EXTENDED OH EMISSION AT 1720 MHZ*

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Abstract. Low-velocity OH emission lines at 1720 MHz have been investigated in the direction of W41, W43, W51, and 3C 353. The emission lines in the directions of W43 and W51 show no detectable circular polarization and are about 27 and 32 arcmin in size, respectively. The inferred peak brightness temperatures are 0.6 K for W43 and 2.0 K for W51. This emission may be similar to the nonthermal 1720-MHz emission in dust clouds.

Low-velocity OH emission lines at 1720 MHz have been investigated in the direction of W41, W43, W51 and 3C 353. The work was prompted by the observations of Goss (1968) and Goss and Robinson (1968), who found low-velocity ($|V|<10$ km s^{-1}) 1720-MHz emission in the directions of several sources. Since the gas giving rise to this emission is presumably local, no physical connection between the OH and the background discrete sources was postulated. (For W43 and W51 the background sources are H II regions with velocities $|V|>10$ km s^{-1}). In most cases H I absorption lines are found at approximately the same velocities as the 1720-MHz OH in these directions. Later work by Hardebeck (1971) failed to detect the W51 line using an interferometer with a fringe separation of $\sim 5'$. This negative result suggested to us that the OH source might be extended with a size $>5'$.

Observations were carried out with the 25-m telescope of the Onsala Space Observatory at 1720 and 1667 MHz, and with the higher resolution of the Nançay Radio Telescope at 1720 MHz. The emission lines in the directions of W43 and W51 show no detectable circular polarization and are about 27 and 32′ in size, respectively. The inferred peak brightness temperatures are 0.6 K for W43 and 2.0 K for W 51. This emission may be similar to the nonthermal 1720-MHz emission in dust clouds.

The sources OH 31-0 and OH 49-0 (in the vicinity of W43 and W51, respectively) exhibit OH emission at 1720 MHz and absorption at the other three 18-cm lines. The 1720-MHz emission is extended, with angular sizes of the order of 30′. The intensity ratio between the main lines is close to that expected for LTE conditions with small optical depth, whereas the 1612-MHz line is abnormally strong. This suggests a

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smaller excitation temperature for this transition. The 1720-MHz emission line does not show any strong circular polarization, and the velocity width is broader (up to 10 times) than the emission lines from Class I OH sources. The emission and absorption probably take place in OH gas concentrations close to the Sun in which the ground state energy levels appear to be populated in a way similar to that found in some dust clouds. The pumping is probably caused by IR radiation. The observed properties of the 1720-MHz emission may be summarized as follows:

(i) the lines are broader than for Class I OH masers;

(ii) the intensity of the lines is not strongly correlated with the continuum brightness due to background sources;

(iii) the lines are not strongly circularly polarized as in the case of Class I sources; and

(iv) the apparent angular extent is many orders of magnitude greater than the Class I sources. The OH emission and absorption in the direction of 3C 123, 3C 353, Cas A, Sgr A and OH 23-0 probably have properties similar to OH 31-0 and OH 49-0. These properties are consistent with an enhanced excitation temperature for the 1720-MHz transition, although the presence of an actual population inversion in this transition cannot be ruled out.

References

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