A CHEMICAL AND DYNAMICAL MODEL FOR THE OXYGEN-RICH SUPERGIANT VY CMA

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VY Canis Majoris (VY CMa) is an oxygen-rich supergiant star that is loosing mass at a very high rate ($\sim 2 \times 10^{-4} M_{\odot} yr^{-1}$). A source of OH, H_2O, and SiO maser emission, the circumstellar envelope was never thought to be abundant in molecules. Recent observations using the telescope facilities of the Arizona Radio Observatory (ARO) has shown that this source is the most chemically diverse O-rich envelope to date. Seventeen different species have now been found in VY CMa, including exotic compounds such as NaCl and PN. Six carbon-containing molecules have been identified, as well, including CS, HCO^+, and HNC. The line profiles vary dramatically from species to species. Modeling of the profiles indicates the presence of a spherical wind, a highly collimated blue-shifted outflow almost directly along the line of sight, and a poorly-collimated red-shifted expansion at a $\sim 45^{\circ}$ angle from the line of sight. This model agrees extremely well with Hubble Space Telescope infrared observations and atomic emission/absorption line data. Various chemistries exist in these regions. Sulfur-bearing species such as SO and SO_2 are abundant in the collimated outflows, for example, while SiO dominates the spherical wind. The carbon is almost equally shared between CO and HCN in all three regions. Details of this chemistry will be presented, as well as an interpretation of the dynamical structure of VY CMa.