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TOROIDAL MODE: FROM GIANT RESONANCE TO INDIVIDUAL STATES

Last years the toroidal dipole resonance (TDR) attracts a high attention [1-4]. This mode is located at the energy of the pygmy dipole resonance and is believed to form the low-energy part of the isoscalar giant dipole resonance. The TDR is the only known dipole {\it vortical} mode in the family of intrinsic electric excitations.Just TDR perhaps generates the pygmy dipole resonance at the nuclear surface region [3]. Last years, various TDR properties were explored by our group within the self-consistent Skyrme Quasiparticle Random-Phase Approximation (QRPA), see review [4].However the TDR still has many open problems and even its experimental observation can be disputed [5].

In this connection, we propose a new route to study the toroidal mode: to switch the effort from TDR (embracing many states and masked by other multipole modes) to {\it individual} well-separated low-energy toroidal states. As was recently shown [6], such states can exist in low-energy spectra of light nuclei with a strong axial prolate deformation. For example, in 24Mg, this state appears as the lowest dipole K=1 excitation. These states can be easier discriminated and identified in experiment than TDR. Being observed, they could serve as excellent test cases to probe various reactions for vortical nuclear excitations. As a first step, we discus the possibility to observe the toroidal individual states in inelastic electron scattering.

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