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Single-particle and collective motion in nuclear open quantum systems

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The properties of drip-line nuclei are profoundly affected by the environment of continuum states and the presence of decay channels. Their description requires the development of realistic theoretical approaches rooted in the open quantum system framework. However this formidable task presents many challenges and calls for closer collaborations between theorists and experimentalists. In this presentation a brief introduction to the problem of the description of weakly bound and unbound nuclei will be given with an emphasis on the relationship between nuclear structure and reactions. This will be illustrated by two recent investigations on the nuclei ^{11}Be and ^{39}Mg, where the role of the interplay between the collectivity and the continuum on single-particle structure has been studied. Finally the question of the existence of a nuclear system in the continuum is discussed for the case of the four-neutron system.