Recent results from the decay studies of high-energy giant resonances

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A systematic study of high-energy overtone modes of isoscalar giant resonances, especially of the $3\hbar\omega$ isoscalar giant dipole resonance (ISGDR) has been established in particle decay experiments in order to investigate the microscopic structure of the giant resonance formation and to offer a novel test for the most recent RPA calculations [1,2]. Beside the fundamental interest of studying internal structures, the ISGDR - possessing compression oscillation character similarly to the giant monopole resonance (ISGMR) - has special relevance in modeling astrophysical phenomena through the application of the compression modulus in the nuclear equation-of-state.

Experimental data on the ISGDR available so far have been obtained from singles measurements using inelastic α-scattering to excite isoscalar modes. The extraction of bulk resonance parameters such as excitation energy and width has always encountered the problem of the instrumental background and nuclear continuum, mainly under weakly excited damped resonance structures. These background contibutions required special treatment to separate them from giant resonance strengths, and introduced additional uncertainties in the deduced resonance parameters. The observation of the direct particle decay was proven to be a clean and efficient tool to overcome background subtraction problems. The experimental resolution enabled the separation of some low-lying single-hole states in the daughter nuclei, which selected resonance strengths with particle-hole structures and suppressed statistical decay contributions of the continuum states [3]. We obtained a better definition of the ISGDR strength distributions and structure information for several spherical nuclei, and preliminary indications for a quadrupole structure around $4\hbar\omega$ excitation energy in ^{208}Pb.

The experimental details and the interpretation of the results will be presented.

References

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