Contribution ID: **320** Type: **Oral**

Low-energy dipole response in the Sn isotope chain: Pygmy or not pygmy?

Thursday, 30 November 2023 17:15 (15 minutes)

The observation of resonance-like structure in the electric dipole response of heavy nuclei at energies around or below the neutron, commonly termed pygmy dipole resonance (PDR), has been a topic leading to considerable experimental and theoretical activities in recent years [1-4]. The interest has been triggered by attempts to understand the underlying structure but also because of its impact on the cross sections of (n,γ) reactions relevant for the nucleosynthesis of heavy elements. Qualitatively all mean-field based models predict the appearance of such a mode, however, with a broad range of predicted strengths and energy centroids depending on the chosen interaction and model space. Many theoretical studies interpret the PDR to arise from neutron skin oscillations, which implies a dependence of the PDR strength on neutron excess. The chain of Sn isotopes represents a particularly interesting case to test the impact of neutron excess on the low-energy E1 response in a systematic manner because their g.s. structure changes little. Here, we report results from a systematic investigation of the gamma strength functions (GSFs) in Sn isotopes with mass numbers between 111 and 124. It is based on a combined data set from Oslo-type experiments (as described in Ref. [5]) and a study of the (p,p') reaction [6] at very forward angles, together covering an energy range 2 - 20 MeV. This allows a decomposition of the low-energy dipole response with minimal assumptions into contributions from the tail of the giant dipole resonance and possible resonance-like structures on top. The excess strength is dominated by a peak at about 8 MeV seen in the isovector response only. For masses ≥118, the data demand the inclusion of a second peak centered at about 6.5 MeV and identified as the PDR by comparison with isoscalar probes [7,8] and (γ,γ') experiments [9,10]. Its strength corresponds to 0.1 - 0.5% of the TRK sum rule (much smaller than predicted in most theoretical investigations) but exhibits an approximately linear increase with mass number. The results are also compared to ab initio-based microscopic models [11].

Supported by the Research Council of Norway (project number 316116), the DFG under contract SFB 1245 (project 279384907), the GANIL visitor program, US-NSF grant PHY-2209376, and US-NSF career grant PHY-1654379.

[1] N. Paar, D. Vretenar, E. Khan, and G. Colò, Rep. Prog. Phys. 70, 691 (2007).
[2] D. Savran, T. Aumann, and A. Zilges, Prog. Part. Nucl. Phys. 70, 210 (2013).
[3] A. Bracco, E. Lanza, and A. Tamii, Prog. Part. Nucl. Phys. 106, 360 (2019).
[4] E. Lanza, L. Pellegri, A. Vitturi, and M. Andrés, Prog. Part. Nucl. Phys. 129, 104006 (2023).
[5] M. Markova et al., Phys. Rev. Lett. 127, 182501 (2021); Phys. Rev. C 106, 034322 (2022); Phys. Rev. C 108, 014315 (2023).
[6] S. Bassauer et al., Phys. Rev. C 102, 034327 (2020).
[7] J. Endres et al., Phys. Rev. Lett. 105, 212503 (2010).
[8] L. Pellegri et al., Phys. Lett. B 738, 519 (2014).
[9] K. Govaert et al., Phys. Rev. C 57, 2229 (1998).
[10] B. Özel-Tashenov et al., Phys. Rev. C 90, 024304 (2014).
[11] E. Litvinova, arXiv:2308.07574 (2023).

Attendance Type

In-person

Primary author: VON NEUMANN-COSEL, Peter (Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany)

Presenters: VON NEUMANN-COSEL, Peter (Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany); MARKOVA, Maria (University of Oslo); Dr LARSEN, Ann-Cecilie (University of Oslo); LITVINOVA, Elena (Western Michigan University)

Session Classification: Session 5

Track Classification: Nuclear Structure, Reactions and Dynamics