EXPERIMENTAL RESULTS ON THE PYGMY DIPOLE RESONANCE USING THE NRF METHOD

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Beside the Giant Dipole Resonance (GDR), many nuclei show the feature of additional low-lying electric dipole (E1) strength below and around the particle separation energies, which is usually denoted as Pygmy Dipole Resonance (PDR) [1]. The existence of the PDR in nearly every studied nucleus and the smooth variation of its properties lead to the assumption that the PDR is a newly discovered collective mode. While some of the gross characteristics are reproduced by different theoretical model descriptions, its detailed structure and the degree of collectivity are a matter of ongoing discussions.

An excellent tool to investigate bound E1 excitations is the method of nuclear resonance fluorescence (NRF) [2], which has been used in the last years to perform systematic studies of E1 strength below the neutron separation energy in nuclei of different mass regions [1]. Besides the possibility to perform systematic studies of the gross features of low-lying E1 strength this experimental method allows the investigation of the fine structure or of individual states using high-purity Germanium (HPGe) detectors in the γ-ray spectroscopy. Modern photon sources for this kind of experiments are bremsstrahlung and laser-compton-backscattering (LCB). While experiments with bremsstrahlung allow to investigate a large energy region within one experimental run and to identify single photo-excited states, the mono-energetic and highly polarized character of LCB is ideal to investigate certain energy regions or individual states in detail. In addition, experiments with mono-energetic photons provide the possibility to get insight into the decay properties of the PDR [5]. To further increase the sensitivity to certain decay channels and to investigate in detail the decay behaviour of the PDR we recently performed γ-γ coincidence spectroscopy in combination with the LCB beam at the High-Intensity Photon Source (HIγS) using the new installed γ^3 setup [3]. An overview on the available experimental data on low-lying E1 strength obtained with the NRF method will be presented.

REFERENCES

[1] D. Savran et al., Prog. Part. Nucl. Phys. 70 (2013) 210
[2] U. Kneissl et al., Rep. Prog. Phys. 70 (2007) 691
[3] B. Löher et al., Nucl. Inst. and Meth. 723 (2013) 136