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Observations of H_2O and OH masers in star-forming regions

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Abstract. We report long-term observations of H_2O and OH maser emission sources at wavelengths of 1.35 and 18 cm associated with star-forming regions. Strong quasi-periodic flares of maser emission have been observed. Several sources (in particular, G25.65+1.05, IRAS 16293−2422, Cep A) have displayed strong flares in the H_2O line, when their peak flux density raised by a few orders of magnitude above the quiet state. Possible causes of this are discussed.

Keywords. stars: formation, stars: planetary systems: protoplanetary disks, radio lines: stars.

Cosmic maser sources associated with protostellar and/or young stellar objects in star-forming regions often demonstrate strong variability. In particular, this is typical of masers emitting in the 6_{16}–5_{23} rotational line of the water-vapor molecule at a wavelength of 1.35 cm. Since 1980, we have been monitoring a sample of 60 H_2O masers in star-forming regions at the 22-meter radio telescope of the Pushchino Radio Astronomy Observatory, Russia. The same sources are also monitored in the OH lines at $\lambda = 18$ cm on the Nançay radio telescope, France. Some of them are well-known masers, such as Ori A, W43M3, W51, W75N. Strong quasi-periodic flares of H_2O maser emission have been observed by Colom *et al.* (2018); Kurtz *et al.* (2018); Shakhvorostova *et al.* (2018); Volvach *et al.* (2018) in the source G25.65+1.05 (IRAS 18316−0602), maximum peak flux density reaching scores of kilojanskys, whereas the source in its quiescent state had hardly 300 Jy (Fig. 1). This source was observed on 29.09.2017 with a record angular resolution on a baseline of 9 Earth diameters by the space-ground RadioAstron interferometer just during its flare, when its peak flux density reached 13 kJy. It displayed a single unresolved feature smaller than 0.1 mas, see Kurtz *et al.* (2018).

Another example is IRAS 16293−2422, a young binary system, the nearest one to the Earth with two collimated molecular outflows, Girart *et al.* (2018). In 2018 the source also had a strong flare in the H_2O line (Fig. 2).

Possible causes of this are discussed, among them consecutive excitation of the maser by a propagating shock wave and processes related to turbulence and gravitational instability in the circumstellar protoplanetary disks.

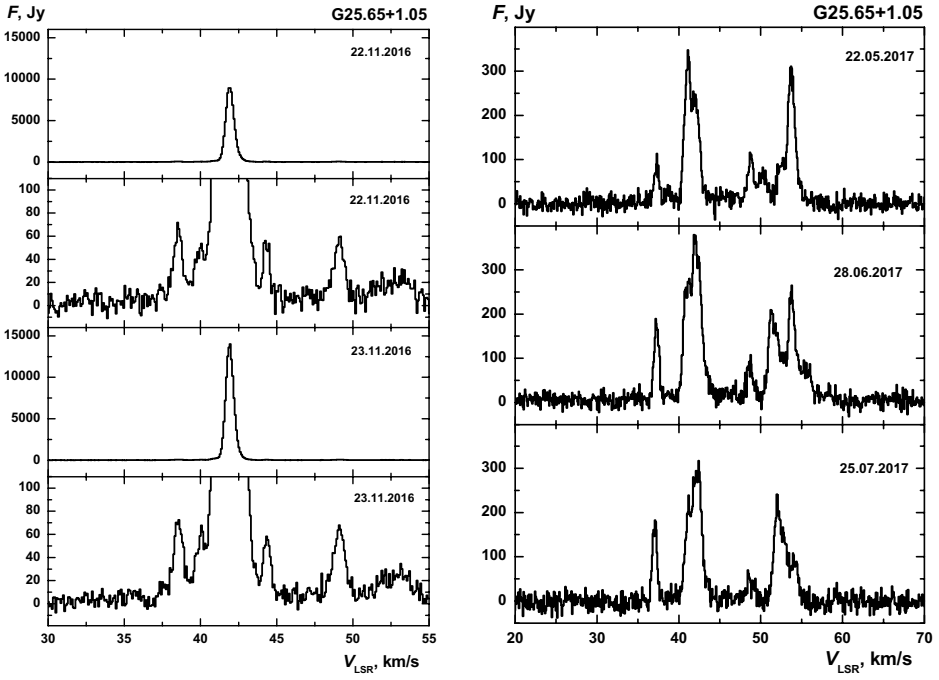

Figure 1. The flare of the source G25.65+1.05 (IRAS 18316−0602) in 2016 (left) and the source in its quiescent state in 2017 (right).

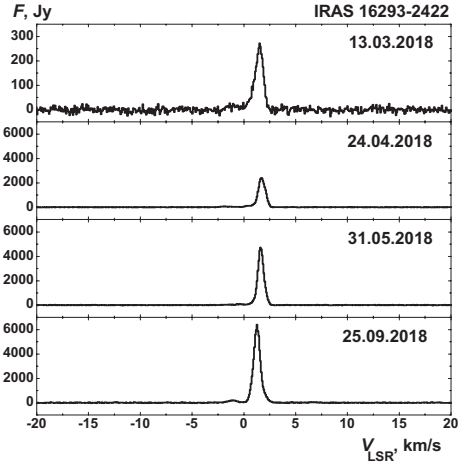

Figure 2. The flare of the source IRAS 16293−2422 in 2018.

The complete version of this poster in the electronic form (together with some OH data) can be found at:
http://comet.sai.msu.ru/~gmr/IAUS345_24122.pdf

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