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Astromers: Nuclear Isomers with Astrophysical Consequences G. WENDELL MISCH, MATTHEW MUMPOWER, Los Alamos National Laboratory, YANG SUN, Shanghai Jiao Tong University — In astrophysical environments, large differences in the destruction rates of a nuclear isomer and its corresponding ground state can cause the nuclear levels fall out of or fail to reach thermal equilibrium. Without thermal equilibrium, there may not be a safe assumption about the distribution of occupation probability among the nuclear levels when computing nuclear reaction rates. We demonstrate a method to compute thermally-mediated transition rates between the ground state and long-lived isomers in nuclei; this allows the two states to be treated as separate species in a nucleosynthesis network calculation. We also establish criteria delimiting a thermalization temperature above which a nucleus may be considered a single species and below which it must be treated as two separate species: a ground state species, and an astrophysically relevant nuclear isomer (astromer) species. We show example applications to the well-known astromer Al-26 (tracer of star formation), as well as Kr-85 (s-process branch point), Cl-34, and Cd-113.

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