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Measurements of the nuclear dipole resonance with MAGIX at MESA

Nuclear multipole resonances have long been studied as a source of information on bulk nuclear properties. The nuclear dipole response has received much experimental and theoretical attention due to the proposed correlation between the pygmy dipole resonance (PDR) and the nuclear equation of state. Such a connection interprets the PDR in neutron-rich nuclei as the oscillation of the neutron skin against the symmetric nuclear core, correlating the strength of the PDR with the neutron skin thickness and nuclear symmetry energy. However, this connection remains model-dependent and controversial, and alternative interpretations of the PDR have been argued for. Additional experimental and theoretical efforts are required to clarify the situation.

Using electron scattering to excite nuclear resonances is complementary to experiments using real photons or hadronic probes. The MAGIX experiment, under construction at the MESA facility at JGU Mainz, is excellently suited for such measurements. MESA will deliver an electron beam with energies up to 105 MeV. Using a pair of magnetic spectrometers, MAGIX will reconstruct scattered electrons with high resolution ($\delta_p/p = 10^{-4}$) across a wide range of scattering angles. These capabilities will allow high-precision measurements of dipole resonances in a range of nuclei, further elucidating the connection of the dipole response to nuclear structure.

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