TIME VARIATION OF SiO MASER EMISSIONS

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We report a series of observations of the v=1, J=2-1 transition of SiO (86243.28 MHz) toward four Mira variables (o Cet, R Leo, W Hya, and R Cas) and Orion A over the period September 1976 - February 1978. Observations were made with the 6-m mm-wave telescope of the Tokyo Astronomical Observatory. Most of the spectra were taken with an acousto-optical spectrometer with an effective resolution of about 57 kHz.

Among these sources, only o Cet tended to show in-phase variation during our observing period. We could find no clear periodicity in the variations of either fluxes or profiles of the other three. In particular we observed irregular variations in W Hya, the spectrum of which consisted of a narrow emission component and a broad wing component (Figure 1). The narrow components showed a rapid decrease by a factor 3 from the beginning to the end of June 1977 (at phase 0.8). A simple radiative pumping model alone cannot account satisfactorily for the variation of the narrow components. The wing component could be seen throughout the observed period; its integrated flux seemed to be small near minimum (Figure 2). It varied independently of the narrow component, and its degree of variation was rather small. These two components may be formed in different regions of the envelope. The broad line shape of the wing component suggests that it may be formed in some region where the maser gain is similar in all directions, such as a region where the dust and gas are rapidly accelerated outward, or the flow is turbulent.

The double emission feature of the Orion SiO maser has steep outer edges and gradually tapering inner edges which resemble the shapes of OH maser lines emitted in the circumstellar envelopes of OH/IR stars. We could notice in the spectra a slight bridge between the double emission features (Figure 3), which seems to show us that these two velocity components originate in the envelope of single star, and not from two independent late-type stars as suggested by Snyder et al. (1978). The relative intensity of the -6.5 km/s component and +16.2 km/s component changed from 0.4 on September 1976 to 1.25 on July 1978. The relative intensity of these two components since their first discovery has been plotted in Figure 4.

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The change of the relative intensity in the J=2-1 transition within the observed period is smaller than that in the J=1-0 transition(Moran et al. 1977, Balister et al. 1977, Snyder et al. 1978, and Lepine et al. 1978).

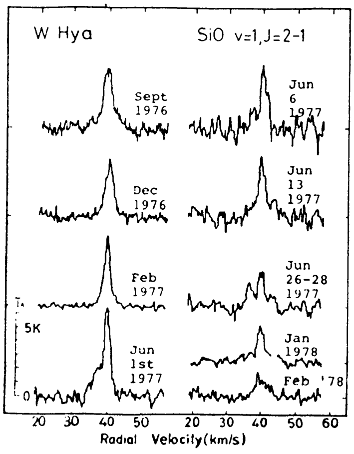

Fig. 1 Spectra of W Hya

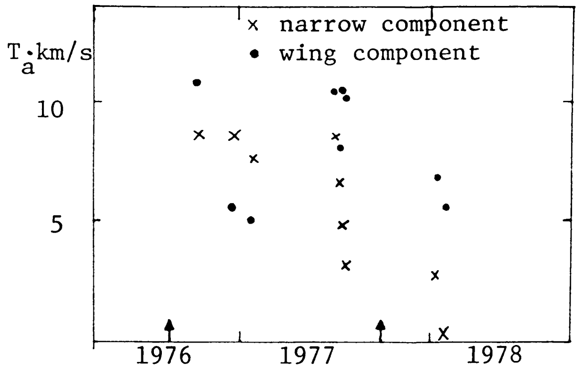

Fig. 2 Variation of integrated fluxes of W Hya

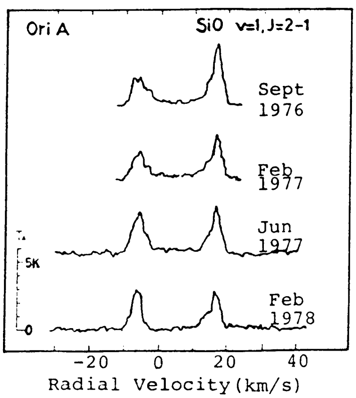

Fig. 3 Spectra of Ori A

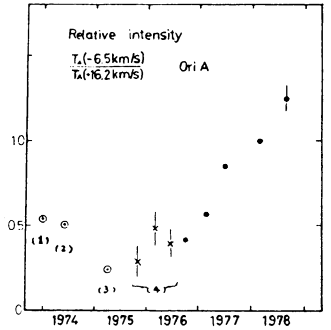

Fig. 4 Relative intensity of double emission feature of Orion A; (1) Snyder et al.(1974), (2) Ulich and Haas (1976),(3) Kaifu(1975), (4) observation with 1 MHz filter bank at TAO

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