First Observations of Complex Molecules in a Wolf-Rayet Ring Nebula

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Abstract:

We report the first observations of complex molecules in the ring nebula surrounding a Wolf-Rayet (WR) star. The molecules HCN, HNC, HCO^+ and CN have all been detected together with ^{12}CO in observations made of the ring nebula NGC3199 around the WR star WR18 made at the Swedish-ESO Submillimeter Telescope (SEST). This is the first time that the HNC, HCN, HCO^+ and CN molecules have been detected in the environment around a Wolf-Rayet star. The existence of such molecules indicates the presence of dense ($>10^4 cm^{-3}$) clumps of neutral materials close to these hot luminous stars. This is a much higher density than implied from optical emission-line data and suggests extreme density variations exist within the ring nebula. Clumps of molecular material are likely to contain a significant neutral gas mass. We discuss the origin of the molecular gas, particularly with respect to the likely prior evolution of the central WR star. We also consider the implications of the observations in terms of the effects of strong stellar winds and ionization from the WR star on the chemistry of molecular gas in its vicinity.

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