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MODELING THE DUST AND AMMONIA EMISSION IN THE G 31.41+0.31 HOT MOLECULAR CORE

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Hot Molecular Cores (HMCs) are dense molecular clumps with $T \gtrsim 100\,$K, found in the proximity of ultracompact H II (UCHII) regions. It is believed that HMCs are envelopes infalling onto a central high-mass protostar. Osorio, Lizano, & D'Alessio (1999) modeled in detail their spectral energy distribution (SED) from dust emission, and obtained their physical parameters.

Here we present a model for the G 31.41+0.31 HMC. This source has a broad sample of dust continuum emission data in the literature, as well as high angular resolution ammonia line observations (see Figure 1). We modeled the SED of the source and we fitted it to the dust emission data, following the procedures described by Osorio et al. (1999). Adopting the density, temperature, infall velocity and velocity dispersion fields of the envelope provided by the SED fit, we have calculated the ammonia line emission, taking the ammonia abundance relative to hydrogen as the only free parameter.

The emerging ammonia line spectra as a function of the radius were derived and compared with the Cesaroni et al. (1998) observations shown in Fig. 1. As can be seen in Figure 2, our best model, assuming a constant ammonia abundance (10^{-7}) along the envelope, cannot reproduce the observations, whereas a model obtained with a variable ammonia abundance in the gas phase (ranging from 10^{-8} to 10^{-6}) can better explain the main characteristics of the observed spectra. We argue that this variation in the abundance results from the release of ammonia molecules from grain mantles at $T \sim 100\,$K, after sublimation of water ice (see Osorio 2000).

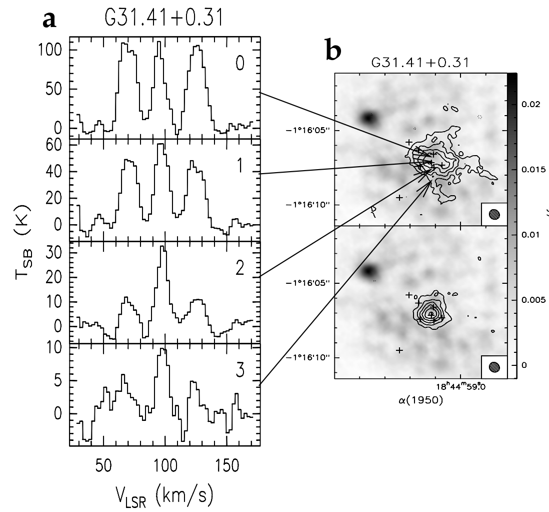

Fig. 1. (a) Observed spectra of the ammonia (4,4) line, corresponding to different radii (indicated in the top right corner in units of 5000 AU) from the center of the G 31.41+0.31 HMC. (b) Contour maps of integrated ammonia emission for the main (top) and satellite (bottom) lines, superimposed on the free-free emission (grayscale) of the UCHII region. Data from Cesaroni et al. (1998).

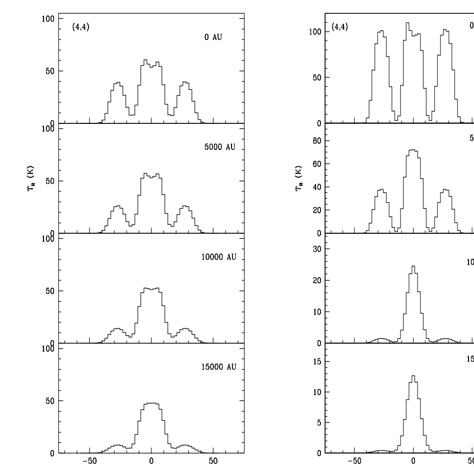

Fig. 2. Predicted ammonia (4,4) line spectra as a function of radius for a constant (left panel), and for a variable (right panel) ammonia abundance.

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