Submm observations of the cometary globule 12, CG12

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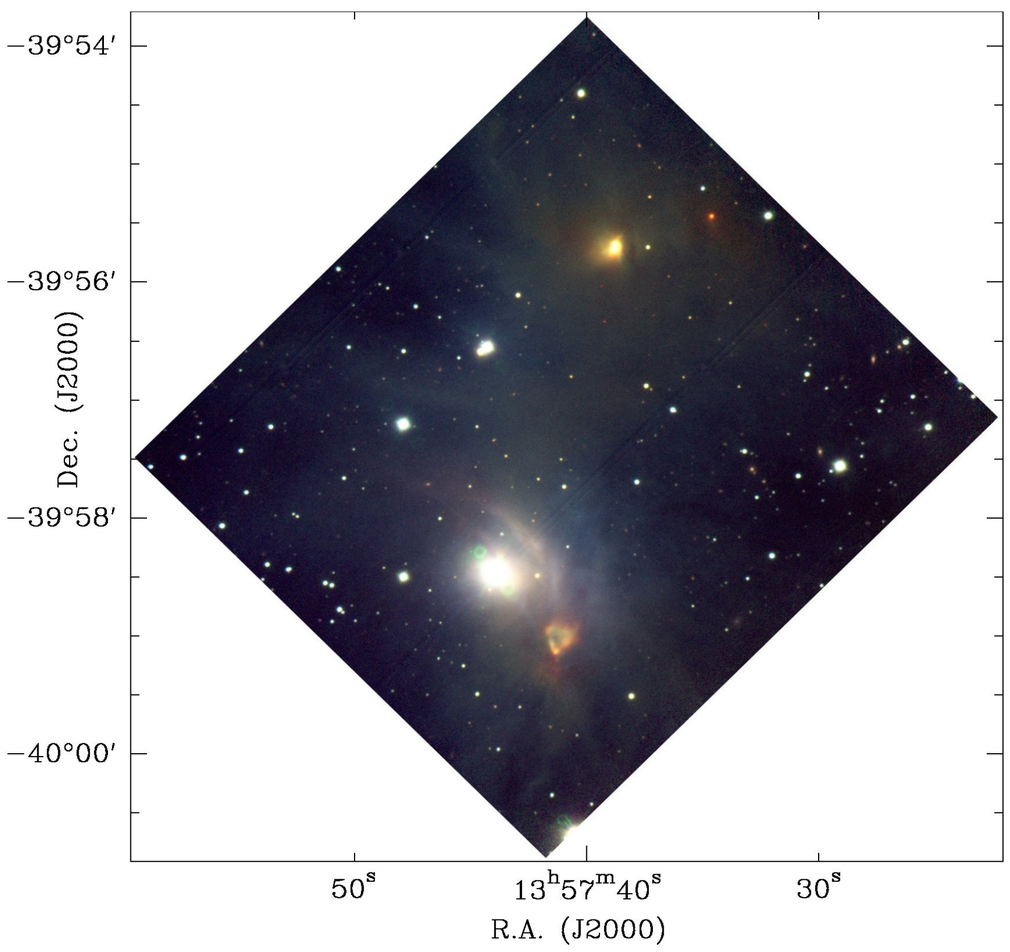
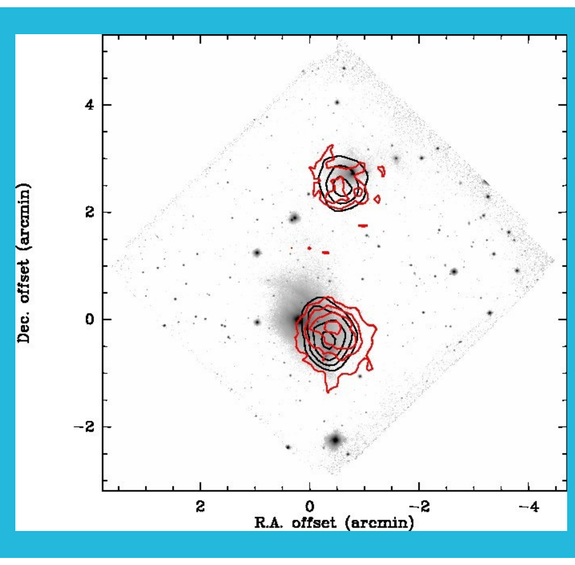
Cometary Globule 12 is a low mass star forming region 200 pc above the Galactic plane which contains two prominent cores, **CG12_S**(outh) and **CG12_N**(orth). Star formation is taking place in both cores. A bright reflection nebulosity, **NGC 5367,** lies near CG12_S and is illuminated by a binary star **h4636** which contains at least one, or possibly two, Herbig AeBe stars. A highly collimated molecular outflow associated with the CG12_S was reported by White (1993), A&A, 274, L33. The structure of CG12 in molecular lines was studied in detail in Haikala and Olberg (2007), A&A, 466, 191 and Haikala et al. (2006), A&A 454, L71. $C^{18}O$ emission in CG12_S traces mainly warm/hot gas on the surface of a dense core detected in CS and DCO^+. CG12_N is cold and the relative velocities and intensities of $C^{18}O$ and high density tracers indicate that molecular material is highly depleted. Getman et al (2008) ApJ 673, 331 find a high concentration of X-ray sources in the CG12 region mainly in the direction of visible or NIR stellar objects and conclude that more than 50 of these are T-Tauri stars associated with the nebula. Haikala and Reipurth (2010), A&A 510, A1+, imaged the head of CG12 in NIR finding numerous new cluster candidates and protostars. ASTE and APEX submm CO observations reveal new details of the outflow activity in CG12

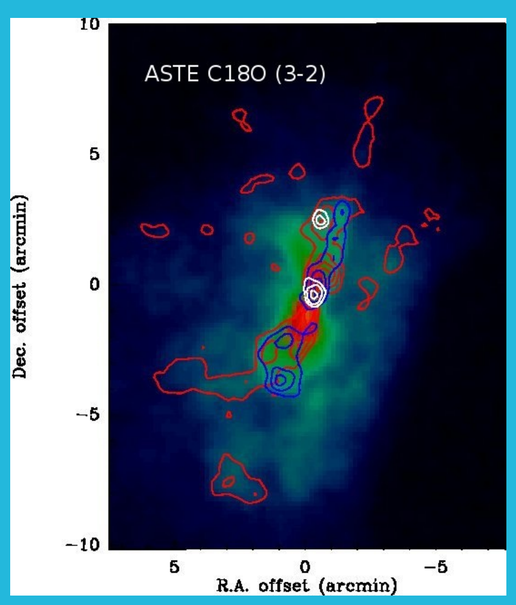


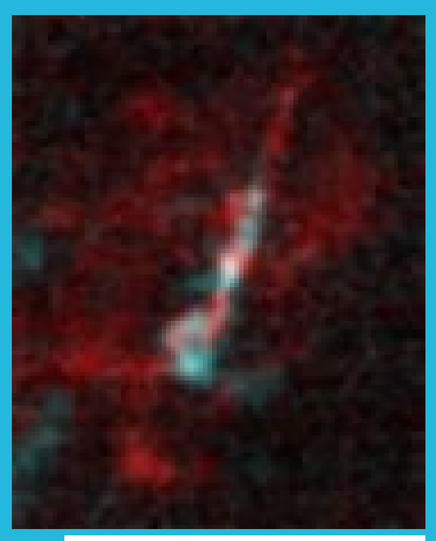


Above: Maximum $C^{18}O$ (3-2) contours (APEX, in red) and 1.3mm continuum (ASTE, in black) superposed on the SOFI Ks image. $C^{18}O$ emission maximum is shifted to the North of the continuum source (and maximum of high density tracers) and traces warm gas offset or on the surface of the dense core.

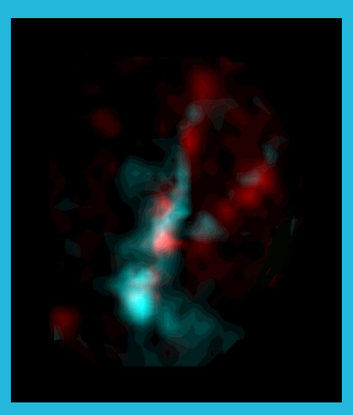
Left: False colour SOFI J,H,K image of the CG12 head The reddish cone SW of the bright binary h4636 lies in CG12_S and the yellowish nebulosity upper centre in CG12_N.

CG12 head was mapped in the ^{12}CO (3-2) line with ASTE. Distribution of the red and blue shifted CO emission superposed on the integrated emission at line rest velocity is shown lower left. Contours of the 1.3mm continuum emission are shown in white. CO emission has maxima on both sides of the CG12_S core. The blue and red shifted emission forms a ~13´ long (2.1pc at the distace of CG12, 560pc) and narrow feature without a clear bipolar structure. The collimated outflow as mapped by White (1993) traces only the centre part of this feature. An other similar but weaker and shorter feature reaches to the NW from CG12_S. This is a real feature as it is seen both in the ASTE CO(3-2) data (below centre) and SEST CO(1-0) mapping (below right).





Red and blue shifted emission (APEX)



Red and blue shifted emission (SEST)

The opening of the cone seen superposed on CG12_S in the SOFI image matches the direction of the large filamentary outflow structure. A faint counter cone is also seen in the NIR image. A possible cavity with brightened rims is seen North of the cone. The orientation of this feature also matches with the outflow direction

The nature of the collimated outflow features in CG12 is unclear because of alternating red and blue shifted emission. Are the two elongated structures related (bright edges of a large outflow cavity)?