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DETERMINATION OF THE ELECTRON DENSITY IN THE ORION NEBULA WITH HIGH SPECTRAL RESOLUTION

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We present the results of long-slit echelle spectroscopic observations of the density-sensitive [S II] doublet in the Orion Nebula. These form part of a large-scale program to map the entire inner Orion Nebula in three dimensions at a resolution of $2'' \times 1'' \times 6$ km s^{-1} and in multiple optical emission lines, covering a wide range of ionization stages.

As well as showing the high-speed phenomena, such as jets and Herbig-Haro objects, in unprecedented detail, this dataset allows, for the first time, a detailed analysis of the structure and kinematics of the bulk of the nebular gas moving at transonic velocities of 5 to 20 km s^{-1}.

Our preliminary analysis covers a region to the west of the nebula, including part of the Bright Bar and HH 203/204 (see Figure 1). In addition to the principal emission component at $v_{\rm hel} \simeq 20$ km s^{-1} that arises from gas near the main ionization front of the nebula, we also find a lower density component at $v_{\rm hel} \simeq 0$ km s^{-1}, whose origin is unclear.

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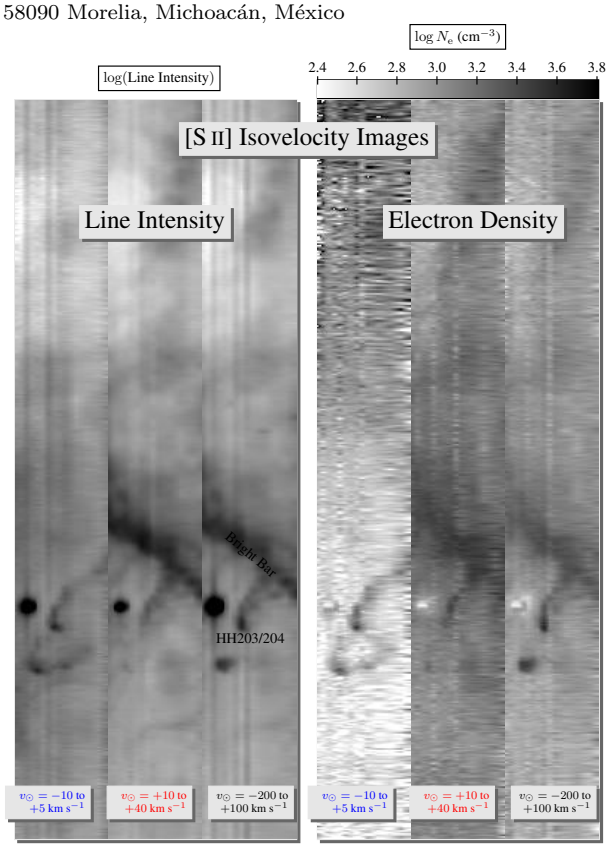

Fig. 1. Multiple longslit spectra are used in the construction of these isovelocity images, which cover an $\simeq 30'' \times 250''$ area around the Orion bar.

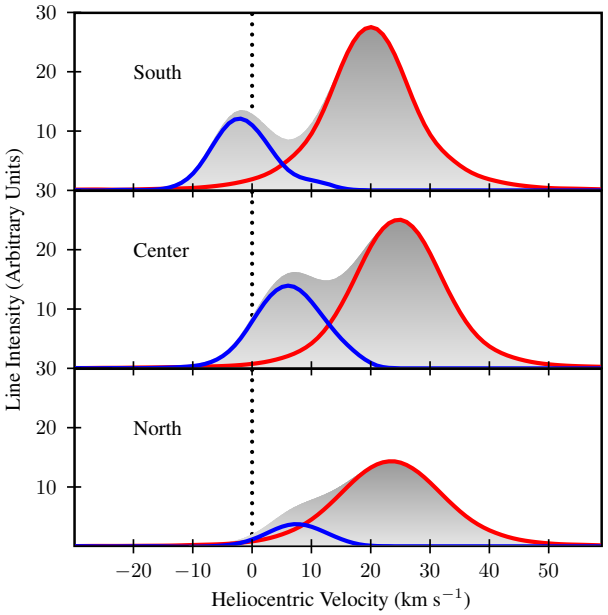

Fig. 2. Spatially integrated [S II] 6716 Å line profiles are decomposed into red and blue components.

The low-density blue-shifted component spatially overlaps the Bright Bar but seems physically separate from it. It is most prominent in the southern region of our slits, where it is well separated in velocity from the main nebular component. Towards the North, the density of this component increases and its velocity moves redward (Figure 2). The component has also been detected in another set of slits in the East of the nebula (not illustrated) but the blending with the main nebular component is worse there.

Two possible explanations for the blue-shifted component are: (i) that it represents a champagne flow away from the background molecular cloud; (ii) that it is a separate H II region ionized by θ^2 Orionis A that is projected onto the Orion Nebula.

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