta decays and particle emissions. An important feature of the loosely bound and unbound nuclei is that their excitation spectra contain low-lying resonant levels. Recently, we have made a plenty of investigations on the resonant excitation spectra of nuclei in the region of the neutron dripline. The calculations were performed using two types of ab-initio methods: Gamow shell model and Gamow in-medium similarity renormalization group, which were developed recently by our group. The resonance and continuum are treated in a self-consistent manner by using the Gamow-Berggren complex-momentum space. The ab-initio calculations start from the chiral effective field theory (chiral EFT). We can well reproduce and explain the experimentally observed resonant states, and as well predict many interesting resonant levels and decays.

References:

1. Resonance and continuum Gamow shell model with realistic nuclear forces, by Z.H. Sun, Q. Wu, Z.H. Zhao, B.S. Hu, S.J. Dai, and F.R. Xu*, Physics Letters B 769 (2017) 227.
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Primary author: Prof. XU, Furong (School of Phyiscs, Peking University)

Presenter: Prof. XU, Furong (School of Phyiscs, Peking University)

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