Spin-dipole excitations studied with tensor polarised deuteron beams*

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In comparison to Gamow-Teller transitions, experimental studies of higher multipole spin-isospin excitations are involved. The associated transitions are shifted to higher excitation energies and the strength distributions are more spread.

During my talk I will present experimental investigation of the S = L = 1 spin-dipole resonance (SDR) in ^{12}B, the so-called first forbidden GT strength. The experiments took advantage of the spin, isospin and J^π selectivity of cross sections and analysing powers of the tensor polarised ^{12}C($\vec{d}$,^{2}He) reaction. The experiment was performed at the Big-Bite Spectrometer of the KVI taking advantage of purely tensor polarised d beams provided by the AGOR cyclotron.

Due the finite orbital angular momentum transfer the SDR splits into three components having $J^\pi = 0^-, 1^-, 2^-$ when the target nucleus has $J^\pi = 0^+$. Besides the location of SDR, the identification of the J^π components has gained special attention. This is not the least due to the requirements imposed by the theoretical interpretation of $0\nu2\beta$-decay measurements where the J^π components of the SDR provide significant contributions to the nuclear transition-matrix element and experimental information on the decomposition of the SDR provides important calibration for theory. A special challenge is posed by the identification of the $J^\pi = 0^-$ component, which is the most elusive component and which is not accessible to electromagnetic probes. The collective $J^\pi = 0^-$ component of the SDR is considered to act as mediator for parity mixing in complex nuclear states and the excitation energy is sensitive to the treatment of pion exchange in the nuclear potential.

The unique energy resolution we achieved at KVI allowed determination of analysing powers for well resolved transitions up to 5 MeV excitation energy. The analysing powers of states with known spin and parity provided the means for the first-time for verification of model-independent predictions of analysing powers at extreme forward angles. In the continuum region, the analysing powers allowed identification of the J^π components of the IVSGDR, including a $0^?$ component located at $E_x = 9.3$ MeV.

In a second part of the talk I will present a short outlook on possibilities to run charge exchange reactions in inverse kinematics. I will put special emphasis on the feasibility and the specific challenges of the $(d,^2He)$ reaction performed at FAIR energies.

*This work was performed as part of the research program of the *Stichting voor Fundamenteel Onderzoek der Materie (FOM)* with financial support from the *Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO)*.