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NAME: Harriet Dinerstein
AFFILIATION: University of Texas at Austin
CONTRIBUTION: Online
TITLE: Towards Constraining the s-Process Contributions of AGB Stars to Elements at r-Process Peaks
AUTHORS: Harriet L. Dinerstein [1], N. C. Sterling [2], William D. Vacca [3], Kyle F. Kaplan [1], Manuel A. Bautista [4], and J. Garcia-Rojas [5]
AFFILIATIONS: [1] University of Texas at Austin [2] University of West Georgia [3] Gemini Observatory/NSF's NOIRLab [4] Western Michigan University [5] Instituto Astrofisica de Canarias

ABSTRACT:
Elements heavier than the Fe peak are synthesized partly by slow (s-process) and partly by rapid (r-process) neutron capture reactions. The spectrum of the recent kilonova GW170817 implied that binary neutron-star mergers are sites of the r-process, but its high expansion velocity precluded detailed compositional analysis. However, it has long been known that some AGB stars host the s-process. When their stellar envelopes are expelled as planetary nebulae, products of s-processing in the progenitor star are dispersed into space. Recent infrared (IR) emission line observations are expanding the suite of trans-iron elements with derived abundances in planetary nebulae (Sterling 2020, Galaxies, 8, 50), including elements usually associated with the r-process. From IR plus optical spectra, Te and Xe (Z = 52 and 54) of the second-r-process peak (Solar System r-process fractions > 80%) are observable as multiple ions: [Te III], [Te IV]; [Xe III] - [Xe VI] (Dinerstein et al. 2022, AAS 24035106D). Recently detected IR lines of Br and Rb (r-fractions > 50%) add [Br IV] and [Rb III] to [Br III], [Br V], and [Rb IV] (Dinerstein et al. 2021, AAS 23754813D). Initial results show that Kr, Te, Xe, and perhaps Rb can be enhanced by up to 10 times initial values, while Se and Br are enriched by smaller factors. Such studies are steps toward constructing an accurate inventory of the sources of trans-iron elements. This work is supported by the U.S. National Science Foundation.