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POLARIMETRIC DIFFERENTIAL IMAGING OF THE PROTOSTAR ELIAS 2–29

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We present dual imaging Adaptive Optics (AO) near-IR observations of Elias 2-29, a protostar in the Rho Ophiuchi star forming region. Our H- and K-band observations reveal the presence of a highly inclined circumstellar disk, which is spatially resolved in polarized light.

Polarimetric differential imaging is a powerful technique to detect circumstellar disks around young stars (e.g. Kuhn et al. 2001; Apai et al. 2004; Brandner et al. 2005). We have applied this technique to study the circumstellar matter around Elias 2–29, a Class-I source in the Rho Ophiuchi Star Forming Region (SFR). The target is known to be surrounded by a disk (and possibly by an envelope) but it has not been spatially resolved so far (Boogert et al. 2002).

The data were collected with the Nasmyth Adaptive Optics System (NAOS) and the infrared detector CONICA at the Very Large Telescope (VLT/Paranal). NAOS is equipped with an infrared wavefront sensor (WFS) that allows diffraction limited observations of young stellar objects deeply embedded in their parental clouds. Elias 2–29 is a very bright object in the near-IR ($Ks = 6.9$), so we used it as a reference star with the AO system. The observations were performed with the Wollaston prism and different H- and K-band filters. We acquired images with short and long exposure times in order to analyze the inner and outer regions of the disk, respectively. Finally, we took exposures at four different rotator angles (0, 45, 90 and 135) and built the Stokes vectors (Q&U) combining the information of redundant datasets.

The results are displayed in Figure 1. The Stokes images, *Q, U* and *P*, show that Elias 2–29 is surrounded by extended polarized emission detected as far as $\sim$1.0″ from the central star. The polarized light is concentrated in two different regions: a central elliptical region surrounding the star and two spiral-like structures at both sides of the central area. We also detect a more diffuse emission in the outer parts of the image, probably related with a protostellar envelope. Recently, Ybarra et al. (2006) have proposed that the *spiral* structures may be associated with a precessing jet carving out the protostellar envelope.

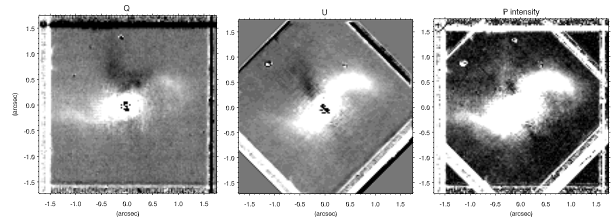

Fig. 1. NACO K-band images of Elias 2–29. North is Up and East is left. The Q- and U-intensity images (left and middle panels) were obtained with individual exposures of 20 seconds. The central source is saturated in order to obtain a better signal in the outer parts of the image. The polarization intensity image, *P*, is displayed in the right panel. A dark lane is visible in the NE-SW direction, while most of the polarized emission is detected in the perpendicular direction (NW-SE). It is remarkable the presence of two compact emission features ('spiral-like' structures) at a radius larger than 0.5 ″.

Currently, we are comparing the observations with theoretical models (as those presented in Wolf et al. 2003), to derive the physical properties of the circumstellar disk and envelope.

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