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PHOTOMETRIC MEASUREMENTS OF WH_β AND $[OIII]/H_\beta$ OF HII REGIONS IN M83

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ABSTRACT. WH_β and $[OIII]/H_\beta$ were measured photoelectrically in 12 HII regions of M83. It was not found any systematic variation of WH_β or $[OIII]/H_\beta$ across M83. The very low excitation of the emission nebulae in M83 may be a consequence of the time evolution of the HII regions.

I. INTRODUCTION

In many spiral galaxies there is a strong dependence between the spectrum of a HII region and their galactocentric distance (Searle, 1971; Smith, 1975), which is attributed to a chemical composition gradient across the disk of the galaxy. In this work, we study the behavior of the H_β emission line equivalent width WH_β and the ratio of the forbidden lines $\lambda\lambda$4959, 5007 [OIII] to H_β in M83 (= NGC 5236).

II. THE OBSERVATIONS

We measured photoelectrically WH_β and $[OIII]/H_\beta$ in 12 HII regions of the M83 with the 1.60 m telescope of the OBSERVATÓRIO ASTROFÍSICO BRASILEIRO at Itajubá, Brazil. We used three interference filters: the H_β narrow, with passband $\Delta\lambda$ = 30 Å; the H_β wide, with $\Delta\lambda$ = 150 Å; the [OIII] centered at 5000 Å, with $\Delta\lambda$ = 90 Å. The shift of the transmission of the filters caused by the radial velocity was taken into account.

III. THE RESULTS

Log $[OIII]/H_\beta$ and WH_β versus the galactocentric distance ρ are plotted in the figures 1 and 2, respectively. The main conclusions are:

i) The $[OIII]/H_\beta$ and WH_β values of the HII regions at a same galactocentric distance show considerable scattering. It is not observed a

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gradient of $[OIII]/H_\beta$ or WH_β across M83.

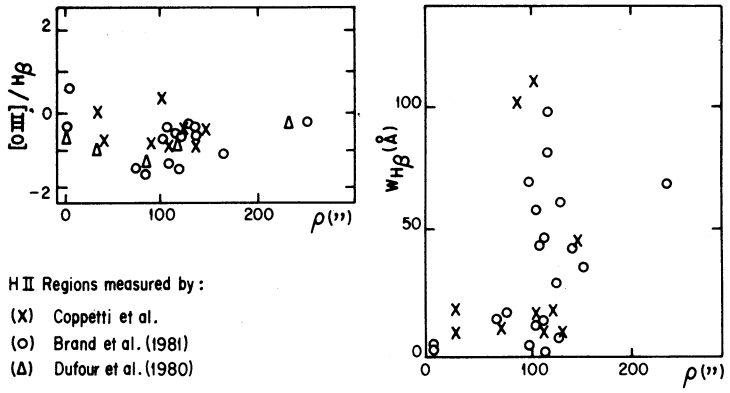
ii) The HII regions of M83 have very low excitation. The $[OIII]/H_\beta$ ratios and the WH_β values are smaller than those ordinarily found in other spiral galaxies.

IV. DISCUSSION

The very low excitation of the HII regions in M83 is surprising. There are many HII regions with $WH_\beta \gtrsim 20$ Å and $[OIII]/H_\beta \gtrsim 0.1$. These emission nebulae must be excited by stars with effective temperatures $T_{eff} \gtrsim 30000$ K, which correspond to ZAMS stars with mass $M \gtrsim 15\ M_\odot$. This seems to be an excessively small value for the upper stellar mass limit of the ionizing associations.

In a previous work we studied the time evolution of HII regions through models which take into account a single burt for the formation of the ionizing associations with different initial mass functions IMF ($1 \leq \chi \leq 3$) and upper stellar mass limits ($30 \leq Mu/M\odot \leq 120$). We found that WH_β and $[OIII]/H_\beta$ decrease monotonically as a function of time and consequently they are good HII region age indicators (Copetti et al., 1984).

Comparing these models with the observations, we concluded that the low values of WH_β and $[OIII]/H_\beta$ of the most emission nebulae in M83 are only compatible with evolved HII regions, with ages of about 4 to 7×10^6 years, if one assume that stars with mass $M \geq 30\ M\odot$ are formed in the ionizing associations in M83.



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