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Weakly bound nuclei: A unified description of intrinsic and relative degrees of freedom

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In this talk we present a recently developed method where cluster correlations co-exist with an underlying mean-field described core-structure. The method will be applied to nuclei close to the driplines, which are assumed to clusterize into a well-defined core and two valence nucleons. The variation of an antisymmetrized product of cluster and core wave functions and a given nuclear interaction, gives rise to a set of self-consistent equations of motion, which split into a set of standard Hartree-Fock equations, but distorted by the presence of the valence nucleons, and a three-body equation where the core-nucleon interaction is dictated by the core mean field.

The technique is first tested on the neutron dripline nucleus 26O, considered as 24O surrounded by two neutrons, for which experimental data are available. We choose Skyrme effective interactions between all pairs of nucleons, and the hyperspherical adiabatic expansion method to solve the three-body problem. On the proton dripline sector, we show results for 70Kr, described as 68Se plus two protons, which is a prominent waiting point for the astrophysical rp-process. We calculate radiative capture rates and discuss the capture mechanism. Finally, results for different Ca isotopes are also shown. In particular, we investigate the appearance of the halo structure in the case of 72Ca, as well as the possibility of appearance of Efimov states.

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