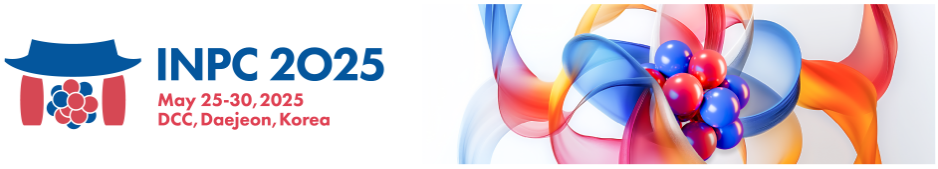

Contribution ID: **65** Type: **Contributed Oral Presentation**

The controlling of the Thorium-229 isomer states in CaF_2 crystal.

Tuesday, 27 May 2025 11:40 (15 minutes)

Thorium-229 possesses an exceptionally low-energy isomeric state (~8.356 eV, ^{229m}Th), which can be excited using the state-of-the-art tabletop lasers operating in the vacuum ultraviolet (VUV) region [1–3]. The transition from the ground state to ^{229m}Th is considered a clock transition, offering the potential for a nuclear clock that could surpass current optical atomic clocks in robustness and performance. Such a nuclear clock could be the next-generation platform for probing new physics beyond the Standard Model. To study this charming transition, we utilized the high-brilliance synchrotron radiation at SPring-8 (Hyogo, Japan) and developed an experimental setup capable of manipulating the three lowest nuclear states of thorium-229 when they are doped into a CaF_2 crystalline lattice [4]. Our experiment reveals that the lifetime of ^{229m}Th in the CaF_2 crystal could be shortened by X-ray irradiation, and we called this phenomenon the “isomer quenching” [5]. In this presentation, we will introduce our new findings, demonstrating that crystal temperature significantly affects the efficiency of isomer quenching. Additionally, observations of the isomer yield and crystal luminescence suggest a possible interaction process between the thorium nucleus and the crystal environment.

Primary author: GUAN, Ming (Okayama University)

Presenter: GUAN, Ming (Okayama University)

Session Classification: Parallel Session

Track Classification: Applications Based on Nuclear Physics