

Do light nuclei exhibit “collective“ motions?

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The Lorentz integral transform (LIT) method has allowed to perform ab initio calculations of the response function of ${}^4,6\text{He}$, and ${}^6,7\text{Li}$ to the isoscalar monopole [1] and isovector dipole operators [2,3] in a wide range of energies. In this work we focus in particular on the nature of the resonant behaviour of the cross sections exhibited by the results of those calculations and specialize in the ${}^4\text{He}$ case, where one has a 0^+ resonance close to the 3+1 thresholds. In fact, in inelastic electron scattering off ${}^4\text{He}$ one finds a pronounced resonant structure in the isoscalar monopole strength. The knowledge of this strength as a function of energy makes possible calculations of the corresponding non-energy weighted as well as energy-weighted and inverse energy-weighted sum rules. Comparing the sum rules with their contribution from the resonance region allows to establish the degree of collectivity of the resonant structure.

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