

Plenary Talk

PV II Mon 9:15 B Audimax

On the road towards an Optical Nuclear Clock: What do we know about the elusive 229-Thorium isomer ? — ●PETER G. THIROLF — Ludwig-Maximilians-Universität München, Garching, Germany

Today's most precise time and frequency measurements are performed with optical atomic clocks. However, it has been proposed that they could potentially be outperformed by a nuclear clock, which employs a nuclear transition instead of an atomic shell transition. There is only one known nuclear state that could serve as a nuclear clock using currently available technology, namely, the isomeric first excited state of ^{229}Th . Since 40 years nuclear physicists have targeted the identification and characterization of the elusive isomeric ground state

transition of $^{229\text{m}}\text{Th}$. Evidence for its existence until recently could only be inferred from indirect measurements, suggesting an excitation energy of $7.8(5)$ eV. Thus the first excited state in ^{229}Th represents the lowest nuclear excitation so far reported in the whole landscape of known isotopes. Recently, the first direct detection of this nuclear state could be realized via its internal conversion decay branch, which confirms the isomer's existence and lays the foundation for precise studies of its decay parameters, in particular its half-life, excitation energy and nuclear structure. This would pave the way towards an all-optical control and thus the development of an ultra-precise nuclear frequency standard. Moreover, a nuclear clock promises intriguing applications in applied as well as fundamental physics, ranging from geodesy and seismology to the investigation of possible time variations of fundamental constants.