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Understanding the Nature of the Low-energy Enhancement in the Photon Strength Function of 56Fe

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The recent discovery of the low-energy enhancement in the photon strength function (PSF) of medium mass nuclei in the Fe and Mo region [1] has attracted great experimental and theoretical attention, as it may represent a new decay-mode [2]. The presence of an enhanced decay probability of low-energy gammas rays below the neutron threshold has the potential to greatly affect a broad range of applications including the astrophysical r-process and nuclear reactors [3-4]. Recent shell model calculations on 94Mo, 95Mo and 90Zr show that the enhancement could be due to a large B(M1) strength for low energy gamma-rays caused by orbital angular momentum recoupling of high-j orbits [5], while other mechanisms suggest an enhanced E1 strength [6].

A recent experiment designed to confirm the multipolarity and determine the electric or magnetic character of transitions in the region of the PSF enhancement in 56Fe was performed at ATLAS/ANL using GRETINA and the Phoswich Wall [7]. A 16 MeV proton beam was used to inelastically excite an 56Fe target to the quasicontinuum where it promptly decayed by gamma-ray emission. The PSF can be extracted using two-step cascades from the quasicontinuum to specific low-lying levels by a model independent method first employed in 95Mo [8]. This method is being extended to take advantage of GRETINA as a polarimeter to obtain angular and polarization information in the region of the low-energy enhancement of the PSF. Preliminary results will be discussed.

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