OBSERVATION OF NEW LOW-LYING STATES IN $N = Z$ NUCLEI USING A FAST β-DECAY TAGGING SYSTEM ON THE ARGONNE FMA

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New low-lying states, including long-pursued $T = 1$ isobaric analogue states, have been observed in the odd-odd $N = Z$ nucleus ^{62}Ga using a new experimental system developed for use at the ATLAS facility at Argonne. The system enables in-beam γ-ray spectroscopy of exotic nuclei with $N \sim Z$ close to the proton drip-line through the installation of a highly segmented 160 $\times$ 160 DSSD at the focal plane of the FMA. Extremely high levels of selectivity can then be achieved by taking advantage of fast β-decays exhibited by exotic nuclei near the proton drip-line, which are not observed in more stable isobaric contaminants, to provide a clean 'tag' for γ rays measured by the Gammasphere. The experiments were carried out with the benefit of new digital acquisition systems for both the FMA and Gammasphere. The ability to produce clean 'singles' spectra has considerable advantages over techniques that rely on γ-ray coincidence analyses in cases where weak transitions are not in coincidence with the yrast band. Results from the new system will be discussed and a comparison made with (spherical and deformed) shell model and IBA calculations. The structure and properties of $N \sim Z$ nuclei in this region, neighbouring the proton drip-line, are also of great potential interest for studies of the astrophysical *rp*-process as will be discussed in the presentation.