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Three-fold increase of M1 strength in ^{40}Ar at 10 MeV excitation energy. WERNER TORNOW, SEAN FINCH, FNU KRISHICHAYAN, Duke University and TUNL, ANTON TONCHEV, Lawrence Livermore National Laboratory — We reexamined the excitation energy region of ^{40}Ar around 9.8 MeV with the goal of determining the known M1 strength located at 9.76 MeV [1] more accurately. The physics motivation was based on the fact that i) the neutrino-nucleus interaction cross section is proportional to the M1 strength of a nucleus, ii) DUNE, the Deep Underground Neutrino Experiment at SURF will be using liquid argon as detector medium, iii) the energy spectrum of supernova neutrinos is peaked at approximately 10 MeV. Mono-energetic and linearly polarized photons of 9.88 MeV were produced via Compton backscattering of 548 nm FEL photons from 543 MeV electrons at the High-Intensity γ-ray Source (HIγS) facility at TUNL. The 1.25 cm diameter photon beam with energy spread of 300 keV (FWHM) interacted with argon gas contained in a high-pressure cell. The cell was viewed with HPGe detectors placed at 90$^{\rm o}$ relative to the incident photon beam in the horizontal and vertical planes to distinguish between E1 and M1 de-excitation γ-rays. Our re-measurement provided an increase in M1 strength by a factor of approximately 3, mostly due to the discovery that the known level in ^{40}Ar at 9.84 MeV is of M1 character and not of E1 character, as previously thought. In addition to the already known M1 state at 9.76 MeV [1], we observed weaker M1 states at 9.70, 9.81, 9.87, and 9.89 MeV.
[1] T.C. Li *et al.*, Phys. Rev. C **73**, 054306 (2006).

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