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TOROIDAL MODE IN NUCLEI: FROM GIANT RESONANCE TO INDIVIDUAL STATES

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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 forms the low-energy part of the isoscalar giant dipole resonance. The TDR has many remarkable properties. This is the only known dipole vortical mode in the family of intrinsic electric excitations. The TDR is perhaps the origin of the pygmy dipole resonance [3]. Various TDR properties were explored by our group within the self-consistent Skyrme Quasiparticle Random-Phase Approximation (QRPA), see review [4]. Nevertheless, despite an impressive general theoretical and experimental effort, our knowledge on the TDR is still poor 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 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 easily discriminated and identified. They can serve as an excellent test cases to probe various reactions for vortical nuclear excitations. We briefly discuss the possibility to observe the toroidal individual states in inelastic electron scattering to back angles.

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Nuclear Structure, Spectroscopy, and Dynamics

Primary author: Prof. NESTERENKO, Valentin (BLTP, Joint Institute for Nuclear Research, Dubna, Moscow region, Russia)

Co-authors: Dr REPKO, Anton (Institute of Physics, Slovak Academy of Sciences, 84511, Bratislava, Slovakia); Prof. KVASIL, Jan (IPNP, Charles University, CZ-18000, Praha 8, Czech Republic); Prof. REINHARD, Paul-Gerhard (Institute of Theoretical Physics II, University Erlangen, Erlangen, Germany); Dr KLEINIG, Wolfgang (BLTP, Joint Institute for Nuclear Research, Dubna, Moscow region, Russia)

Presenter: Prof. NESTERENKO, Valentin (BLTP, Joint Institute for Nuclear Research, Dubna, Moscow region, Russia)

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