Decay of the "stretched" M4 state in ^{13}C studied by gamma-particle coincidences

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The results of the experiment aiming at investigation of "stretched" single-particle state in ^{13}C, which has been recently performed at Cyclotron Centre Bronowice (CCB) at IFJ PAN in Kraków, will be presented. The stretched states, arising from the promotion of one particle across the shell gap and possessing the highest possible spin which such configuration offers, are the simplest nuclear excitations in the continuum. Their properties are poorly known, even though they are of key importance for the physics of unbound systems. In light nuclei, as ^{13}C, stretched excitations appear as high-lying resonances and direct measurement of their decay should provide data, which will be used as a very demanding test of state-of-the-art theory approaches, from Shell Model in the Continuum to ab-initio type, shedding as well light on details of the nuclear force.

Here, the investigations of the decay of the so-called M4 resonance located at 21.47 MeV in ^{13}C will be presented. The experimental data were obtained by measuring inelastically scattered protons (which excite the resonance) in coincidence with charged particles, from the resonance decay, and gamma rays from daughter nuclei. In particular, the emitted gamma rays give a precise knowledge of the feeding to specific states, even in the case of neutron decay from the resonance state. Measurements were done by employing inelastic scattering of proton beam from the cyclotron at CCB in Krakow on a ^{13}C thick target and detecting emitted gamma rays and light charged particles. The detection setup consisted of: i) the KRATTA telescope array, ii) an array of LaBr3 detectors, iii) two clusters of the PARIS scintillator array, and iv) a thick position-sensitive Si detector.

The experimental results will be compared with the theoretical calculations based on the Gamow Shell Model approach, provided by the theory group in Kraków.