

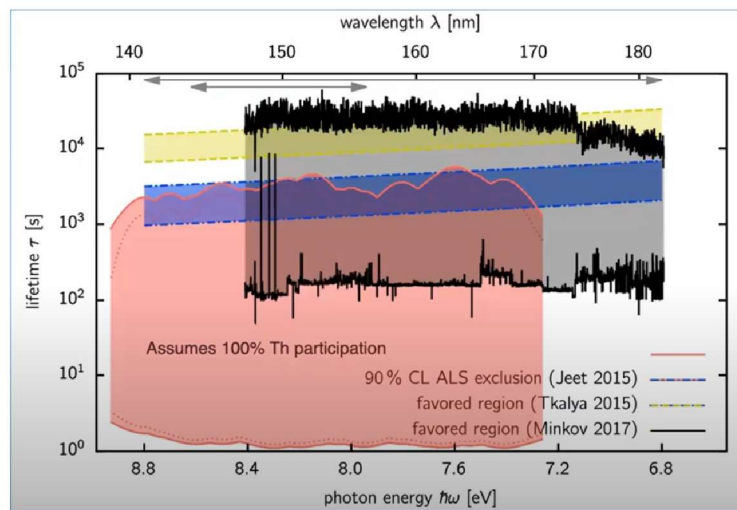


Eric Hudson

University of California, Los Angeles

September 16, 2024 at 3:30 pm in SPL 57

Laser spectroscopy of a nucleus



In 1976 Kroger and Reich established the existence of a low-lying nuclear excited state in ^{229}Th through the spectroscopy of γ rays emitted following the α decay of ^{233}U . The prospects of a laser-accessible nuclear transition touched off a flurry of proposals to utilize this apparently unique nuclear transition as a sensitive probe of both nuclear structure and chemical environment, to constrain physics beyond the Standard Model, and to construct a clock with unprecedented performance. Unfortunately, Kroger and Reich could only tell us that the transition energy was less than about 100 eV and therefore scientists have spent the intervening 48 years searching for the thorium nuclear transition.

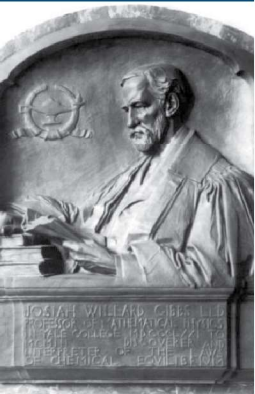
I'll describe our efforts over the last 16 years to construct the first thorium-doped crystals and their use to perform nuclear laser spectroscopy, resulting in a measurement of the nuclear transition energy as $8.355733(2)_{\text{stat}}(10)_{\text{sys}}$ eV in $^{229}\text{Th}:\text{LiSrAlF}_6$. I will also discuss recent work observing the nuclear transition in thin films of $^{229}\text{ThF}_4$; ongoing work to understand and harness the effect of the crystalline host on the isomeric transition; and the next steps for using this transition to probe new physics and build better clocks. This work was funded by the NSF and ARO.



Refreshments will be provided.

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Physics Club is a weekly colloquium of general interest to the Department of Physics, Applied Physics, Astronomy, and Mathematics. The series is aimed at graduate students, postdoctoral researchers, research staff and faculty. The name dates to the late 1890s, the era of J Willard Gibbs, who influenced the intellectual life at Yale through a number of "graduate clubs". Physics Club is sponsored by the Yale Physics Department and Yale University.



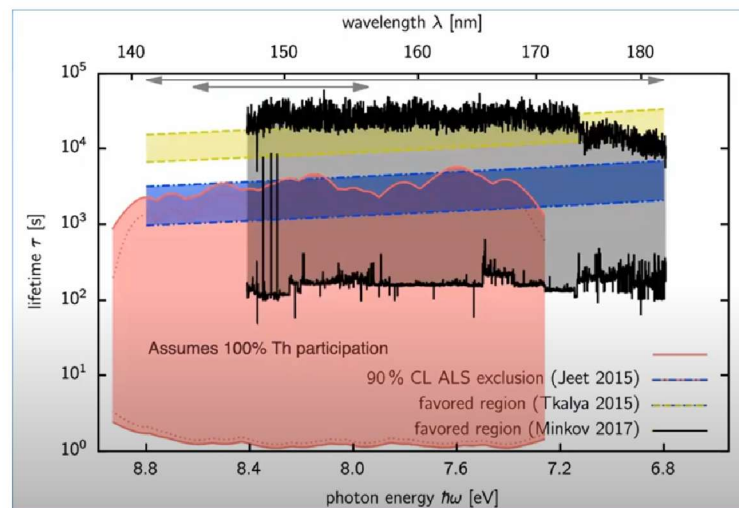


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