Jets at all Scales
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VLT/NACO detection of a proplyd/jet candidate in the core of Trumpler 14

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Abstract. This paper reports the discovery and presents the results of a first analysis of the observed morphology of a candidate external irradiated circumstellar disk/jet system found in the deep core of Trumpler 14, a cluster an order of magnitude more massive than the only cluster where bona-fide proplyds have been found, the Trapezium cluster in the Orion Nebula.

Keywords. HII regions, planetary systems: protoplanetary disks, ISM: globules, ISM: jets and outflows, stars: formation, open clusters and associations: individual (Trumpler 14)

The proplyd/jet candidate was discovered during a VLT/NACO $JHKsL'$Brα survey of the core of Trumpler 14 (Vicente *et al.* 2010, Ascenso *et al.* 2007), a young cluster in the Carina Nebula (NGC 3372), and is similar in size and morphology to the numerous proplyds found in the Trapezium cluster (Bally *et al.* 2000, Vicente & Alves 2005). Archival HST/ACS/HRC optical images, together with the adaptive optics near-IR images and existing photoevaporation theories, were used to investigate the morphology of the object and the possible scenarios for its nature, origin and expected lifetime.

The evaporating globule is located very close to the O2If* supergiant star, HD 93 129Aa, at a projected distance of ~ 0.024 pc. Visible as a tailless object in the optical emission lines, [OIII] and Hα, as a faint point source in H and with a faint tail in K_s, it appears in the L' band and 4.05 μm images as an extended object with a bright "head" and a long irregular, clumpy tail pointing nearly radially outwards from HD 93129A (Fig. 1). In the L'-band image, the object's head has a diameter of 560 AU and a head-to-tail length of 3 080 AU, for the adopted distance of 2.8 kpc to Trumpler 14. A spike emerging from the head and a 2-tail morphology, also visible in the deconvolved image, are suggestive of the presence of a jet. Are the two sections of the tail associated with different physical processes? Possible scenarios for the observed morphology include: 1) a jet + proplyd evaporative flow, 2) a precessing jet/disk, and 3) a non-resolved binary driving two jets. With the present data we cannot state beyond any doubt that this object is a true

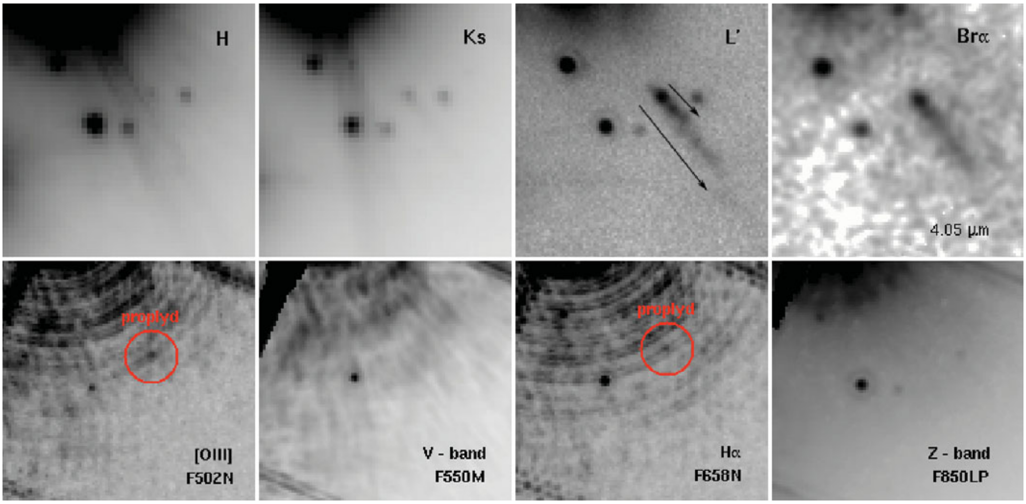

Figure 1. VLT/NACO near-IR images (upper row, 2".5 x 2".5) and HST/ACS/HRC optical images (bottom row, 2".3 x 2".3) of the proplyd/jet candidate in the core of Trumpler 14. North is up and east to the left. A spike emerging from the globule's head and a 2-tail morphology in the L'-band image are suggestive of the presence of an externally illuminated bipolar jet where dust is entrained. Tail1 is shorter and brighter with a head-to-tail extent of 0.5" (1400 AU), and tail2 is longer (1.1" or 3 080 AU), fainter, and nearly parallel to the former. Their length and direction are indicated by the black arrows in the L'-band image.

proplyd/jet as opposed to an evaporating gaseous globule but photoevaporation mass-loss rates, predicted at that location, favor a very compact and dense system, and hence, the proposition that it is indeed a proplyd. A 560 AU spherical globule of molecular hydrogen would be disrupted and completely evaporated in less than 50 yr. Future detailed high-resolution multi-wavelength observations are required to determine accurately the physical parameters of this intriguing object and will lead to a better understanding of its nature.

Other proplyd candidates have been discovered in the core of Trumpler 14 in HST/ACS images (S. Vicente PhD thesis 2009, Smith *et al.* 2010). This discovery is surprising since Trumpler 14 is older (1-2 Myr, Smith *et al.* 2006) than the Trapezium (0.1–1 Myr), a much more extreme environment ($Q_H \sim 22$ times larger) and has a PDR located at 2 pc from the cluster core (Brooks *et al.* 2003). The survival of these candidate protoplanetary disks raises many questions related to the current photoevaporation theories developed for the Trapezium proplyds. Can we apply the same models to the harsh environment of Trumpler 14? What is missing in the whole picture?

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