

CTIO High Resolution Spectroscopic Observation of the Planetary Nebula M2-9 and the Symbiotic Stars RR Telescopii and He 2-106

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We report the discovery of the HeII Raman scattered feature around 6543 Å in the spectra of the bipolar planetary nebula M2-9 and the symbiotic stars RR Telescopii and He 2-106. We obtained the spectra using the echelle spectrometer mounted on the CTIO 1.5 m telescope during the nights of Aug. 14-16, 2000, for which we used a TEK2048 CCD with one pixel corresponding to ~ 0.05 Å. This feature is formed by the Raman scattering by H I of He II 2s-6p transition photons with slightly shorter wavelength than that of H Ly β . The scattering hydrogen atom is initially in the ground state and de-excites to the 2s state re-emitting a Raman-scattered photon with wavelength blueward of H α . Thus far, the Raman scattering by atomic hydrogen has been found observationally only in symbiotic stars with an exception of the planetary nebula NGC7027, in which He II Raman scattered feature around 4850 Å was reported by Pe'quignot et al. (1997). The operation of Raman scattering in these objects implies that a high column density H I component from recent mass loss surrounds the UV emission region ionized by a hot white dwarf. It is also found that all these objects show broad wings around H α that may also be formed through the Raman scattering of Ly β . We present a brief discussion the importance of our observation.