

Excitation of Low-Energy Nuclear States at High-Energy Storage Rings

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²²⁹Th with a low-lying nuclear isomeric state is an essential candidate for a nuclear clock as well as many other applications. Laser excitation of the isomeric state has been a long-standing goal. With relativistic ²²⁹Th ions in storage rings, lasers in the visible or infrared range can be used to excite ²²⁹Th isomers, facilitated by the tunability of both the laser-beam and ion-bunch parameters [1]. Notably, the expected nuclear hyperfine mixing (NHM) effect in H- or Li-like ²²⁹Th ions (see, for instance,[2]) offers novel opportunities of exciting thorium isomers. In the direct resonant excitation scenario, the significantly reduced isomeric-state lifetime in H- or Li-like ²²⁹Th ions would correspond to much higher excitation rates compared to bare thorium nuclei [3]. Furthermore, the NHM effect allows for the excitation of transitions that change both the electronic and nuclear states simultaneously [4].

In this talk, we will discuss laser excitation of relativistic ²²⁹Th ions at storage rings and present the possibility of exciting the isomeric state in Li-like ²²⁹Th ions using electronic transitions.

References

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