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PROTON EMISSION FROM HIGHLY EXCITED ^{58}Ni NUCLEI FOLLOWING ELECTROEXCITATION*

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In order to investigate the proton decay of highly excited ($25 \le E_x \le 41$ MeV) medium heavy nuclei we have studied the reaction ^{58}Ni(e,e'p)^{57}Co at four momentum transfers between 0.4 and 0.85 fm^{-1} using 183 MeV electrons from the MAMI A accelerator in Mainz. We have observed a surprisingly large probability (> 17%) for direct decay through proton emission populating low-lying hole states[1] of the residual nucleus ^{57}Co, namely the $(1f_{7/2})^{-1}$ ground state (denoted by "p_0") and an unresolved group of states at $E_x(^{57}\text{Co}) \approx 3$ MeV, dominated by the $(2s_{1/2})^{-1}$ and $(1d_{3/2})^{-1}$ hole states ("p_1").
The angular correlation functions (ACF) show a pronounced forward-backward asymmetry (see e.g. fig. 1) indicating interference of multipolarities of opposite parity. For the first time continuum RPA calculations[2] of ACFs have been performed for medium heavy nuclei which yield, on absolute scale, a good agreement with the data. The analysis of the ACFs and the comparison with these calculations have revealed overlapping and very broadly distributed multipole strengths of the multipolarities $\lambda = 1, 2, 3, 4$ in the excitation energy range covered. The sum rule exhaustion in this energy range is rather low (< 6% EWSR) for each $\lambda \in \{1, 2, 3\}$, but $\approx 20\%$ EWSR for $\lambda = 4$. There is no evidence of any compact multipole strength. The kinematical situation is typical for a transition between sequential decay and quasi-free proton knock-out. All the more remarkable is the success of the RPA calculations.

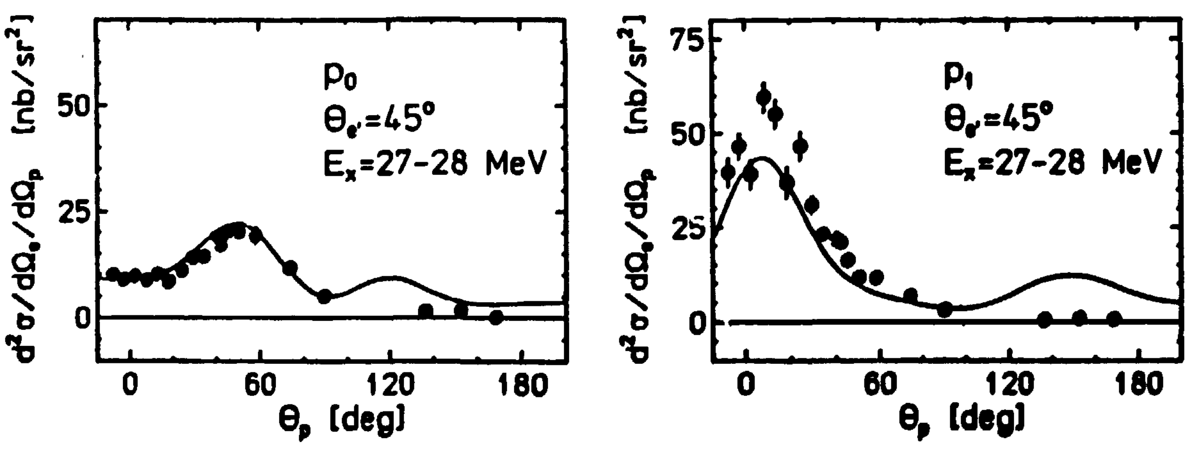

Fig. 1: Measured angular correlation functions (dots) in the p_0 and p_1 decay channels for the excitation energy bin $E_x = 27 - 28$ MeV at an electron scattering angle of 45°. The solid lines represent the result of continuum RPA calculations multiplied with appropriate spectroscopic factors taken from ref. 1.

[1] K. Reiner et al., Nucl. Phys. A472 (1987) 1
[2] J. Ryckebusch et al., Nucl. Phys. A476 (1988) 237
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