ESTIMATES OF MAGNETIC FIELDS IN INTERSTELLAR GAS CLOUDS FROM 18-CM OH SATELLITE LINES

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In interstellar clouds, where "thermal" /nonmaser/ OH emission in the 18-cm lines is observed, prominent anomalies of the intensities of the two satellite lines, 1612 and 1720 MHz, are often seen. If a cloud is observed against a background source of radio continuum, then one satellite may be in strong absorption, while the other one is in emission almost as strong as that in the main lines, 1665 and 1667 MHz. In those clouds, for which several positions were observed in the OH lines, the roles of the satellites are sometimes interchanged with the displacement along the cloud. At the same time, the main lines usually have the intensity ratio close to the equilibrium one. This behaviour indicates to deviations of the level populations of OH molecules from the Boltzmann ones.

Such extended clouds with the anomalous OH satellites were classified by Caswell and Haynes /1975/ as Class IIc OH sources. Many examples can be found in Caswell and Haynes /1975/, Haynes and Caswell /1977/, Pashchenko /1979/, Lucas et al. /1979/ and in other works.

These satellite anomalies can be explained by the model of spin alignment of OH molecules in an external magnetic field, by the action of the infrared radiation of an embedded /protostellar or young stellar/ object at the wavelengths about 100 mcm /Burdyuzha and Varshalovich, 1973/. Thereby, the satellites' intensities are affected first of all. A consideration of the IRAS Point Source Catalog shows that many OH clouds with satellites' anomalies really contain strong far-infrared emitters.

The geometry of the model is presented on Figure 1. On Figure 2, "maps" of satellites' anomalies in a cloud, as viewed at different angles ϑ, are shown. These "maps", when compared with the observed ones, allow in principle to estimate the direction of the magnetic field with respect to the line of sight. Earlier measurements of

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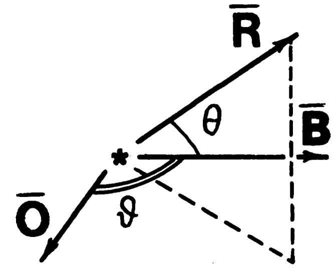

Figure 1. Geometry of the model:
* - the embedded IR source,
R - the direction of the pumping radiation,
O - towards the observer,
B - the magnetic field direction.

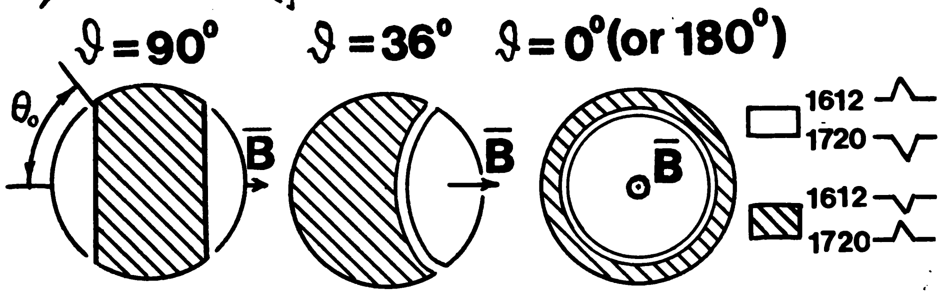

Figure 2. Simplified model "maps" of a spherical OH cloud with an IR source in its centre and with a homogeneous magnetic field; $\theta_0 = 54^0$ is the critical angle in the model of Burdyuzha and Varshalovich /1973/.

interstellar magnetic fields by means of Zeeman doublets with components of opposite circular polarization /e.g., Kazès et al. /1988/, Goodman et al. /1989// yield but the longitudinal component of the field /+ or -/. Our "maps" in combination with Zeeman results can give the true vector of the magnetic field intensity.

However, the situation in a real cloud may be more complicated, with the regions of emission and absorption in the same satellite overlapping; this may result in a "P Cyg" /or "inverse P Cyg"/ type profile, which is sometimes really observed /Pashchenko, 1979/.

A detailed publication on this subject is now in preparation.

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