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A STUDY OF THE VARIABILITY OF WATER MASER EMISSION IN A SAMPLE OF YSOS

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We present results of water maser observations in a sample of YSOs. The observations were made using the Haystack 37 m antenna during a span of time of about eight months. The sample was selected to study the variability of the water maser emission in sources with far-infrared luminosity between 300 and $24 \times 10^3\ L_\odot$. Based on the observed variability, the sample can be divided into two main groups. About half of the sources show large variations in the intensity of the stronger features (more than an order of magnitude) in timespans between one and several months, while in the other sources the changes in intensity are smaller (less than a factor of 10) but on similar timescales. Finally, the variability of the observed water maser emission does not show a clear time pattern.

It is well known that H_2O maser emission, associated with young stellar objects (YSOs), shows variability on short (days and weeks) and long (months and years) timescales. To study this issue, we observed H_2O maser emission in a sample of YSOs with the Haystack 37 m radio telescope from 2000 December to 2001 July at about one month intervals.

We find different kinds of maser variability in our sample of YSOs, which can be divided into four main groups (see Figure 1). In addition, we find that in all sources at least one of the main maser features appeared or disappeared during the observations and about half of the sources have at least one maser feature that periodically increases its intensity with time.

To quantify the degree of variability of the maser features, we compute the variability index (V_i) of all maser components of the sample. The variability index is defined as $V_i = F_{max}/F_{min}$ (Palagi et al. 1993), where F_{max} and F_{min} are the maximum and minimum observed flux density for each maser component (F_{min} takes the value of the noise level in the spectrum when a component disappears).

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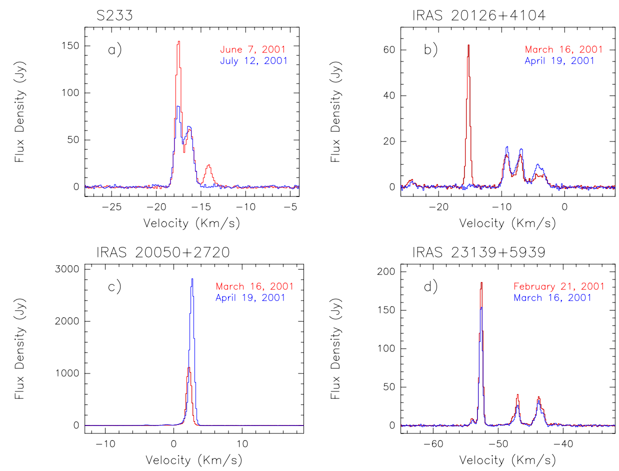

Fig. 1. Maser variability of four YSOs. The two spectra in each panel were taken about one month apart. The first observed spectrum is shown in light gray and the second is shown in dark gray. This figure shows 4 different kinds of maser variability: (*a*) The weakest component disappears, while the strongest component decreases in intensity. (*b*) The strongest feature completely disappears, while the other features do not show large variations in intensity. (*c*) The maser feature increases its intensity more than a factor of two. (*d*) All maser components show little variation in intensity.

From the variability indices, we find that all the sources have maser features with $V_i < 10$ and that about 60% of the sample have maser features that show large variations in the intensity ($V_i > 10$). However, we do not find any relation between the luminosity of the sources and the variability of the H_2O maser features. Finally, we find that most of the maser features have variability indices between one and three, although a wide range of values is found in the sample.

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