

# Planetary Nebula Observations with Ground-based and Space Telescopes

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Although a large ground-based telescopic observation is possible, there is a lot that one cannot know from the ground-based observation alone. For example, it would be impossible to derive Carbon composition from the optical spectral analysis alone: the UV spectra available through the International Ultraviolet Explorer (IUE) were the only source of Carbon abundance determination before the Hubble Space Telescope (HST) launch. For any Planetary Nebula (PN), ground based observational data in the optical wavelength region can be combined with Space Telescopic observations secured with e.g., the IUE or HST. Since 1986, I and Dr. Aller H. Aller obtained high spectral resolution data of about 45 bright PNe covering the range from 3600 Å to 10050 Å with Hamilton Echelle spectrograph at the Coude focus of the Lick 3-m telescope. In our previous studies based on such ground-based observations, the spectral data have been analyzed utilizing theoretical photoionization models --- the optical nebular images were not often available and, as a result, we had to refer to radio frequency images for the nebular shape. Thanks to the recent HST observations, we could investigate the ground based observations more thoroughly; Space Telescopic UV spectral data also enabled us to probe the gaseous plasma diagnostics (electron densities and temperatures) in the UV region. Investigation of a nebular (or stellar) evolutionary status would be now progressed more confidently than before, based on such new observational evidences secured through both ground-based and Space Telescopes.