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Spectral and VLBI-structure monitoring of an OH maser flare in W75N

A. V. Alakoz[1], V. I. Slysh[1] and V. Migenes[2]

[1]Astro Space Center, Lebedev Physical Institute, Profsouyzanya 84/32, Moscow, Russia
email: rett@asc.rssi.ru; vslysh@asc.rssi.ru

[2]Departamento de Astronomia, Universidad de Guanajuato, Apdo. Postal 144, Guanajuato, CP 36000, GTO Mexico
email: vmigenes@astro.ugto.mx

Abstract. We present VLBI and single dish observations of a strong (1000 Jy) OH maser flare at 1665 MHz in the star-forming region W75N. This new flare appeared in 2003, after a 100 Jy flare in 2000. Three major spectral features N_1, N_2, and N_3 were present at all epochs, with N_1 declining and N_2 increasing in flux density during observations taken in 2003–2006. All three features have strong linear polarization approaching 90 %. VLBI maps show that along with the strong features N_{1-3}, many weaker features have appeared within 100 mas of the ultra compact HII region VLA 2. The proper motion of the flare feature N_1 was measured: $\Delta\alpha = 1.36 \pm 0.3$; $\Delta\delta = -0.3 \pm 0.3$ mas in 1.75 years, corresponding to a tangential velocity of about 8 km s^{-1} relative to the rest of the features, and is comparable to the radial velocity range in the VLA 2 disk.

Keywords. ISM: individual (W75 N) – masers – stars: formation – radio lines: ISM – ISM: molecules – ISM: kinematics and dynamics

1. Introduction

OH maser spots in W75N are grouped along two almost perpendicular straight-line segments, with the HII regions located approximately in the middle of the lines. The overall picture resembles two edge-on discs, which contain OH masers and are centered on VLA1 and VLA2. VLBA observations in November 2000 and January 2001 have shown that two new spectral features appeared with a flux density 145 and 35 Jy. One can suppose that the flare of these features (called P_1 and P_2) was a precursor of a stronger flare which was first observed 2.5 years later, on October 24, 2003 with the Nançay radio telescope (Alakoz *et al.* 2005). This time very strong features N_1 and N_2, with a flux density for N_1 up to 1,000 Jy, have emerged in the spectrum of 1665 MHz line. This is possibly a record flux in the history of observations of OH masers. In early 2004 we started a spectral monitoring campaign with the 64-m Kalyazin radio telescope. Also, we have used new EVN 1665 MHz multi-epoch observations in combination with EVN and VLBA archive data (Slysh & Migenes 2006, Fish *et al.* 2005, Fish & Reid 2007) to measure absolute positions and proper motions of flaring OH maser components. In this paper we present a short summary of the monitoring results.

2. Results

Fig. 1 shows 1665 MHz RCP spectra of W75N for the period from July 2004 to July 2006. Strong variability, by about two order of magnitudes was observed in the flare features N_1 – N_4, without significant changes in the other features. Mapping of the maser has revealed that N_1 – N_4 are new features, not coinciding in position and radial

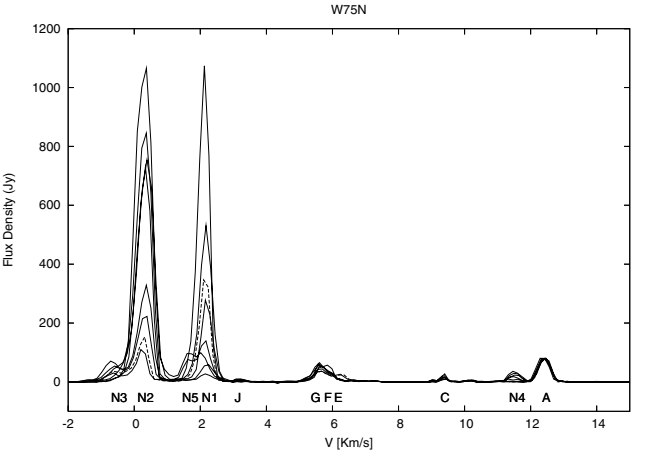

Figure 1. Overlapped spectra from eight observing sessions in Kalyazin (Jul. 2004 – Jul. 2006). 1665 MHz maser emission in RCP.

Table 1. Proper motion of OH maser spots in W75N from September 2004 to June 2006

Maser Spot	N1	N2	N3
ΔR.A., (mas)	1.36	−0.41	−0.8
ΔDec., (mas)	−0.31	1.29	3.6

velocity with P1 and P2, which have already faded and are now not detectable. The proper motion measurements exclude a possibility that they are the same features, with large tangential velocity. In Table 1 the variation of the relative distance between the strongest features in two years, from 2004 to 2006, is given. The relative displacement of the maser spots is very small (Table 1), with a maximum value of 1.4 ± 0.3 milliseconds corresponding to a transverse velocity 7.8 ± 1.7 km s^{-1}. For N_3 the errors are larger, about 2 mas because of the extended image of this feature., and the values given in Table 1 must be considered as upper limits. Therefore, the maser spots are stationary or slowly moving objects. Such a velocity is consistent with a Keplerian velocity in the circumstellar disc, but is too small for a shock or stellar wind. The OH maser flare can be due to a MHD-shock travelling from the young star and energizing maser emission in clumps encountered on its way out.

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