

Revista Mexicana de Astronomía y Astrofísica

Revista Mexicana de Astronomía y Astrofísica
Universidad Nacional Autónoma de México
rmaa@astroscu.unam.mx
ISSN (Versión impresa): 0185-1101
MÉXICO

2000

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Revista Mexicana de Astronomía y Astrofísica, volumen 009
Universidad Nacional Autónoma de México
Distrito Federal, México
pp. 225-226

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DUST AND THE TEMPERATURE STRUCTURE OF ORION

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RESUMEN

En este trabajo se realizaron dos modelos de fotoionización: (*a*) con polvo, (*b*) con alta densidad. Se obtuvieron cocientes de líneas de [O III] y [N II] sensibles a la temperatura, los cuales fueron comparados con cocientes obtenidos de las observaciones.

ABSTRACT

In this work two photoionization models were calculated: (*a*) with dust, (*b*) with high densities. We compared the models with a new long slit spectrum of the Orion Nebula.

Key Words: **DUST: EXTINCTION — H II REGIONS — ISM: INDIVIDUAL (ORION NEBULA)**

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 $R_{[\text{O III}]} = [\text{O III}] 4363/[\text{O III}] 5007$ and $R_{[\text{N II}]} = [\text{N II}] 5755/[\text{N II}] 6583$, 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. 1*a*), as in Baldwin et al. (1991).
2. *Second Model.* The presence of a very high density zone near the ionizing star causes $R_{[\text{N II}]} = [\text{N II}] 5755/[\text{N II}] 6583$ to be larger (see Fig. 1*b*).

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 $T_{[\text{N II}]}$.

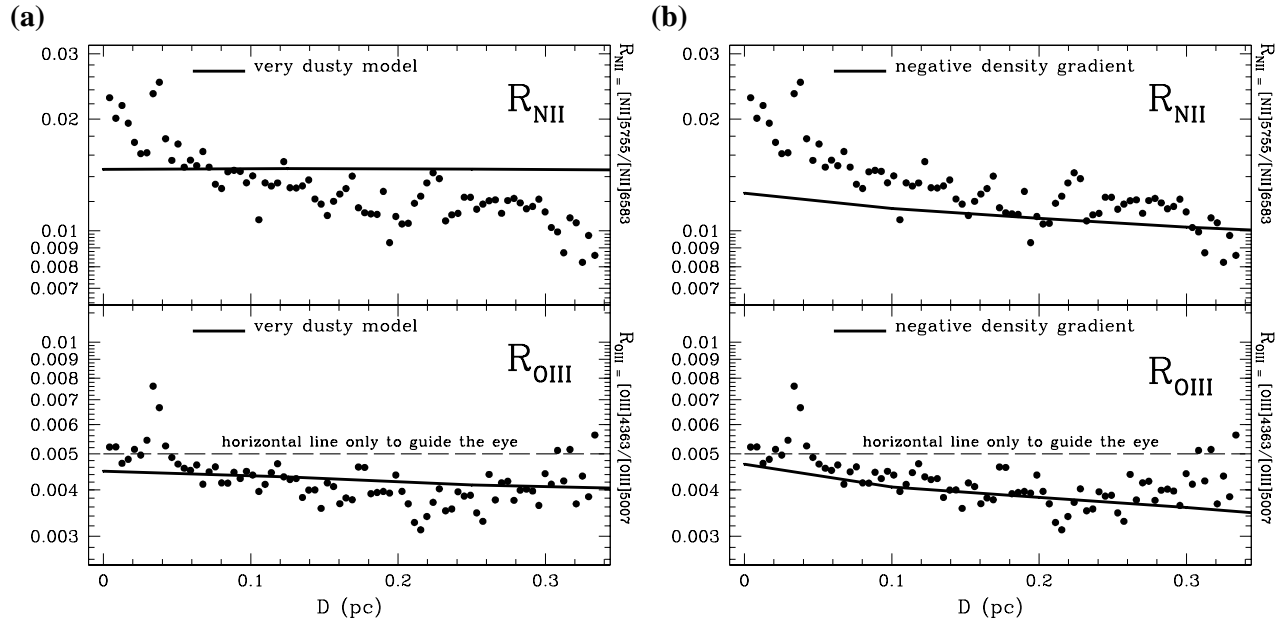


Fig. 1. The behavior of the temperature indicator line ratios $R_{[\text{O III}]}$ and $R_{[\text{N II}]}$ (see text) as a function of distance from the exciting star. (a) Model containing dust mixed with the ionized gas. (b) Model considering a strong density gradient from $5 \times 10^4 \text{ cm}^{-3}$ near the star decreasing with radius to $5 \times 10^3 \text{ cm}^{-3}$.

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