Young stellar objects and outflows in the W3(H_2O)/W3(OH) region

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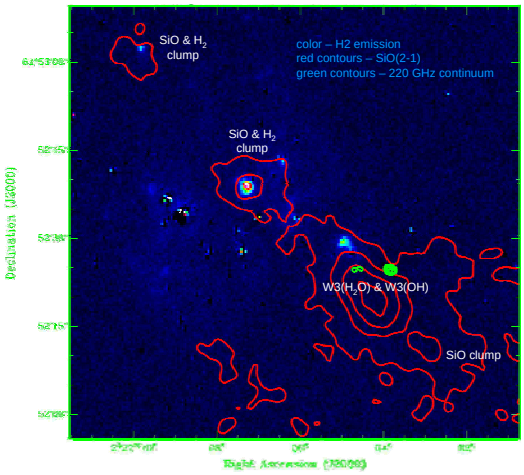
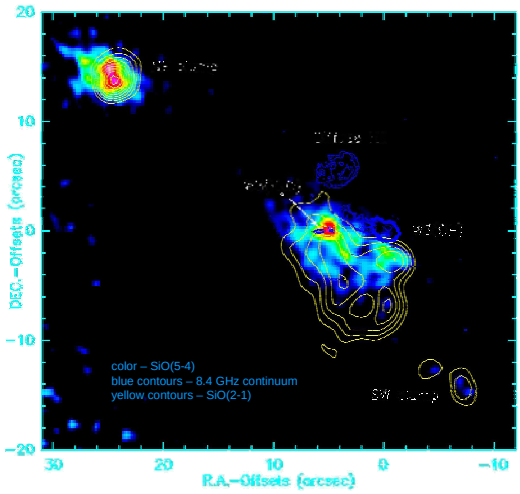
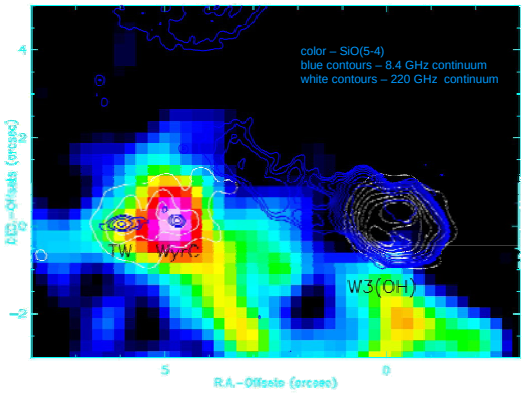
BIMA observations of emission in the SiO (2-1) and SiO (5-4) lines display a region of size ~10" (corresponding to 0.1 pc) encompassing the cluster of water masers W3(H_2O) and 3 compact clumps. One of the compact clumps is located ~20" southwest from W3(H_2O) and is seen also in methanol emission. The other two clumps are located ~25" and ~50" to the northeast from W3(H_2O) and are seen in infrared lines of molecular hydrogen, that obviously indicates their association with shock waves. The arrangement of clumps tells that they most likely correspond to periodic ejections of material from the young stellar object located in the region of the cluster of water masers W3(H_2O).

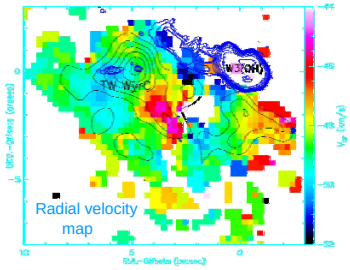


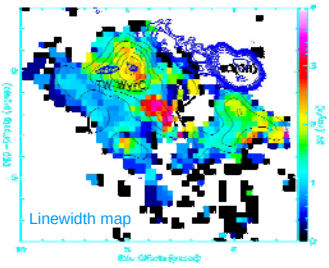


In the W3(H_2O) region observations of radio continuum and molecular lines display the presence of two young stellar objects (YSOs) surrounded by envelopes emitting in CH_3CN, CH_3OH and the ambient cloud emitting in lines of CH_3OH and other molecules. Proximity of positions (angular separation ~1") and radial velocities (differ by ~2 km/s) of the young stellar objects testify that they are likely forming a binary system with total mass ~15 M_o (Sutton, Sobolev et al. 2004).

One of these YSOs is known as the TW object and is associated with a jet or disk producing synchrotron emission in the ~1.2" structure extended east - west (Wilner, Reid & Menten 1999; Shchekinov & Sobolev 2004). The second YSO designated as Wyr C is located on a continuation of this structure in the western part of the water maser cluster (Wyrowski et al. 1999). The peak of emission of some molecules with non-stationary chemistry (SiO, C_2H_5CN, HDO, etc.) coincides with Wyr C. This suggests that the source of periodic ejections with the higher probability is Wyr C object. This hypothesis is supported by the fact that the direction of periodic ejections is greatly inclined (~45º) with respect to the synchrotron structure of the TW object.

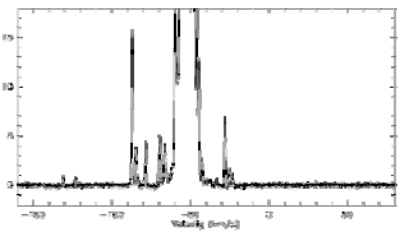




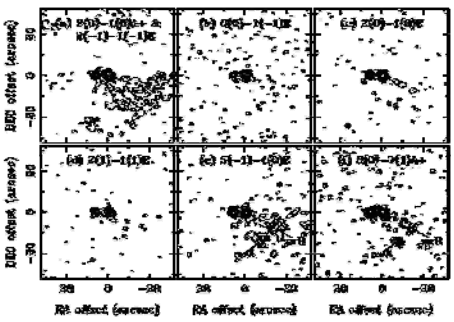


Extended areas of SiO and methanol emission trace zones where the shock waves which have arisen due to the ejection of material from YSO interact with substance of a dense cloud on the border of which the young stellar objects of W3 (OH)/W3 (H_2O) region were formed.

Water masers in W3(H2O) region display velocities which differ by up to ~80 km/s from systemic velocity. This indicates that the outflows in the region are faster than revealed by SiO observations.



Effelsberg spectrum of H2O masers



BIMA maps in CH3OH lines

The outflow is likely inducing formation of new stars in swA and swB clumps seen in methanol emission (Sutton, Sobolev et al. 2004).