DIVERSITY IN THE ELEMENTAL COMPOSITION OF PLANETARY NEBULAE

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Planetary nebulae are comprised of the expelled outer layers of evolved low and intermediate mass stars. Their composition reflects both the make-up of their birth clouds and the alchemical effects of nuclear processing within the stars as they age. Historically, the study of nuclides affected by in situ reactions within the star has focused primarily on He and the CNO group of elements. A few years ago, we demonstrated the prevalence of enhanced abundances of Se and Kr, part of the first (lightest) peak of the slow neutron-capture process. Here we give an update on our results for these and other s-process products. We also developed a method for determining total abundances of the Fe-group despite large and uncertain depletions of most of these species into dust grains, by using the less refractory element Zn as a tracer. This enables us to locate specific objects in the abundance ratio phase space [alpha/Fe] vs. [Fe/H], which can be used to identify the parent stellar populations of individual stars and to constrain the star formation history. A substantial number of planetary nebulae with apparently normal (near-solar) alpha-species abundances have elevated [alpha/Fe] that compensates for, and therefore masks, their lower [Fe/H] values. This is the case especially for older stellar populations such as the Milky Way’s bulge and thick disk. We acknowledge support from NSF grant 0708425.