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IONIZATION OF THE DIFFUSE GAS IN GALAXIES: HOT LOW-MASS EVOLVED STARS AT WORK

N. Flores-Fajardo,[1] C. Morisset,[1,2] G. Stasińska,[2] and L. Binette[1]

The Diffuse Ionized Medium (DIG) is visible through its faint optical line emission outside classical H II regions (Reynolds 1971) and turns out to be a major component of the interstellar medium in galaxies. OB stars in galaxies likely represent the main source of ionizing photons for the DIG. However, an additional source is needed to explain the increase of [N II]/Hα, [S II]/H$\alpha$with galactic height.

In this work we propose the following scenario: The extraplanar DIG is distributed in clouds (for simplicity represented by rectangles) that are ionized by two stellar populations. The radiation field from the OB stars embedded in H II regions escapes from the density bounded zones and ionizes the "bottom" parts of the gas clouds. The Hot Low-Mass Evolved Stars (HOLMES), which are distributed in the galaxy thick disk and halo, also contributes to the ionization of the clouds. Their influence with respect to that of OB stars increases away from the galactic plane. Figure 1 shows the details of the proposed scenario.

We chose to focus on the edge-on spiral galaxy NGC 891, a galaxy that has been extensively observed, especially in optical emission lines, thus providing the best diagnostics for our scenario. We used data from Otte et al. (2001).

The ionizing spectral energy distribution (SED) from OB stars is obtained using the code Starburst99 (Leitherer et al. 1999), considering continuous star formation. The SED of HOLMES is obtained using the code PEGASE (Fioc & RoccaVolmerange 1997) considering a instantaneous starburst for a look back time greater than 10 Gyr. The photoionization models for the DIG were computed with Cloudy (Ferland et al. 1998). Each model is defined by the ratio $\Phi_{\mathrm{HOLMES}}/\Phi_{\mathrm{total}}$, the ionization parameter U, O/H and N/O.

Our scenario, which considers both the population of OB stars and that of HOLMES, is able to explain the long standing problem of the ionization of the DIG. See Figure 2.

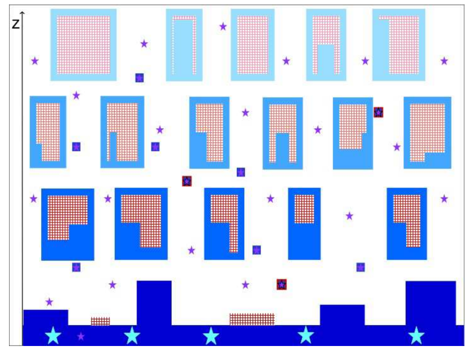

Fig. 1. Schematic representation of the extraplanar gas and ionizing stars. Ionized gas is represented in blue, neutral gas in red grid. OB stars in the disk are in cyan and halo HOLMES are in purple.

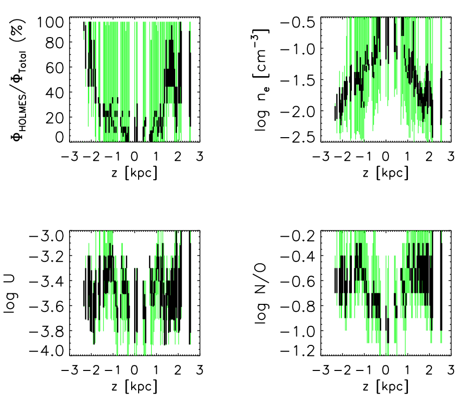

Fig. 2. $\Phi_{\mathrm{HOLMES}}/\Phi_{\mathrm{total}}$, n_{e}, U and N/O vs z for the models that fit [O III]/Hβ, [O II]/Hβ, and [N II]/Hα simultaneously. The light green bars indicate the range of the values for wich the models in the grid fit the observations at a given z. The dark bars show the same, but are restricted to solar abundance models.

[1]Instituto de Astronomía, Universidad Nacional Autónoma de México, Apdo. postal 70-264, México D.F. 04510, Mexico.

[2]LUTH, Observatoire de Paris, CNRS, Université Paris Diderot, Place Jules Janssen 92190 Meudon, France.

REFERENCES

Ferland, G. J., et al. 1998, PASP, 110, 761
Fioc, M., & Rocca-Volmerange, B. 1997, A&A, 326, 950
Leitherer, C., et al. 1999, ApJS, 123, 3
Otte, B., et al. 2001, ApJ, 560, 207
Reynolds, R. J. 1971, PhD Thesis, Univ. of Wisconsin, USA