

Sulfur, Chlorine & Argon Abundances in Galactic PNe

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Abstract. We report first results from our extensive study of S, Cl and Ar abundances in a large sample (>60) of primarily Type II planetary nebulae (PNe) in the Galaxy (see Kwitter & Henry 2001, ApJ, 562, 804). Ratios of S/O, Cl/O, and Ar/O constitute important tests of differential nucleosynthesis of these elements and serve as strict constraints on massive star yield predictions. The use of PNe to measure the original stellar abundances of S, Cl, and Ar is possible because PN progenitors, intermediate-mass stars between 1 and $8M_{\odot}$, lack sufficient mass to synthesize these elements. Therefore, their abundances measured in the nebulae at present reflect accurately the original stellar abundances.

Here we present results from new ground-based optical spectra of planetary nebulae extending from 3600-9600Å. The observed spectral range includes the strong near-infrared lines of [S III] $\lambda\lambda 9069, 9532$, which allowed us to extensively test their effectiveness as an indicator of S^{++} . We find that the S^{++} abundances derived from these lines are quite consistent with those derived from the $\lambda 6312$ line when the latter is well measured. In addition, we find that the atmospheric absorption affecting the near-infrared lines can be minimized by using in the calculation whichever of the pair is less affected: if the observed ratio of $\lambda 9532/\lambda 9069$ exceeds 2.48, the theoretical value, we use $\lambda 9532$; if we observe a ratio <2.48, we use $\lambda 9069$ instead. We also introduce a new, model-tested ionization correction factor for sulfur that includes the latest atomic data and the effects of matter-boundedness.

For the northern subsample we find the following averages:
 $S/O = 1.2E-2 \pm 0.71E-2$, $Cl/O = 3.3E-4 \pm 1.6E-4$, $Ar/O = 5.0E-3 \pm 1.9E-3$.

Subsequent papers in this series will present the full analysis and compare our derived abundances of S, Cl, and Ar with nucleosynthesis predictions from massive stars. (A companion paper in this volume by Milingo, Henry & Kwitter discusses the southern subset observed at CTIO; see also Milingo, J.B., Kwitter, K.B., Henry, R.B.C., & Cohen, R.E. 2002, ApJS, *in press*; Milingo, J.B., Henry, R.B.C., & Kwitter, K.B. 2002, ApJS, 2002, *in press*.)

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