Dipole Excitation of Soft and Giant Resonances in ^{132}Sn and neighbouring unstable nuclei

Konstanze Boretzky for the LAND-FRS Collaboration
GSI Darmstadt, Germany

Results from dipole strength measurements for exotic nuclei in the ^{132}Sn region will be presented.

Theoretical calculations predict a sizeable concentration of dipole strength at energies below the Giant Dipole Resonance (GDR) in case of very neutron-rich nuclei. For light nuclei this low-lying strength as e.g., observed in earlier experiments of our collaboration for oxygen isotopes, is according to theory of non collective character. In contrast, for medium heavy exotic nuclei a collective phenomenon is predicted, often called soft dipole or pygmy resonance.

The experimental technique comprises the electromagnetic projectile excitation of a secondary beam of unstable nuclei in a high-Z target at beam energies of several hundred MeV. Secondary beams of unstable $^{129-132}$Sn and neighbouring isotopes with similar A/Z ratio were produced by in-flight fission of a primary ^{238}U beam at the fragment separator FRS at GSI and were directed to a secondary lead target at the LAND setup. The measurement of the four-momenta of all decay products following the projectile excitation, i.e., neutrons, γ-rays and the heavy fragment, allows to reconstruct the excitation energy by means of the invariant mass analysis. Dipole strength distributions ranging from the neutron separation threshold up to 30 MeV excitation energy were derived from the measured excitation cross sections.

The data reveal the giant dipole resonance structure. For the GDR parameters, within error bars, no significant deviations from the systematics known from photoabsorption measurements in stable nuclei are observed. In addition, clear evidence for a resonant-like, relatively narrow structure at lower excitation energy is obtained. In ^{130}Sn and ^{132}Sn, e.g., this low-lying resonance is centered at around 10 MeV and comprises 7(3) %, respectively 4(3) % of the Thomas-Reiche-Kuhn sumrule strength. The data are compared to results from relativistic and non-relativistic (Q)RPA calculations[1][2].

[1] D. Vretenar *et al.,* Nucl. Phys. **A692** (2001) 496
[2] D. Sarchi *et al.,* Phys. Lett. **B601** (2004) 27