VARIABILITY OF INTERSTELLAR WATER VAPOR MASERS

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1. Introduction

We present some results of observations of H_2O masers (1.35 cm line) in Star-Forming Regions. The observations have been made from the beginning of the eighties at the 22 m radiotelescope at Pushchino, Russia (Lekht et al. 1995). The time interval between two consecutive observations is about one month. The spectral resolution is 0.1 km/sec and the sensitivity, for a time integration of 15 minutes, is about 10 Jy. The sources with which we deal in this work are: ON1, ON2, W31A, W75S, S128 and S252A. We pay attention to results of flux variations that are either common to all the sources or are results that allow to establish differences between them.

2. Results

For the analysis we have, for each source, integrated the flux over the entire spectrum. In the sources where the emission preferentially appeared in groups of spectral features, we computed the integrated flux for those groups. We also analyzed flux time curves of spectral features. In the 3D plot of Fig.1, we may see the evolution of the spectrum of the S128 H_2O maser.

One may basically divide the variations into flares and long-term variations. Flares are flux enhancements that last for timescales of the order of one year or less. Long-term variations are the background variations. The time curves of the channels where a flare was observed have been separately analyzed. Flares of H_2O emission have been observed in all the sources studied here. The results of our studies can be summarized as follows: a) In all the sources we recorded flares which took place in a spectral range where no emission, above the noise level, was observed before. The typical time of these events is of few months to about one year. In some cases, during such flares any side features disappeared but they reappeared again after the flaring feature turned down. b) In spite of the preceding results, generally new features appeared during a flare. However, it seems that there is no relation between the velocity width of the emission and the intensity of the flare. c) An anticorrelation between the fluxes of pairs of spectral features has been observed in ON2 (Lekht et al. 1996) and W75S (Lekht et al. 1995b). The anticorrelation took place only during some time intervals. d) During some time intervals, these sources also show an anticorrelation between different groups of features. e) In the remaining sources neither anticorrelation between the fluxes of groups of features nor anticorrelation of separated features (during flares) were observed. f) In the strongest flare observed in S252A, a delay of the time curve of the red side of the line was observed (Fig.2). Unlike in other sources, S252A did not show persistent spectral features at a given velocity. The features always showed a drift to the red side of the spectrum.

The results for flares, except for some details, are similar for those of long-term variations (Lekht et al. 1995b, Berulis et al. 1995, Lekht et al. 1996).

3. Conclusions

The appearance of new flaring features probably indicates that the conditions for masering appeared at a new location, probably due to a travelling perturbation. Since this was observed for all sources, we think that this phenomenom is common. In cases where the lateral features dissapeared during

J. Andersen (ed.), Highlights of Astronomy, Volume 11B, 970–971.

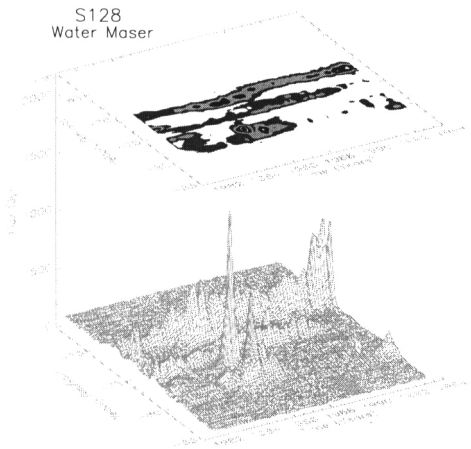

Figure 1. 3-D plot of the S128 H_2O Spectrum

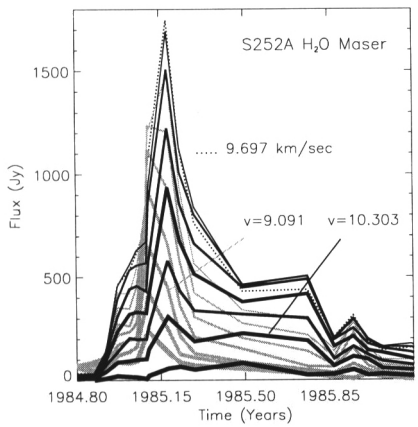

Figure 2. Time curves for different channels during the strongest flare at the S252A H_2O maser. Dotted line denotes the curve of the maximum. Black lines are red shifted channels. Grey lines are blue shifted

the flaring of a new feature, the perturbation that produces a new feature may also quench old ones.

The anticorrelation between different spectral ranges indicates that the masers are saturated. Probably we are observing different classes of masers. One class of masers is always near partial saturation and at times becomes saturated. The other class was unsaturated during the time interval of the observations and probably is in a state where saturation rarely occurs.

References

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