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Formation of clusters in stable and unstable nuclei explored by antisymmetrized molecular dynamics

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Clustering is one of the elementary degrees-of-freedom of nuclear excitation together with the single-particle and collective mean-field excitations. Owing to the theoretical and experimental developments in the decades, the concept of the nuclear clustering itself is rapidly expanding. In particular, increasing computational power provided an opportunity to extend our knowledge on nuclear clustering. The antisymmetrized molecular dynamics (AMD) is one of the theoretical models which boosted the study of nuclear clustering combined with high performance computing. In this presentation, we discuss frontier issues of nuclear cluster physics, mainly focusing on the latest results obtained by AMD studies. Particular attentions will be paid on the following topics. (1) Evolution of clusters in N=Z nuclei. By increasing the excitation energy, a variety of clusters appears. Such examples will be demonstrated in the case of ^{24}Mg, ^{28}Si and ^{32}S. The isoscalar monopole excitation function will be focused as an experimental signature of clustering. (2) Formation of covalent clusters in neutron-rich nuclei. Excess neutrons develop a novel type of clusters with covalent neutrons. Theoretical exploration of covalent states will be discussed.