Abundances and depletion of iron-peak elements in the Strontium filament of Eta Carinae

Manuel A Bautista[1] , Henrik Hartman[2] , Marcio Melendez[3] , Theodore R Gull[3] , Katharina Lodders[4] , Mariela Martinez[5]

1 - Virginia Tech
2 - Lund Observatory, Sweden
3 - NASA/GSFC
4 - Washington University
5 - Instituto Venezolano de Investigaciones Cientificas, Venezuela

We carried out a systematic study of elemental abundances in the Strontium Filament, a peculiar metal-ionized structure located in the skirt plane of the Homunculus, ejecta surrounding Eta Carinae. To this end we interpret the emission spectrum of neutral C and singly ionized Al, Sc, Ti, Cr, Mn, Fe, Ni, and Sr using multilevel non-LTE models for each ion. The atomic data for most of these ions is limited and of varying quality, so we carried out *ab initio* calculations of radiative transition rates and electron impact excitation rate coefficients for each of these ions. The observed spectrum is consistent with an electron density $\approx 10^7$ cm^{-3} and a temperature between 6000 and 7000 K. The observed spectra are consistent with large enhancements in the gas phase Sr/Ni, Sc/Ni, and Ti/Ni abundance ratios relative to solar values. Yet, the abundance ratios Cr/Ni, Mn/Ni, and Fe/Ni are roughly solar. We explore various scenarios of elemental depletion in the context of nitrogen-rich chemistry, given that the stellar ejecta has enriched nitrogen at the expense of greatly depleted oxygen and carbon due to mixing in the $>$60 solar mass star. Finally, we discuss the implications of these findings for the generation of dust during the evolution of supermassive stars from main sequence to pre-supernova stage.