

# The Ground Based Leg for our ISO PNe: Spectroscopy

F. Kerber<sup>1</sup>, T. Köberl<sup>1</sup>, H. Gratl<sup>1</sup> and M. Roth<sup>2</sup>

<sup>1</sup>Institut für Astronomie, Universität Innsbruck, Austria;

<sup>2</sup>Las Campanas Observatory, Carnegie Institution of Washington, Chile

The Infrared Space Observatory (ISO) has to be regarded as the most powerful infrared facility that has ever been available to the astronomical community. In order to fully exploit the wealth of information contained in ISO data, one has to supplement the satellite observations with a ground-based campaign. In collaboration with the Kiel group, our group in Innsbruck is carrying out two observing programs with ISO. Our observations aim at the study of hot dust in bipolar PNe seen edge-on and in so-called "born-again" PNe.

Both are carefully selected subsamples of PNe. For the bipolar PNe a geometry with a denser torus seen edge-on and diluted polar regions is assumed. The "born-again" are a very special group of PNe that have a H-deficient inner nebula that may be the result of a late He-flash. See the contribution by Kerber et al. in this volume for the first results on Sakurai's object, the most recent example of such a rare event.

For the PNe of our ISO sample we have obtained spectra covering the wavelength range between 3800 Å and 6800 Å; they were taken in April 1996 with the 2.5 m duPont Telescope at Las Campanas, Chile. Using the modular spectrograph together with the TEK 1 CCD detector (24 μm, 1024 × 1024 px<sup>2</sup>) we observed with a spectral resolution of about 2 Å/pixel. The gap between the optical and the ISO data is covered by DeNIS data and additional IR imaging. On the basis of these data we establish photoionization models of the nebulae, in order to be able to isolate the contribution of the dust component from the ISO observations. To this end it is essential to derive the physical parameters of the nebular gas from optical spectra, to be able to assess the contribution of the gas in the NIR. So far preliminary plasma diagnostic results have been derived for K 1-4 and Hf 48.

## Plasma Diagnostics

### *K 1-4*

	eastern knot	western knot
Reddening c	1.44	1.8
Temperature [K]	8920 K	8530 K
Density [m <sup>-3</sup> ]	2.15 × 10 <sup>8</sup>	1.55 × 10 <sup>8</sup>

### *Hf 48*

Reddening c	1.86
Temperature [K]	10560 K from [N II]
Density [m <sup>-3</sup> ]	1.03 × 10 <sup>9</sup> m <sup>-3</sup>

This work has partly been supported by the "Fonds zur Förderung der wissenschaftlichen Forschung", project no. P10279-AST and by a travel grant from the Austrian "Bundesministerium für Wissenschaft, Kunst und Verkehr". The plasma diagnostics was done with the program *HOPPLA*, provided by J. Köppen. This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France.