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Available in: http://www.redalyc.org/articulo.oa?id=57100956
DUST AND THE TEMPERATURE STRUCTURE OF ORION

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1. OBSERVATIONS OF ORION

We obtained new observations of the central part of the Orion Nebula. These observations, described in more detail in González-Gómez & Mayya (1999), were taken at the Observatorio Astronómico Guillermo Haro (OAG). The spectrum covered the range 3600–9600 Å and the instrument used was a Boller & Chivens spectrograph mounted with a 1024 and 1024 TEK CCD.

2. PHOTOIONIZATION MODELS

We present photoionization models calculated with spherical geometry. Using the temperatures determined from the line intensity ratios \( R_{\text{[O III]}} = \frac{[\text{O III}] 4363}{[\text{O III}] 5007} \) and \( R_{\text{[N II]}} = \frac{[\text{N II}] 5755}{[\text{N II}] 6583} \), we investigate two possible interpretations of the differences we found between \( T_{\text{[N II]}} \) and \( T_{\text{[O III]}} \) as well as the spatial gradients in both these temperatures.

1. First Model. The presence of dust mixed with the ionized gas causes both \( T_{\text{[N II]}} \) and \( T_{\text{[O III]}} \) to be larger than the dust-free case (see Fig. 1a), as in Baldwin et al. (1991).

2. Second Model. The presence of a very high density zone near the ionizing star causes \( R_{\text{[N II]}} = \frac{[\text{N II}] 5755}{[\text{N II}] 6583} \) to be larger (see Fig. 1b).

3. DISCUSSION

The behavior of the dusty model is overall in better agreement with the data since it reproduces well the gradient in \( T_{\text{[O III]}} \) although it fails to reproduce the gradient in \( T_{\text{[N II]}} \).
Fig. 1. The behavior of the temperature indicator line ratios $R_{\text{[O III]}}$ and $R_{\text{[N II]}}$ (see text) as a function of distance from the exciting star. (a) Model containing dust mixed with the ionized gas. (b) Model considering a strong density gradient from $5 \times 10^4$ cm$^{-3}$ near the star decreasing with radius to $5 \times 10^3$ cm$^{-3}$.

REFERENCES


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