Search for isomers in $^{199-203}$Tl

N. FOTIADES, R.O. NELSON, M. DEVLIN, LANL, J.A. BECKER, W. YOUNES, LLNL — The $^{203}$Tl$(n, xn\gamma)$ reactions were used to study excited states in $^{199-203}$Tl isotopes. The data were taken using the GEANIE spectrometer comprised of 26 high-purity Ge detectors. The pulsed neutron source of the Los Alamos Neutron Science Center’s WNR facility provided neutrons in the energy range from 0.6 to 250 MeV. The time-of-flight technique was used to determine the incident neutron energies. Partial $\gamma$-ray cross sections were measured from the beam-on data while half-lives of isomers were determined from the beam-off data. A candidate for the unknown $9/2^-$ isomer in $^{203}$Tl has been identified. The half-life of this state is less than the shortest half-life that could be determined in the present experiment (typically, the half-lifes that can be currently measured with GEANIE vary between a few $\mu$s to a few ms). The candidate state is located at 1484-keV excitation energy, in excellent agreement with the theoretical prediction for the excitation energy of the $9/2^-$ state in Ref. [1]. In $^{202}$Tl, for the previously known $7^+$ isomer at 950-keV excitation energy a 592(4) $\mu$s half-life was obtained in the present work, which differs by $\sim$ 4% from the value adopted in the literature [572(7) $\mu$s]. In the lighter Tl isotopes, the life-time measurements yielded results in agreement with previously known values reported in the literature. This work was supported by the U.S. Department of Energy under Contracts No. DE-AC52-06NA25396 (LANL) and W-7405-ENG-48 (LLNL).


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