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Mass Measurements of Exotic Neutron-Deficient Nuclides Below ^{100}Sn at IGISOL and Their Astrophysical Implications

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The investigation of heavy N = Z nuclei and their neighbors has attracted significant attention both theoretically and experimentally due to their crucial role in nuclear structure studies and their substantial impact on modelling nuclear astrophysical processes, particularly as inputs for the astrophysical rapid proton-capture (rp) and νp processes [1-3]. Recent advancements at the IGISOL facility in Finland have enabled direct mass measurements of highly exotic neutron-deficient nuclides, specifically around the N=50 shell closure below ^{100}Sn [4-5].

Using the JYFLTRAP double Penning trap [6], coupled with the newly commissioned inductively heated hot-cavity catcher laser ion source at IGISOL, we have successfully measured the atomic masses of $^{95-97}$Ag [5]. This setup allows the production of very exotic neutron-deficient nuclides. The ground state masses of $^{95-97}$Ag and the low-lying isomeric state in ^{96}Ag were determined with the JYFLTRAP, achieving a precision of approximately 1 keV/c^2. Both the conventional time-of-flight ion-cyclotron resonance (TOF-ICR) method [6] and the phase-imaging ion-cyclotron-resonance (PI-ICR) technique [7-9] were employed in these measurements. This allows us to reevaluate the thermonuclear reaction rate of a few reactions along the rp-process path and its influence on the astrophysical rp process. Additionally, a fusion-evaporation method using a ^{58}Ni primary beam on a ^{28}Si target was employed to produce ions of interest in the A = 84 region, with mass measurements conducted using Multi-Reflection Time-of-Flight Mass Spectrometer (MR-TOF MS). These masses will help shed light on the Zr-Nb cycle in the rp process [1] and address some of the major uncertainties in the νp process. Preliminary results of this experiment will be presented.

This contribution will cover the latest results and progress from our mass measurement campaigns of exotic neutron-deficient nuclides using MR-TOF MS and JYFLTRAP at IGISOL.

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