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Photonuclear excitation of 27Al and particle emission on PANDORA project.

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The PANDORA experiment, conducted in October last year in RCNP, delves into photo-nuclear reactions within the mass region below A ~ 56. This project aims to unravel the energy loss process of ultra-high-energy cosmic rays (UHECRs) during inter-galactic propagation. The origin, acceleration mechanism, and composition of UHECRs remain mysteries. Nonetheless, cosmic-ray air-shower observatories such as Pierre Auger and Telescope Array have detected UHECRs with energies above 1020eV. Analysis of air-shower depth distributions revealed a trend to heavier in the mass composition between protons and iron at the highest energies.

UHECR nuclei are anticipated to predominantly loss their energy by emitting particles after photo-nuclear excitation induced by absorbing cosmic microwave background (CMB) photons. Consequently, understanding photonuclear reaction cross-sections and decay branching ratios assumes paramount importance in understanding the energy and mass loss process of UHECRs during inter-galactic propagation.

The experiment employed virtual photon exchange via proton scattering to excite target nuclei and determine the photo-absorption cross-sections covering the giant dipole resonance. Detection of decay particles will extract branching ratios.

I will report the experiment's setup in October 2023 in RCNP and outline the status of the analysis for 27Al.

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