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TITLE: The dual chemistry, ADF and internal kinematics of the planetary nebula Vy 2-2

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ABSTRACT:

Planetary nebulae (PNe) showing OH maser emission (OHPNe) are thought to be nascent PNe. OHPNe are extremely scarce, with only six members confirmed to date. In particular, Vy 2-2 was the first OHPN identified. Its radio continuum emission originates from an angularly small shell ($\sim 0''.24$ in diameter and $\sim 0''.12$ in thickness) bright region and a faint bipolar formation ($\sim 2.0''$). The abundance discrepancy factor (ADF) of Vy 2-2 has been recently found to be ~ 4.3 , inconsistent with the value of ~ 11.8 previously reported. To characterize the physical properties of the photoionized gas and to redetermine the ADF, we have obtained medium-resolution optical spectra. We found that the photoionized gas presents a C/O abundance ratio of ~ 0.15 , and an $ADF \approx 13.6$. Moreover, the N/O abundance ratio is ~ 0.39 , implying a low-mass progenitor, contrarily to the assumed intermediate-mass progenitors of OHPNe. However, the most intriguing result is the detection of stellar emission lines that reveal the unexpected C-rich nature for a central star that, according to all the available information, has ejected an O-rich circumstellar envelope. Also, we have obtained high-resolution optical and near-infrared spectroscopy to study the kinematics of the ionized gas. Our spectra kinematically resolve the bright region and bipolar formation. We found that Vy 2-2 is an extremely young PN for any reasonable distance to the object.