E1 strength around threshold in $^{70}$Ni$^\dagger$

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The electric dipole response of atomic nuclei is presently attracting increasing attention from the nuclear physics research community. In particular, the E1 strength in neutron-rich nuclei, located at around one particle separation energy (6-12 MeV energy range) is the object of a large effort1,2,3,4 (and references therein). In this energy region structures and accumulations of the E1 strength were measured in a variety of nuclei along along the entire valley of stability, but very scarce data for exotic nuclei are available. These structures are commonly called pygmy dipole resonance (PDR) as they lie at energies below the giant dipole resonance (GDR) and have lesser strength. They are at the center of the scientific debate as the strength is connected to the neutron skin thickness5, the symmetry energy term of the nuclear equation of state and has important astrophysical implications in explosive nucleosynthesis scenarios.

In order to understand better the characteristics of this PDR strength it is important to study an isotopic chain of a nucleus with increasing neutron number. As the pygmy PDR strength it is important to study an isotopic chain of a

In order to detect gamma rays from the decay of different nuclear levels, the reaction target was surrounded by a combination of eight large-volume $3.5'' \times 8''$ LaBr$_3$:Ce detectors (providing high efficiency and resolution5) mounted at 30° in the forward direction and of the DALI2 array6 (consisting of 96 NaI(TI) crystals) at mid and backward angles.

Figure 1 shows the first outcome of the experiment, which is the observation of the first 2+ state of $^{70}$Ni. It is planned that the 2+ $\rightarrow$ 0+ B(E2) transition strength will be determined. In the inset an important unresolved E1 contribution between 5 and 8 MeV is observed. The E1 character is deduced from the measured spectra at backward angles and the projectile GDR–tail calculated with a statistical model.

In order to determine the E1 strength distribution in $^{70}$Ni an absolute efficiency measurement of the detectors at NewSUBARU is planned in 2016. The analysis of the relation between the strength and the neutron skin in $^{70}$Ni together with the data of the

References

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2) D. Rossi et al. PRL 111, 242503 (2013).
5) A. Giaz et al. NIM A729, 910 (2013).