Globulettes: birthplaces of free-floating substellar objects?

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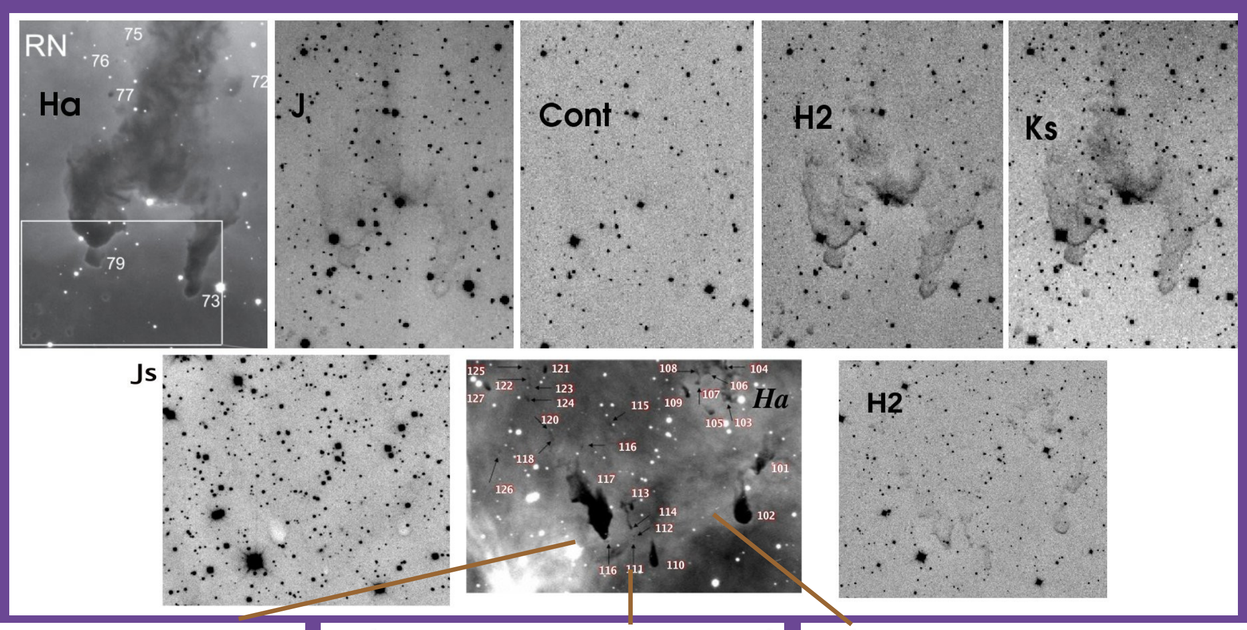
Abstract. We have studied small globules, called *globulettes*, and elephant trunks in the northern part of the Rosette Nebula. Gahm et al. (2007) observed these in Hα. From the observations they derived globulette masses ranging from a few M_{Jup} to several hundred $M_{Jup,}$ majority with < 13 M_{Jup}. Typical size is 2.5 kAU and they seem to be gravitationally stable. This would make them ideal birthplaces for substellar objects. We imaged the globulettes in JHK and H_2 with NTT/SOFI and find that their masses may be an order of magnitude larger than derived from the Hα observations. Both larger and smaller globulettes were detected with Apex in ^{12}CO and ^{13}CO in the 3-2 and 2-1 lines.

Figure 1. The "Wrench" trunk in the Rosette Nebula. In the false-color HαH$_2$JHK image Hα emerges as blue and H_2 as pink in the trunks and rims of the globulettes.



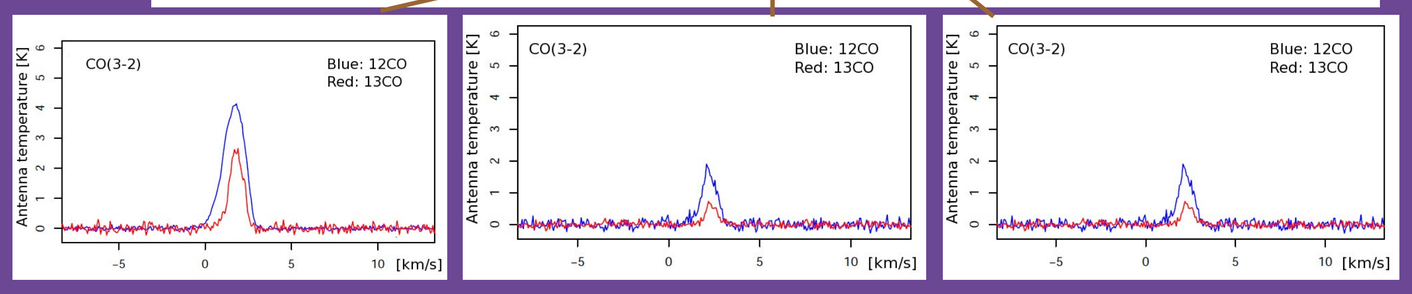


Figure 2. Upper row: The "Wrench" trunk as observed in Hα, wideband Js, H, Ks and narrow band continuum and H_2 1-0 S(1) filters. Bright rims are seen in all bands except for the continuum where the globulettes are barely detectable. Center row: Larger globulettes are opaque in Js, indicating that the cores are dense. Lower row: Apex CO spectra of selected globulettes.

JHK imaging. We imaged the globulettes in JHK in five fields. The imaged fields were used to extract the stellar NIR photometry, estimate extinction and to study the surface brightness. At least some globulettes may have masses up to an order of magnitude larger than previously suggested. Peak A_V through the densest imaged trunks are ~ 25 ^{mag}. Bright, thin rims are detected in several globulettes in Js and Ks.

H2 imaging. Narrow band H_2 S(1) filter at 2.12 μm shows extended line emission in the Rosette Nebula and particularly, bright rims in the globulettes. This resembles the fluorescent H_2 emission observed in the Eagle Nebula (Allen et al. 1999). Comparing the Ks and H_2 images we find that approx. one third of the surface brightness of the globulettes in Ks comes from H_2 1-0 S(1) line emission. Globulettes are barely detected in the 2.09 μm continuum filter. Therefore two thirds of the Ks surface brightness is due to line emission, likely from other H_2 lines.

References: Gahm, Grenman, Fredriksson, Kristen, AJ, 133: 1795, 2007
Allen, Burton, Ryder, Ashley, Storey, MNRAS, 304: 98, 1999

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