Contribution ID: **76** Type: **Talk**

Astromers: Astrophysically Metastable Isomers

Tuesday, 3 May 2022 16:30 (30 minutes)

Astrophysics models usually take one of two approaches to nuclear reaction and decay rates: either they use the nuclear ground state properties, or they take a thermal equilibrium distribution of excited states. Nuclear isomers can invalidate both of these assumptions. If an isomer has a decay rate very different from the ground state rate, its inhibited transitions can cause it to fail to reach thermal equilibrium. Without thermal equilibrium or an easy path to ground, there may not be a safe assumption about the distribution of occupation probability among the nuclear levels. I will demonstrate a method to compute thermally-mediated transition rates between the ground state and long-lived isomers that allows the nucleus to be treated as two separate species: a ground state species, and an astrophysical nuclear isomer (astromer) species. I will show some examples, including the well-known astromer Al-26 (tracer of star formation), Kr-85 (s-process branch point), and likely r-process candidates.

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Session Classification: Evening Online Session