GAS-PHASE ABUNDANCE ANOMALIES AND THE ORIGIN OF PLANETARY NEBULAE

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Six high-excitation PN are found to have gas-phase iron abundances less than solar by ∿1.2 dex, and carbon abundances larger than solar by ∿0.8 dex. The objects have solar abundances of oxygen, and this supports the idea that the missing iron has condensed into grains. Efficient condensation of iron, and of all carbon not in CO molecules, is expected before the shell becomes ionized. The presence of some gas-phase iron therefore requires partial destruction of the grains.

The C/O ratio in PN resembles that of the most carbon-rich N-type stars, and suggests that PN ejection occurs at the end of a period of progressive enrichment in carbon produced by triple-alpha reactions. PN provide a potential test of models for s-process enhancements in carbon stars; if the neutron source is $^{22}Ne(\alpha,n)^{25}Mg$, then PN should have substantial overabundances of Ne and/or Mg.

DISCUSSION

Peimbert: The apparent overabundance of the Ne to O ratio in planetary nebulae with respect to the solar value is mostly due to the adoption of coronal values for the Ne to O ratio; if the cosmic ray solar ratio is adopted, which I prefer, the overabundance is reduced to less than a factor of two and might be non-existent.

MODEL ANALYSIS OF 108-76°1

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108-76°1 was discovered by Boeshaar and Bond (1977, Ap. J., 213, 421) to be a member of the galactic halo component. Herein are presente the results of a computer model analysis of these observations and those of Hawley and Miller (this volume). Models producing the 23% of helium in the doubly-ionized state required by the HeII λ4686 line strength utilized the 95,000°K, non-gray, spherical atmosphere model of Cassinelli (1971, Ap. J., 165, 265) for the central star. Even 100,000°K plane-parallel atmospheres gave less than half the needed He^{++}. The results for model 1 (homogeneous sphere) and model 2 (Gaussian shell) show good agreement with observed fluxes, even for [OII] λ3727. The abundance values

Emission Line Fluxes, H = 100

Ion	λ(Å)	Boeshaar, Bond	Hawley, Miller	Model 1	Model 2
N^+	5755	--	0.6	1.5	1.5
	6548	--	10.7	10.8	10.6
	6584	--	32.0	32.1	31.7
O^+	3727	9.9	7.3	9.4	11.2
O^{++}	4363	8.1	5.0	10.3	9.4
	4959	97.7	113.	108.	102.
	5007	308.	365.	322.	305.
Ne^{++}	3869	293.	101.	272.	268

Number Abundances as $Log_{10}X, Log_{10}H=12$

X	Boeshaar, Bond	Hawley, Miller	Model 1	Model 2
He	10.99	11.06	11.00	11.00
N	-	8.34	7.57	7.47
O	7.44	7.88	7.41	7.41
Ne	7.76	7.72	7.68	7.68

from the observational studies and these models show modest variations relating to differences in the electron temperature used. The [N/O] enrichment factor of Peimbert and Torres-Peimbert (1971, Ap.J., 168, 413) for these models is about +1.0, a value indicating appreciable mixing (Boeshaar, 1975, Ap.J., 195, 695) and much higher than the -0.54 values for K648 in M15. Despite the mixing evident for 108-76°1, the overall abundances are at least a factor of 10 below solar values, consistent with a rapid light element enrichment during the early phases of the Galaxy.

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