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Chemical differentiation in Sagittarius B2(N): first high resolution results

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Abstract. Sgr B2 is an active high mass star forming region in the Galactic center and the pre-eminent interstellar source of organic chemistry. Newly available broad bandwidth radio interferometry data enables a spatially resolved study of the chemical environments within the Sgr B2(N) core. We present selections from a 30 - 50 GHz spectral line survey conducted with the ATCA.

Keywords: astrochemistry – ISM: molecules – individual objects: Sagittarius B2

1. Background and data summary

Sgr B2(N) has significant physical structure on size scales smaller than the beam of a single dish telescope, including compact and extended HII regions (Gaume *et al.* 1995) and a well known hot core, the Large Molecule Heimat (LMH) (Snyder, Kuan & Miao 1994), embedded in an extended molecular envelope (Jones *et al.* 2008). Sgr B2(N) is the most chemically complex region known in the ISM, yet the chemistry has not been adequately mapped to the physical structure, with few lines published at high resolution.

Newly upgraded centimeter wave interferometers enable comprehensive studies of the physical and chemical structure, and offer significantly less line confusion than at high frequency. We conducted a 30 - 50 GHz spectral line survey towards Sgr B2(N) with the Australia Telescope Compact Array (ATCA) and extracted spectra from three distinct physical regions including (1.) the LMH hot core, (2.) the quasi-thermal methanol core "h" (Mehringer & Menten 1997) and (3.) a region containing shell-shaped expanding ionization fronts (Gaume *et al.* 1995), referred to as the N-shells. The data contain more than 1000 spectral features towards the LMH and "h" and hundreds towards the N-shells.

2. Discussion

Most detected molecular transitions are *either* observed in absorption towards the N-shells or in emission towards the hot core (Figure 1). Detected absorption lines are primarily from low energy states ($E_L \lesssim 10$K), indicating highly sub-thermal gas, whereas emission lines from the LMH and "h" have higher energies ($E_U \gtrsim 80$K). Extracted spectra (Figure 2) reveal that the excitation conditions in "h" are similar to those in the LMH. By comparing the spectra towards the LMH and "h", we can compile sets of lines with

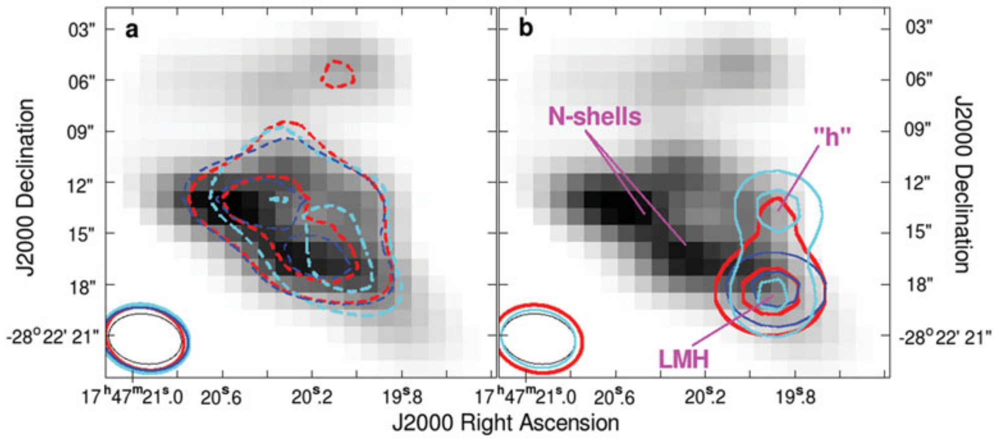

Figure 1. 40% and 80% integrated line emission contours over 40 GHz continuum illustrate observed chemical differentiation. **(a)** CH_2CN (2 - 1), CH_3CHO (2_{02} - 1_{01}), and Z-CH_3CHNH (2_{02} - 1_{01}) are observed only in absorption (dashed contours) preferentially towards the N-shells. **(b)** NH_2D (3_{13} - 3_{03}), CH_3CH_2CN (4_{31} - 3_{30}), and SO_2 ($19_{3,18}$ - $18_{3,15}$) are detected in emission towards the LMH hot core, and NH_2D and CH_3CH_2CN are detected in emission towards "h". [A color version is available online.]

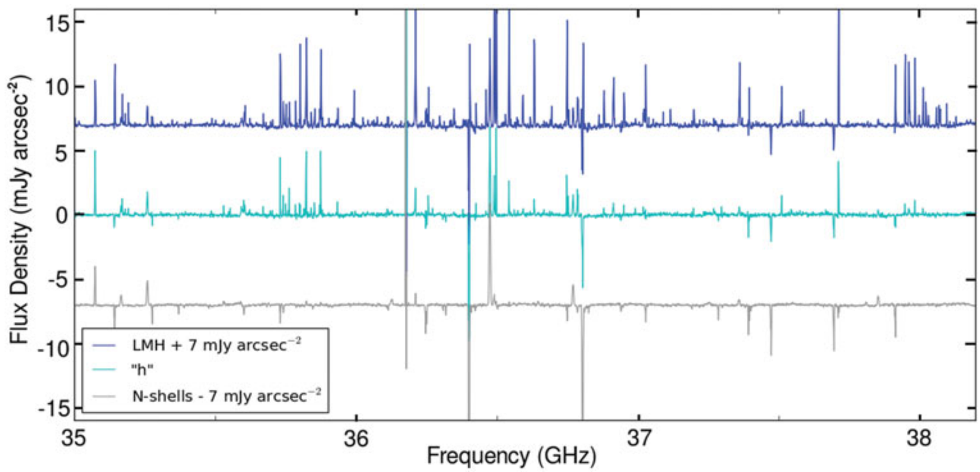

Figure 2. A segment of ATCA spectra. While most transitions detected towards the LMH are present towards "h", many are conspicuously missing or have significantly lower line strengths. [A color version is available online.]

similar line ratios. This can distinguish between transitions of different species, helping to confirm tentative line IDs and constrain the spectra of unidentified molecules.

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