MONITOR OBSERVATIONS OF THE ORION SiO MASER

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Monitor observations of the SiO v=1, J=2-1 transition were made toward the Kleinman-Low infrared nebula. Observations were made from September 1976 to February 1980 with the 6 m mm-wave telescope of the Tokyo Astronomical Observatory. Data were taken with an acousto-optical spectrometer with a frequency resolution of about 50 kHz(Δv=0.17 km s^{-1}).

The appearance of the Orion SiO maser profile is characterized by two strong emission peaks. We have found that velocity structures in the double emission feature tend to shift toward the central velocity. The inward shifts in velocity structures recur at a typical interval of about 2 years. The changes in radial velocity of individual peaks can be followed over 2 years. The rates of velocity shifts were found to be $0.9 \sim 2.7 \times 10^{-3}$cm s^{-2}, were different for each recurrent component. These results are discussed in terms of a decelerating expanding envelope of a pulsating star. The velocity shifts of the maser emission peaks can be explained by (i) expanding shells of dense material expelled recurrently from a central star undergoing a deceleration, or by (ii) shock waves propagating out through an envelope with decreasing velocity. In either case, the size of the region where maser amplification can occur is estimated to be about 1×10^{14} cm, and the maser emitting region is confined to a fraction of this region.

The central star seems to be less luminous than about 1 to 2 x 10^4 $L_\odot$(Genzel et al. 1979). Assuming that the mass of the central star is 1 $M_\odot$, we estimate the radius of the central star to be about 700 $R_\odot$ from the period density formula. A candidate star would be a protostar in the early stage of star formation immediately after flare-up(Narita, Nakano, and Hayashi, 1970). It is likely that the protostellar core would become unstable against radial pulsation in the sequence of evolution and that the collapse of the envelope is stopped and reversed by gas ejection due to the pulsation.

References;

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