DETECTION OF WATER MASER EMISSION FROM A CARBON STAR V778 CYGNI

Y. Nakada, H. Izumiura, T. Onaka, and O. Hashimoto
Department of Astronomy, Faculty of Science, University of Tokyo,
Bunkyo-ku, Tokyo 113, Japan

N. Ukita, and S. Deguchi
Nobeyama Radio Observatory, Tokyo Astronomical Observatory, University of Tokyo,
Nagano 384-13, Japan

and

T. Tanabé
Tokyo Astronomical Observatory, University of Tokyo
Mitaka, Tokyo 181, Japan

Infrared spectra of evolved stars are generally dominated by the radiation from their circumstellar shells. M stars are characterized by the 10 μm emission feature from silicate dust grains, while C stars by the 11 μm SiC band. However, some C stars have been found to show the 10 μm feature indicating the oxygen-rich property of their circumstellar dust (Willems and de Jong 1986, Little-Marenin 1986).

In order to investigate the gas phase chemistry of the circumstellar envelopes around these peculiar objects, we have observed radio molecular lines of H_2O, SiO, HCN, and CO towards three of them BM Gem (C5, 4J), V778 Cyg (C4, 5J), and EU And (C4, 4).

Water maser emission has been detected towards V778 Cyg (Fig. 1) in the present observation. It is another evidence of the oxygen-rich nature of the circumstellar envelope around V778 Cyg, because water vapor has always been found around M stars. Thermochemical calculations also support the idea that the water molecules are present in the oxygen-rich environment but not in the carbon-rich one. The positional coincidence of the water maser with the optical star was found to be less than 0.5 arcsec (Deguchi *et al.* 1987), (Fig. 2). Unfortunately no other emission has been found, though Benson and Little-Marenin (1987) observed a water maser in EU And. Our negative detection of maser emission in EU And was probably due to the intensity variation of the object.

Our observation has confirmed the oxygen-rich chemistry of the circumstellar gas around the carbon-rich star V778 Cyg. The radial vleocity of the maser peak (−17 km s^{-1}) is red-shifted by only 2 km s^{-1} relative to the optical photospheric velocity (−19 km s^{-1}). Therefore, the expansion velocity of the maser emission career in V778 Cyg seems 2 to 10 km s^{-1}, a moderate value contrary to the case of EU And.

The interpretation for these peculiar objects has not been established. There are two possibilities though. One is that we are observing the transition stage of an evolved star from M- to C-type with a

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remnant circumstellar shell expelled in the preceeding M giant stage. The difficulty in this hypothesis is that the transition time will be too short to be observed. The other possibility is that an invisible M star which is bright in the infrared forms the binary system with a visible C star. The accurate observation of the radial velocity variation is necessary to see if this hypothesis is correct or not.

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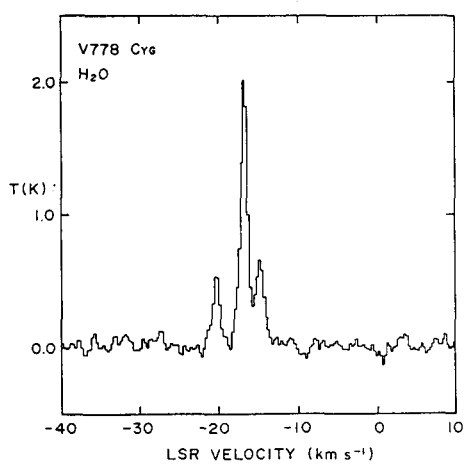

Fig.1. Spectrum of the H_2O maser emission in V778 Cyg.

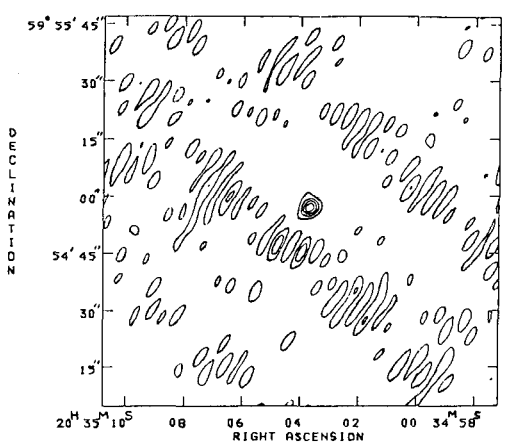

Fig.2. A map of water maser emission toward V778 Cyg. The contour levels are −0.2, 0.2, 0.4, 0.6, and 0.8 normalized to the peak flux 5.9 Jy/beam.

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