N23a The detection of C_{60} in the well-characterized planetary nebula M1-11

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We performed multiwavelength observations of the young planetary nebula (PN) M1-11 and obtained its elemental abundances, dust mass, and the evolutionary status of the central star. The *AKARI*/IRC, VLT/VISIR, and *Spitzer*/IRS spectra show features due to carbon-rich dust, such as the 3.3, 8.6, and 11.3 μm features due to polycyclic aromatic hydrocarbons (PAHs), a smooth continuum attributable to amorphous carbon, and the broad 11.5 and 30 μm features often ascribed to SiC and MgS, respectively. We also report the presence of an unidentified broad feature at 16–22 μm, similar to the feature found in Magellanic Cloud PNe with either C-rich or O-rich gas-phase compositions. We identify for the first time in M1-11 spectral lines at 8.5 (blended with PAH), 17.3, and 18.9 μm that we attribute to the C_{60} fullerene. This identification is strengthened by the fact that other Galactic PNe in which fullerenes are detected, have similar central stars, similar gas-phase abundances, and a similar dust composition to M1-11. The weak radiation field due to the relatively cool central stars in these PNe may provide favorable conditions for fullerenes to survive in the circumstellar medium. Using the photo-ionization code CLOUDY, combined with a modified blackbody, we have fitted the $\sim$0.1–90 μm spectral energy distribution and determined the dust mass in the nebula to be $\sim 3.5\times10^{-4}$ $M_\odot$. Our chemical abundance analysis and SED model suggest that M1-11 is perhaps a C-rich PN with C/O ratio in the gas-phase of +0.19 dex, and that it evolved from a 1–1.5 $M_\odot$ star.