

Nonmicroscopic investigations of 3-alpha bosonic states in ^{12}C nucleus

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The transition from descriptions of nuclear-wave functions in terms of A nucleons (fermions) toward those in terms of $n < A$ composite clusters as e.g. particles (bosons) is far from being obvious. However, it represents a very interesting challenge which can help to point out states in which clustering is expected to be strongly dominant as in so-called condensate state, a typical example being the $0+2$ in the ^{12}C nucleus, known as the Hoyle state [1]. During this talk, we will mainly focuss on recent investigations of the ^{12}C nucleus performed with a nonmicroscopic n -particle model involving local and nonlocal potentials [2]. Faddeev equations formulated in configuration space are used to solve the 3-body problem for bound and resonant states. We demonstrate that the nonlocal potential developed by Z. Papp and S. Moszkowski appears to be particularly well-adapted to study 3 clustering. We point out ^{12}C states of positive-parity which share common features with the $0+2$ Hoyle states and are interpreted as 3-condensate states. Several negative-parity states revealing a clear bosonic n -particle structure are also obtained. We will conclude this talk with preliminary results obtained with a similar nonmicroscopic approach complemented by microscopic calculations for the ^{16}O nucleus.

1. T. Yamada, Y. Funaki, H. Horiuchi, G. Röpke, P. Schuck, A. Tohsaki, Lecture Notes in Physics 848 (2012) - Springer, Clusters in nuclei -Vol.2.
2. R. Lazauskas, M. Dufour, Phys. Rev. C 84, (2011)

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