UCLA

AMO Physics Seminar

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Measurement of ultra-low level of Thorium-229 Isomer with high intense X-ray beam

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Among thousands of nuclei, Thorium-229 is the only nucleus which has nuclear level of a few electron volts. The state, if it really exists low-lying and long-lived, could be manipulated with coherent laser optics, which are commonly used in atomic physics. One promising application is a ultra precise "nuclear clock". Since nuclei are shielded with core electrons, "nuclear clock" is less sensitive to external field and could potentially outperform atomic clocks. The transition could also be utilized for many applications, including test of temporal variation of fundamental physics constant and so on.

To utilize the isomeric transition, we should first observe it and determine its energy level precisely enough for laser excitation. Despite many experimental attempts for more than forty years, there has been only one success in direct detection of the transition, which is done by German group using internal conversion electrons in 2016. Mysterious veil are now being removed but neither precise energy information nor direct optical transition are not obtained yet. Aiming at the detection of optical transition, we have been developing the new method using nuclear resonant scattering with synchrotron radiation X-ray. In this talk, I will introduce recent progress in the Thorium-229 project and its future prospect.