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Advancements in Gamma-ray Spectroscopy: Expanding Sensitivity and Experimental Capabilities

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In recent decades, γ-ray spectroscopy has experienced a significant technological advancement through the technique of γ-ray tracking, achieving a sensitivity almost two orders of magnitude greater than previous Compton-shielded arrays. This leap forward rivals the milestones achieved since the beginning of γ-ray spectroscopy. Combining γ-ray spectrometers with detectors recording complementary reaction products, such as light-charged particles for transfer reactions and scattered ions for Coulomb excitation measurements, further enhances sensitivity.

Nucleon transfer reactions provide a valuable means to explore the energies of shell model single-particle orbitals and study their energy migration away from stability. Additionally, such measurements permit the estimation of cross sections relevant to stellar evolution and nucleosynthesis. Coincident γ-ray and particle measurements offer insights into decay channels for unbound systems, crucial for astrophysics and nuclear structure near drip-lines.

In this contribution, results and prospects for transfer-reaction experiments utilizing newly developed complementary devices and other detectors will be outlined, paving the way for further advancements in γ-ray spectroscopy and nuclear structure studies.

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