The observations of methanol at 36 GHz in Pushchino.

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Introduction

In 1991 our group began to search for new sources of methanol in the $4_{-1} - 3_0E$ line at 36 GHz. This line was detected in space by Turner et al. (1972). Later both maser and thermal emission at 36 GHz was detected in a number of molecular clouds (Morimoto et al., 1985; Haschick & Baan, 1989; Kalenskii et al., 1994). The goal of our work is to obtain an idea about the overall distribution of methanol in the Galaxy and to search for the connection of methanol thermal and maser sources with different objects in star-forming regions (HII-regions, bipolar flows, OH and H_2O masers etc).

At the first stage we observed at 36 GHz sources where other methanol lines have been detected previously. Thirteen new 36 GHz objects were found (Kalenskii et al., 1994). Then we began to search for the 36 GHz line toward objects north of $\delta = -29°$ where no methanol emission was detected previously. Our main targets are the luminous IRAS point sources with colors, typical for ultracompact HII-regions (Wood and Churchwell, 1989), but some other objects with manifestation of star formation were also observed. Preliminary results of this survey are presented here.

Observations

The observations are carried out with the 22-m radio telescope of Astro Space Center in Pushchino near Moscow in the double beam switching mode. The

Table 1: Gaussian parameters of the 36 GHz lines

Source	R.A. (1950)	Dec. (1950)	T_A (K)	$V_{\rm lsr}$ (km s^{-1})	ΔV (km s^{-1})
00494+5617	00 49 29	56 17 36	0.33(0.04)	-31.2(0.2)	3.3(0.5)
05443-0019[b)]	05 44 18	00 19 20	0.1(0.02)	15.2(0.48)	7.0(1.0)
17424-2859[b)]	17 42 29	−28 59 20	0.52(0.06)	28.8(4.2)	24.2(15.4)
			0.95(0.21)	49.1(1.4)	14.4(5.4)
17432-2855	17 43 16	−28 55 05	0.41(0.06)	51.9(0.6)	10.5(1.6)
17433-2841	17 43 21	−28 41 15	0.29(0.06)	34.8(1.7)	14.6(4.0)
17470-2853	17 47 04	−28 53 13	0.53(0.08)	17.3(0.5)	7.2(1.4)
18056-1952	18 05 38	−19 52 34	0.18(0.05)	70.2(0.9)	6.8(2.0)
18151-1208	18 15 09	−12 08 34	0.29(0.04)	30.2(0.2)	1.5(0.2)
14.33-0.64	18 16 01	−16 49 06	1.33(0.24)	22.0(0.3)	3.7(0.8)
M17(2)[a)]	18 17 30	−16 13 12	0.45(0.10)	18.2(0.4)	3.0(0.8)
29.98-0.04[a)]	18 43 35	−02 42 19	0.11(0.01)	102.6(0.4)	4.0(0.5)
18449-0115	18 44 59	−01 15 59	0.70(0.08)	97.8(0.2)	3.4(0.5)
18454-0158	18 45 25	−01 58 12	0.13(0.03)	98.9(0.3)	4.9(0.7)
18469-0132	18 46 59	−01 32 38	0.42(0.05)	84.6(0.2)	3.4(0.5)
18537+0749	18 53 46	07 49 16	1.06(0.08)	31.7(0.2)	4.2(1.2)
59.78+0.06[a)]	19 41 04	23 36 42	0.25(0.05)	22.3(0.4)	3.6(0.5)
19442+2427	19 44 14	24 28 00	0.26(0.03)	23.0(0.2)	2.7(0.4)

[a)] – marginal detection
[b)] – 36 GHz emission was observed nearby by Liechti & Wilson (1996)

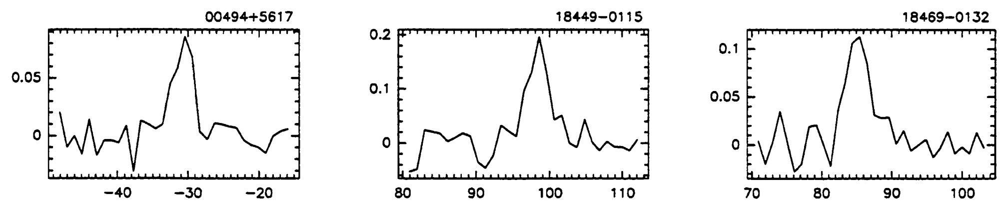

Figure 1: Spectra of the sources observed at 96 GHz.

beam size at 36 GHz is 2 arcmin and the main beam efficiency is 0.36. The front end of the receiver was a maser amplifier; in 1992 it was replaced by a transistor amplifier. The system noise temperature is 220 – 300 K, depending on the weather and elevation. The backend is a 128-channel filterbank spectrometer with 125 kHz (1 km s^{-1}) resolution; some sources were observed additionally with 7.5 kHz (0.062 km s^{-1}) resolution.

Results and discussion

The survey is not yet finished and only preliminary results can be presented. 140 objects were observed and 17 sources were detected. Thus the detection rate is rather low. The width of all the detected lines is several kilometers per second, typical for thermal emission.

One can notice a striking asymmetry in the detection rate toward the Galactic center and in the opposite direction. Fifteen sources were detected in the range of Galactic longitudes 0° – 60° and only two – in all other directions. The detection rate in the former range is 25% and in the latter range – only 2%. Asymmetry in the detection rates was found also in the methanol maser searches. Higher detection rate toward the Galactic center was found in the survey of the Northern hemisphere in the $5_1 - 6_0A^+$ methanol maser line at 6.7 (Slysh et al., in preparation). MacLeod & Gaylard (1993) and Schutte at al. (1993) reported a lower probability to detect a 6.7 GHz maser toward an IRAS source in Carina arm than in other directions; however, Gaylard and MacLeod (1993) concluded that the low detection rate in the Carina arm, reported by Macleod & Gaylard and Schutte et al. is due to insufficient sensitivity of their surveys.

The most probable explanation for the asymmetry of the detection rate in our survey is the same as was given by MacLeod & Gaylard (1993) and Schutte at al. (1993) to explain a low probability to detect a 6.7 GHz maser toward an IRAS source in Carina arm. They suggested that it may be due to the combination of sensitivity limitations and the Galactic metallicity gradient, i.e. the decrease of abundance of heavy elements with the galactocentric distance. However, further studies of this interesting phenomenon are necessary.

References

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