Detailed monitoring of the water vapor maser in the binary protostellar system of solar masses IRAS 16293-2422

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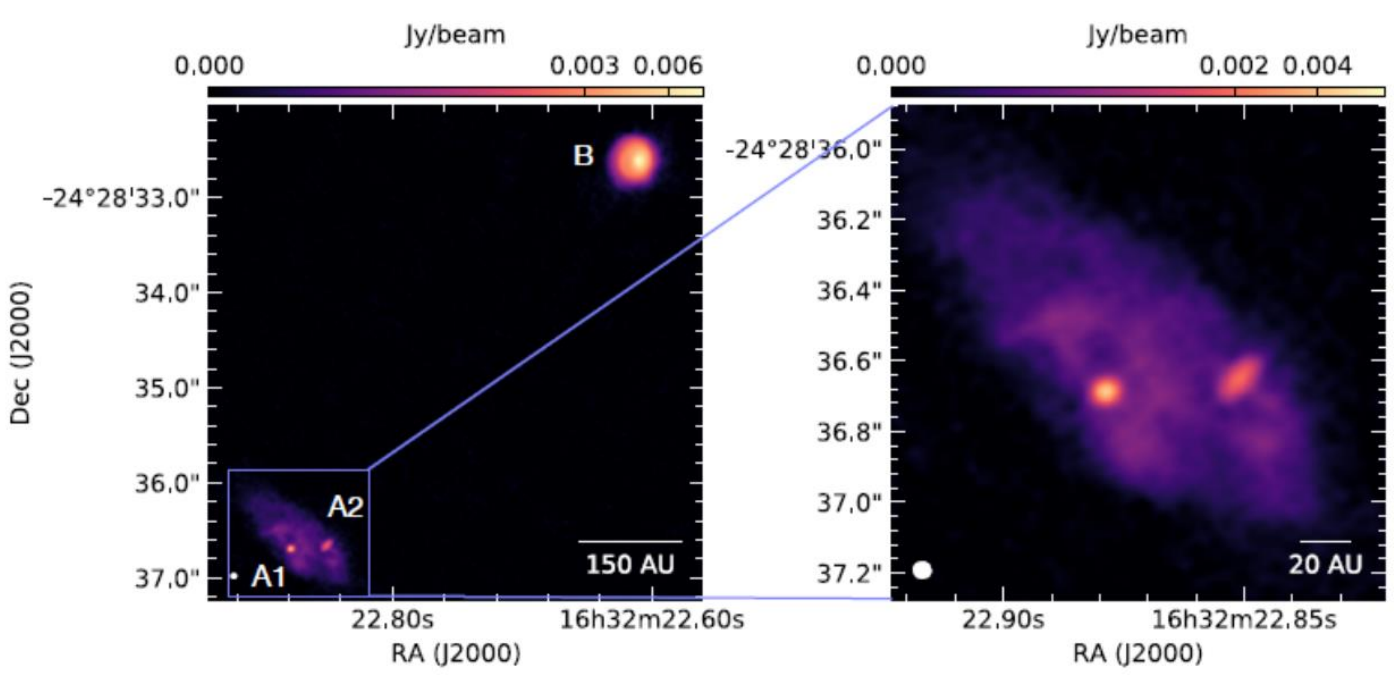
The double system of solar masses IRAS 16293-2422 has been studied for more than 30 years as an example of a binary protosolar system. The existence of compact unresolved emission A1 possibly connected with to the dusty circumstellar disk by a size of low 3.6 au. The detail A2 was resolved and consisted with a gas-gust circumstellar disk by a size of 12 au.

Detailed monitoring about one year of the water vapor maser in the double protostar object nearly solar masses IRAS 16293-2422 was performed. The observations were made at the frequency 22.235 GHz of the 6_{16} - 5_{23} water-vapor maser transition. For observation used the 22-m Simeiz telescope (RT-22).

A unusual powerful short maser are was detected, occurred at the top of a longer but less powerful are, possibly initiating a powerful maser radiation of more short maser one.

Based on ALMA Band 3 continuum observations IRAS 16293 have in his composition compact sources A1 and A2 with a minimum total mass 2.2+-0.3 Mo and the separation between A1 - A2 about 54 au (Maureira et al., 2020):



Each of they include protostar+disk and the gas mass within the Keplerian orbit. Line-of-sight velocities are 2.1 and 5.8 km/s for A1 and A2, respectively.

The gas-dust disks around protostars may contain of water maser components that move in Kepler orbits around protostars.

The question arises, in, which of the disks is may be our water maser with a features of 6 and 8 km/s?

The new data obtained in both cases are extremely important, as they indicate that the configuration of the flare events could have been not random need for appeared of power flares.

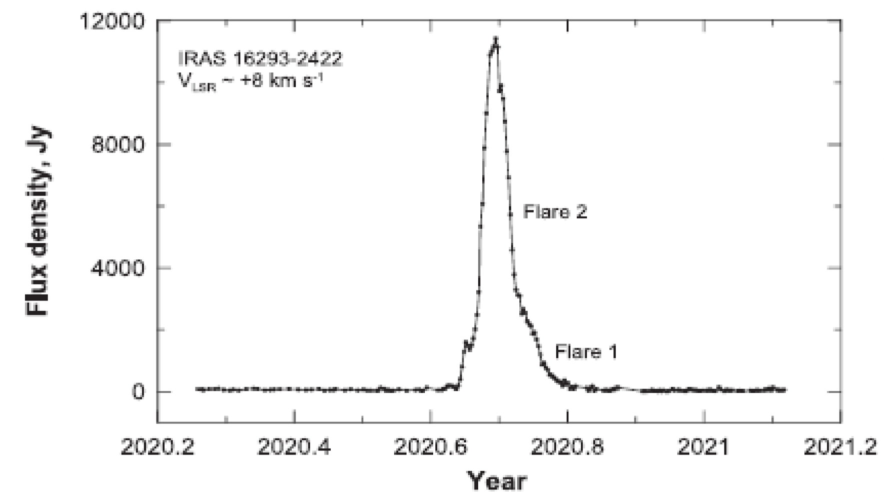


Fig.1. The 1-yr observations of the flux density with the time of the water maser emission in IRAS 16293 from 2020 March to 2021 February.

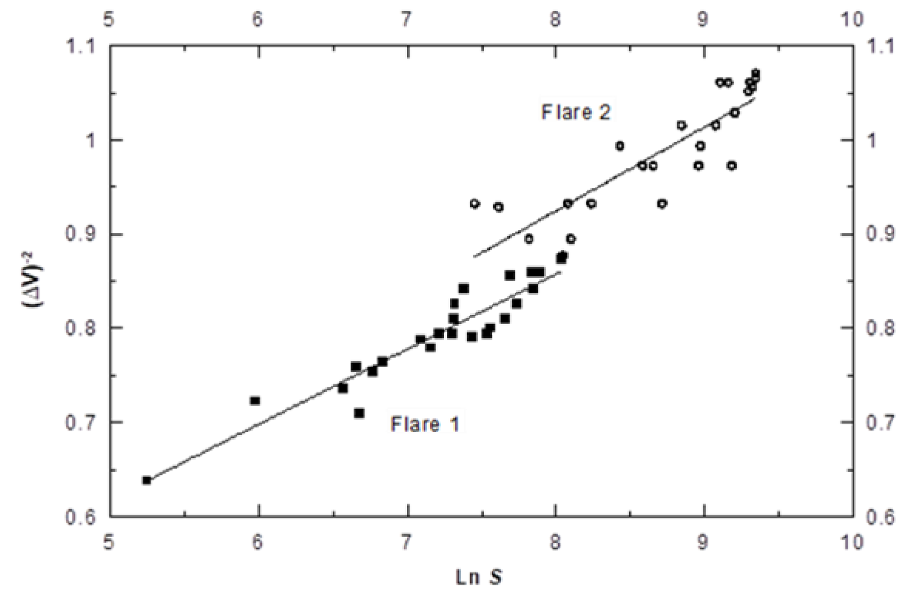


Fig. 2. The dependencies between $(\Delta v)^{-2}$ and ln(S).

The specific pump power required for the observed flux density from IRAS 16293 is introduced:

$$n_1 n_e \geq \frac{10 l^{-3} D^2 F(\Delta\nu_{H_2O}/\nu_{H_2O})}{q^r_e(E_r/k T_e)[(T_H - T_e)/T_H]}.$$

The data obtained by us probably confirm the assumptions made at the early stages of the study of the water maser regarding the state of the maser in maser clusters (Goldreich et al. 1972).

As applied to our flares it is formulated as follows: a maser cluster can simultaneously contain maser formations in both the unsaturated and saturated states, which are on the line of sight to the observer and have close velocities of features.

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