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Searching for the first excited nuclear state of ^{229}Th XIA HUA, LIN LI, State Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, ZHENG-TIAN LU, University of Science and Technology of China, XIN TONG, State Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences — The first excitation energy of ^{229}Th (Thorium) is only 7.80.5 eV and can be excited directly using lasers. Which makes the design of a nuclear clock based on the first excited nuclear state of ^{229}Th becomes possible. We are proposed to measure the energy of this first excited nuclear state of ^{229}Th based on $^{229}Th^{3+}$ coulomb crystals in vacuum chamber. The procedure includes 1) Preparation of $^{229}Th^{3+}$; 2) Confinement of $^{229}Th^{3+}$ using radio frequency quadrupole ion trap, together with Doppler laser cooling and high vacuum technology. Obtaining long lifetime and stabilized confined $^{229}Th^{3+}$ coulomb crystals; 3) Illuminating the $^{229}Th^{3+}$ Coulomb crystal with tunable lasers. Determine the energy range and lifetime of the first excited nuclear state of ^{229}Th. The probability of first excited nuclear state of ^{229}Th is small, makes it difficult to observe and measure directly. Alternate method is to measure the electron bridge to obtain information of the first excited nuclear state of ^{229}Th indirectly.

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