Cosmic Masers - from OH to H_0
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New OH Observations toward Northern Class I Methanol Masers

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Abstract. Maser emission of OH(1720) is formed, according to modern concepts, under the influence of collisional pumping. Class I methanol masers (MMI) are also formed by a collisional mechanism of the inversion of the molecular levels. It is not excluded in this case that physical conditions in the condensations of the interstellar medium where masers are formed may be similar for MMI and OH(1720) masers, and they can associate with each other. To establish a possible association between these two kinds of masers, and obtain reliable statistical estimates, a survey of class I methanol masers at a frequency of 1720 MHz has been carried out.

Keywords. interstellar medium, masers, molecules

1. Observations and Results

The observations were made at a frequency of OH 1720.530 MHz with the 70-m radio telescope of the National Academy of Sciences of Ukraine (NASU). The sample included 111 objects from the class I methanol maser catalogue (http://www.asc.rssi.ru/MMI), available for observations in Evpatoria, Crimea (declination $>-35°$). The antenna beam width was $9'$. A digital autocorrelation spectrometer, fabricated in the Institute of Radio Electronics of NASU, Kharkov, Ukraine, was used - with a frequency resolution of 4.028 kHz (4096 channels, 16.5 MHz bandwidth) or a radial velocity of 0.7 km s^{-1} at 1720 MHz.

There are 72 spectra without obvious interference, 27 (38%) have no OH emission or absorption lines, 30 sources have both emission and absorption details. All spectra exhibit notable circular polarization. Gaussian parameters for the line profiles were obtained. Many emission lines are narrow ($\Delta V < 2$ km s^{-1}). Flux densities in narrow features greater than 100 mJy were obtained for a significant number of sources and for some more than 500 mJy.

2. Statistical Analysis and Discussion

OH maser emission at 1720 MHz in the direction of SNR are observed in 10% cases, i.e. in 20 SNR out of 200 (Hewitt & Yusef-Zadeh 2008 and references therein).

OH maser emission at 1720 MHz in the direction of star forming regions (SFR) from observations in the southern hemisphere is present in 11% of cases, i.e. in 28 SFR out of 200 (Caswell 2004).

OH maser emission at 1720 MHz in the direction of class II methanol masers observed in the northern hemisphere is present in 6% of cases, i.e. in 6 SFR from 100 (Szymczak & Gerard 2004).

Narrow emission lines of OH(1720) in the direction of class I methanol masers in the observational data of this survey is present in 38% of cases, i.e. in 27 MMI from 72.

3. Conclusions

• The detection of emission in OH(1720) lines and their correlation with the positions and velocities of class I methanol masers may be considered as an indirect indication of the presence of shock waves in the observed regions: this idea was also discussed in Frail (2008), Pihlström *et al.* (2011) and Litovchenko *et al.* (2011).

• The width of the observed OH(1720) features means that they may be maser lines, and values of the observed fluxes enable us to propose these sources as prospective candidates for VLBI experiments to determine the sizes and brightness temperatures of the emitting condensations.

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