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The ejecta of η Carinae

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Abstract. High-dispersion spectroscopic observations of the neutral Homunculus and the ionized Little Homunculus, ejecta of η Car, are being analyzed to determine the relative abundances of metals. Thousands of lines of neutral and singly-ionized metals and molecules seen in the Homunculus suggest that this oxygen-, carbon-poor, nitrogen-, helium-rich gas contains very different dust grains likely devoid of metal oxides. The gas to dust ratio is likely much larger than the canonical 100:1 implying that the $12\,M_\odot$ estimate of the ejecta is a lower limit.

Keywords. stars: individual (η Car), winds, mass loss, abundances, binaries

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High-dispersion spectra of η Car recorded with the *HST*-STIS and the VLT-UVES are filled with thousands of narrow absorption lines with several different velocity systems (Gull *et al.* 2006). Two well-isolated, dominant velocity systems correspond to the Homunculus ($-513\,km\,s^{-1}$, 760 K, $10^{6-7}\,cm^{-3}$), ejected in the 1840s and the Little Homunculus ($-146\,km\,s^{-1}$, 6400 K, $10^{7}\,cm^{-3}$) associated with the 1890s lesser event (Gull *et al.* 2005). In the $-513\,km\,s^{-1}$ gas, lines of Fe I, Fe II, Ni II II, Cr II, Ti II, V II, Sr II, Sc II, Mn II, Mg II, Na I, etc., (with ionization potentials less than 8 eV), are found along with nearly a thousand lines of H_2, plus several lines of CH, OH, NH, and CH+ ($-513\,km\,s^{-1}$, but 60 K, $10^{7}\,cm^{-3}$), but no CO. The H_2 absorption lines originate from very high rotational levels and are characteristic of UV photo-excitation/dissociation, are present during η Car's periodic broad (5 year) maximum but disappear during the few month long low-excitation minimum. This suggests a layered structure with transition from partially ionized gas to a neutral gas with molecular and dust formation. IR flux measures (Smith *et al.* 2003) imply a total ejection mass of $\sim 12\,M_\odot$.

Initial measures of ionic and neutral column densities of this gas and the Strontium Filament, a partially ionized emission nebula in the skirt of the Homunculus, demonstrate that gaseous Ti/Ni, Cr/NI, V/Fe are much more than solar, indicating that most metals remain suspended in be of silicates and alumina (Chesneau *et al.* 2005). Additional abundance ratios, but are constrained by the need for improved laboratory measurements and/or theoretical modeling of gf-values for these species.

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References

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