The Cocoon Nebula and its ionizing star: do stellar and nebular abundances agree?

J. Garcia-Rojas, S. Simon-Diaz, C. Esteban

(1) IAC, Tenerife, Spain, (2) Dep. AstrofÃsica, ULL, tenerife, Spain

Main sequence massive stars embedded in an Hii region should have the same chemical abundances as the surrounding nebular gas+dust. The Cocoon nebula (IC5146), a close-by Galactic Hii region ionized by a narrow line B0.5 V single star (BD+46 3474), is an ideal target to perform a detailed comparison of nebular and stellar abundances in the same Galactic Hii region.

We investigate the chemical content of oxygen and other elements in the Cocoon nebula from two different points of view: an empirical analysis of the nebular spectrum and a detailed spectroscopic analysis of the associated early B-type star using state-of-the-art stellar atmosphere modeling. By comparing the stellar and nebular abundances, we aim to indirectly address the long-standing problem of the discrepancy found between abundances obtained from collisionally excited lines and optical recombination lines in photoionized nebulae.

We collect long-slit spatially resolved spectroscopy of the Cocoon nebula and a high resolution optical spectrum of the ionizing star. Standard nebular techniques along with updated atomic data are used to compute the physical conditions and gaseous abundances of O, N and S in 8 apertures extracted across a semidiameter of the nebula. We perform a self-consistent spectroscopic abundance analysis of BD+46 3474 based on the atmosphere code FASTWIND to determine the stellar parameters and Si, O, and N abundances.

The Cocoon nebula and its ionizing star, located at a distance of 800Â±80 pc, have a very similar chemical composition as the Orion nebula and other B-type stars in the solar vicinity. This result agrees with the high degree of homogeneity of the present-day composition of the solar neighbourhood (up to 1.5 Kpc from the Sun) as derived from the study of the local cold-gas ISM. The comparison of stellar and nebular collisionally excited line abundances in the Cocoon nebula indicates that O and N gas+dust nebular values are in better agreement with stellar ones assuming small temperature fluctuations, of the order of those found in the Orion nebula (t^2 = 0.022). For S, the behaviour is somewhat puzzling, reaching to different conclusions depending on the atomic data set used.

Reference: A&A (in press)
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1410.0119

Comments:

Email: ssimon@iac.es