OBSERVATION OF THE $2_{1,1} - 2_{1,2}$ TRANSITION OF METHANOL AT 2502.8 MHz IN SGR B2

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We have detected the $2_{1,1} - 2_{1,2}$ line of A-species methanol at 2502.784 MHz (Heuvel & Dymanus 1973; Xu & Lovas 1997) using the Nançay Radio Telescope[1], towards Sgr B2. The elliptic beam from this large telescope has HPBWs of $2.2' \times 11'$ – the major axis being aligned with the local vertical – which was large enough to include all the (M), (S), and (N) substructures of the source (Benson & Johnston 1984). The measurements were conducted in a sequence of 1-hour observations around local source transit in July/August 2016 and April 2017 using a sky symmetric position switching scheme where the observation is timed so that the on- and off-positions are observed along the same azimuth/elevation track in the local sky. The off position used was located approximately 21.3 arcminutes east of Sgr B2 and some tests were done with different throws to try to eliminate the possibility of off-beam contamination. A set of overlapping pointings were done in order to estimate the source size along the Right Ascension coordinate, see Fig. 1.

Our search for this line was motivated by the fact that the lower sibling transition at 834 MHz (Radford 1972) had only been detected in the Milky Way centre sources Sgr B2 and Sgr A* (Ball et al. 1970), and that there was a detection of the higher related transition[2], near 5 GHz, reported by Robinson et al. (1974) and Mezger & Smith (1976) in Sgr B2. To our knowledge, observations of the 2.5 GHz line has not been reported before.

Analysis of the results will appear in a later publication but we note here that the source appears rather compact as compared to what is suggested by the 834 MHz map by Gottlieb et al. (1979). The line profile properties are similar to the 834 MHz line, and it also shows a remarkable likeness – in an inverted sense – to the absorption line at 12.2 GHz (Whiteoak et al. 1988).

A search for this line was also conducted towards Orion-KL where narrower lines can be expected and thus a possibility to resolve the hyperfine structure of these lines existed. The effort did not yield any detection down to a 1σ level of about 20 mJy (at 1 km s^{-1} resolution).

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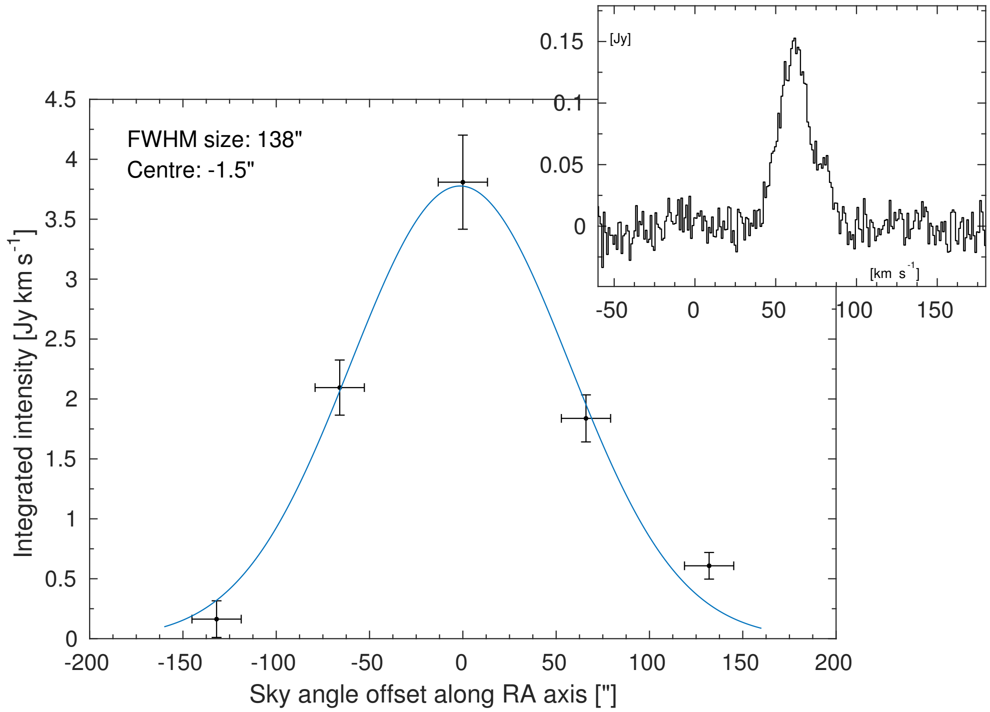

Figure 1. Integrated intensities along a strip of five positions with half-beam spacing centred on Sgr B2. The superimposed fit shows that distribution is consistent with a Gaussian source considerably smaller than the beam size of 132 arcseconds. The vertical errors include baseline noise and an adopted 10% calibration uncertainty. The horizontal bars correspond to expected 1σ pointing errors. The centre spectrum at the top has v_{LSR} as spectral axis and is resampled to 1 $\mathrm{km\,s^{-1}}$ $\mathrm{channel^{-1}}$. It was observed at the equatorial coordinates $17^{\mathrm{h}}47^{\mathrm{m}}20\overset{\mathrm{s}}{.}5$, -28°23′06″.0 (J2000). Third order polynomial baselines were subtracted in the velocity range -245 to +125 $\mathrm{km\,s^{-1}}$. Note that the flux density numbers pertain to the noise weighted *average* of two circular polarisation components.

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[2] The $3_{1,2}$-$3_{1,3}$ transition, see e.g. Fig. 3 in Ball et al. (1970). Note that the $J_{K_{\mathrm{a}},K_{\mathrm{c}}}$ notation is used in this Research Note, cf. Xu & Lovas (1997).