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Mirror Symmetry and Proton Emission in the Upper fp Shell

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An experimental campaign focusing on isospin-symmetry and proton emission in the upper fp shell was performed at Argonne National Laboratory (ANL) in 2020, with the nuclear structure group from Lund University leading three out of five experiments. The overarching goal was to perform in-beam high-resolution particle- and γ-ray coincidence spectroscopy. The first experiment focused on particle and γ-ray coincidence spectroscopy of 57Cu. The second experiment studied isobaric analog states in mass A = 61,62. The third experiment explored isospin symmetry at the limits of nuclear binding via proton-γ spectroscopy of 65As.
The focus of the campaign on proton spectroscopy called for a new approach in charged-particle detection. A very complex experimental setup comprising two CD-type double-sided Si-strip detectors (DSSDs) in combination with Microball detector was employed, in conjunction with the Gammasphere array, the Neutron Shell, and the Fragment Mass Analyzer (FMA). A novel combination of CD-DSSD (2 × 2048 pixels) detectors with the Microball array [Fig. 1 (b) and (c)] allowed to add proton tracking capabilities while keeping high particle detection efficiency.
The fusion-evaporation reaction 40Ca + 24Mg ⟶ 64Ge* at a beam energy of 106 MeV was used to populate excited states in 61Ga. Results from an earlier experiment concerning the Tz = 1/2 nucleus 61Ga imply a proton-emitting state at about 2.4 MeV excitation energy [Fig. 1 (a)]. Preliminary results from the ongoing analysis will be presented.

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