W43A: A MAVERICK MASER SOURCE

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We report here on some preliminary results from a multi-epoch monitoring project of the OH and H_2O masers in the source W43A. Our results suggest that W43A is a very young stellar object which has just entered a strong stellar wind stage.

Type I OH masers are normally associated with regions of star formation and are known to have a complex spatial structure, they are also associated with strong H_2O masers and $\Delta V_{H2O} \geq \Delta V_{OH}$. Type II OH masers are associated with late-type giant stars and tend to exhibit a definite shell structure indicative of an expanding circumstellar envelope. In many cases Type II masers are also accompanied by H_2O masers and $\Delta V_{H2O} \leq \Delta V_{OH}$. The maser source W43A is a dramatic exception to the standard classification. The two H_2O emission complexes are observed to be separated by $\sim 180 kms^{-1}$ while the two principal OH complexes are separated by $\sim 16 kms^{-1}$. Due to the unusual nature of these observations we have observed the maser emission with various interferometers in an attempt to deduce the nature of the source.

To date we have five epochs of interferometric observations of W43A: 1) March 1981: MERLIN observations of the OH 1612 MHz masers (see Figure 1a); 2) February 1985: VLA observations of the OH 1612 MHz and H_2O masers. The VLA OH observations confirmed the MERLIN data, the VLA H_2O map is shown in Figure 1b. 3) May 1986: VLBI frequency-switched observations of the H_2O masers searching for component proper motions (data being reduced); 4) September 1986: VLBI observations of the OH 1612 MHz masers, the map resulting from these data shows essentially the same picture as the MERLIN data from 5 years previously but in more detail; the maser distribution is still seen to be peculiar with no hint of the shell structure we have come to expect in Type II OH masers. 5) November 1986: second epoch VLBI observation of the H_2O masers.

The MERLIN map of the OH 1612 MHz masers revealed that the blue and red-shifted components are separated by 0.21 ± 0.03 arcsec and that each of them consists of a number of point sources located within the same region. The blue-shifted masers lie at a position angle of $\sim 285°$ with respect to the red-shifted. The VLA OH 1612 MHz data confirmed

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the MERLIN data but the VLA H_2O map was a great surprise. In Figure 1b it can be seen that the separation of the two H_2O components is $\sim$ 0.5 arcsec, over twice that of the OH masers; normally H_2O masers lie closer to the central exciting source than OH masers. More surprisingly the position of the blue and red-shifted H_2O maser components is reversed compared with the OH masers, i.e. the velocity gradient for the H_2O masers is in the opposite direction across the source than that for the OH masers.

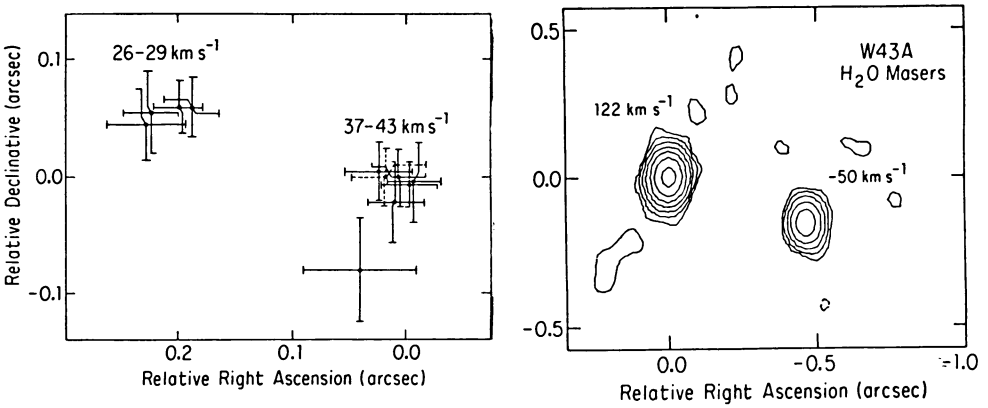

Figure 1:a) shows the MERLIN map of the OH 1612 MHz data, the velocities given are with respect to the lsr; b) the VLA map of the H_2O masers.

What is W43A? From CO data we have obtained and from IRAS observations which imply a dust temperature $\leq$ 30 K we believe W43A is in fact a young stellar object and not an evolved star. The OH and H_2O maser observations reveal the presence of a disc structure suggestive of either rotation or some mechanism confining the maser emission to a plane. The separation of the H_2O masers is about twice that of the OH masers suggesting either a very peculiar excitation mechanism and/or temperature gradients or a geometric effect. The large difference in ΔV_{OH} and ΔV_{H2O} suggest either strong acceleration or deceleration occurring in the W43A region, however, the opposite polarity of the two velocity gradients again suggests an odd geometric arrangement.

A whole series of models can be constructed in an attempt to explain our observations of this source but we favour one in which the central object is a new protostar which has just entered the stellar wind stage, this wind may be pushing on the inner regions of a disc of gas which contains the H_2O masers causing a rapid expansion. The OH masers are then presumed to lie in the less dense outer regions of the disc which are still falling towards the central object. A rotational component in the outer regions would produce the peculiar velocity distribution observed and could be supported by a central object with a mass of 1-20 $M_\odot$.

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