Study of cluster reactions in advanced shell model approaches.

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Nuclear clustering is important component of nuclear dynamics. Nuclear reactions which make this dynamics visible are actively investigated in modern experiments. In particular a new thick ^{4}He target inverse kinematics technique provides a great body of data concerning complicated α-particle resonance spectra of nuclei. Thus to build a theory capable to shed light on the properties of these processes is of high importance.

In the current talk the feasibilities of modern microscopic approaches such as: Cluster-Nucleon Configuration Interaction Model, No-Core Shell Model, etc. in the study of these problems are discussed.

The proposed approach to clustering explores: the concepts of the cluster spectroscopic factors, the distribution of clustering strength; orthogonality conditions model description of exit\entrance channels; SU(3) group-theoretical properties of the initial and the final states; some other algebraic methods inherent to the operating with the harmonic oscillator basis.

Quality of the shell model description of clustering phenomenon is illustrated by examples of complex spectra of cluster states.