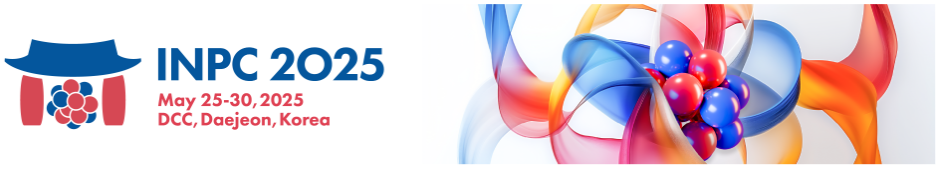

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Development of Laser Isotope Separation (LIS) of 48Ca for the Study of Neutrinoless Double Beta Decay

Tuesday, 27 May 2025 09:00 (15 minutes)

Neutrinoless double beta decay (0νββ) is a powerful method for exploring the mysteries of the universe, such as the matter-dominated universe, lepton number violation, and neutrino mass. CANDLES investigated this phenomenon using 48Ca, which has the highest Q-value at 4.23 MeV among the double beta decay nuclides. Nevertheless, a large amount of double beta decay nuclides is required, but 48Ca has a natural abundance of 0.187%. A large-scale production system is being developed to produce 48Ca using laser isotope separation (LIS) with the isotope shift of 48Ca. Isotope separation occurs when incoming photons impart momentum to the target isotope, leading it to diverge from the initial atomic beam. The spatial distribution of the calcium atomic beam was measured using time-of-flight (TOF). This measurement showed a displacement of 48Ca at 3.84 ± 0.83 mm, while no displacement was observed for other isotopes, including 40Ca and 44Ca, when the oscillation wavelength of 48Ca was tuned. This presentation will outline the current statuses, strategies, and requirements for mass production utilizing single-frequency and high-power laser diodes, targeting production rates of 300 kg per year.

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