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Toroidal dipole mode in nuclei and other systems

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A toroidal dipole mode is a general phenomenon pertinent to both classical and quantum systems. In conventional fluid dynamics, this turbulence-induced mode is associated with the simplest vortical flow called Hill's vortex [1]. In solid-body physics [2], nanophysics and metamaterials [3] this is a second-order E1 effect leading to fantastic applications of the microwave-infrared fields [2,3].

During last decades, the toroidal E1 mode in nuclei attracts a high attention [4-10]. Its nuclear realization can give a fundamentally new information on the properties of this mode. I give a short review on the toroidal dipole in various systems and report a recent progress in investigation of E1 toroidal resonance in nuclei (interplay of the toroidal and pygmy E1 resonances [6], individual low-energy E1 toroidal states in light deformed nuclei [7,8], relation with cluster modes in light nuclei [9], toroidal resonance and nuclear vorticity, possible ways for identification of individual toroidal states in experiment [10]).

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