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Study of 3- and 4-neutron systems using the hyperspherical method

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The low energy collision of three- and four-neutrons is studied using the adiabatic hyperspherical representation, aimed at understanding whether low energy resonances might exist. This study is motivated by the recent experimental claim of an observation of a four neutron resonance [Kisamori et al., 2016]. From the theoretical side, several studies haven been reported, however, the conclusions reached are in conflict. We study directly the three- and four-neutrons scattering process by means of the adiabatic formalism, and using modern microscopic nucleon-nucleon and three-nucleon interactions. We have found that a resonance-like feature arises in the time-delay spectrum for four neutrons, which according to criteria utilized to classify features in atomic physics, would indeed be designated as an observable resonance, at an energy around 0.7 MeV. A similar structure is also observed for three neutrons, although much less evident, at an energy very close to zero.

Author: Dr VIVIANI, Michele (INFN Pisa)

Co-authors: Prof. GREENE, C. H. (Department of Physics and Astronomy, Purdue University); Dr KIEVSKY, Alejandro (INFN)

Presenter: Dr KIEVSKY, Alejandro (INFN)

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