A New Proposal to the High Intensity Gamma-Ray Source (HIγS) PAC-10

The Pygmy Dipole Resonance in $^{124}$Sn

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1 Experiment Summary

We propose to investigate the low-lying electric dipole strength in the semi-magic nucleus $^{124}$Sn using the $\gamma$-$\gamma$ coincidence method. The use of a high-efficiency $\gamma$-detection setup will allow for the first time to extract the part of the E1 strength that decays via $\gamma$-cascades, which has been missed in most of the previous experiments investigating the Pygmy Dipole Resonance (PDR) in stable nuclei below the particle threshold. The extracted strength of the PDR from the previous measurements thus provides only a lower limit of the dipole strength. Therefore, a systemic comparison of data sets for different nuclei and in particular a comparison with measurements for short-lived nuclei has not been possible so far. It has been shown recently in an experiment on $^{138}$Ba performed at the (HI$\gamma$S) facility that the part of the E1 strength that decays via $\gamma$ cascades might be indeed significant in particular close to the threshold.

Aim of the proposed experiment is to measure in addition to ground-state decays 2-photon cascades via low-lying excited states. An inclusive measurement of the strength decaying via the low-lying states, in particular via the first $2^+$ state, will be provided as well. The excitation-energy range of 5 MeV to 9 MeV will be investigated, thus covering the full energy-range of the PDR including one measurement just above the neutron separation threshold. From the data, the total absorption cross section will be extracted as well as the decay pattern. This measurement will serve as a benchmark for the next-generation experiments with radioactive beams along the tin isotopic chain, which are being planned for 2012 at the R3B experiment at GSI.