PROTOPLANETARY DISks IN THE HOSTILE ENVIRONMENT OF CARINA

A. Mesa-Delgado1, L. Zapata2, W. J. Henney2, T. H. Puzia1, and Y. Tsamis3

We report the first direct imaging of protoplanetary disks in the star-forming region of Carina, the most distant, massive cluster in which disks have been imaged.

Using the Atacama Large Millimeter/submillimeter Array (ALMA), the disks are observed at the location of the young stellar objects (YSOs) PCYC 429 for 104-593 and PCYC 1173 for 105-600 (Povich et al. 2011). As it is shown in Fig. 1, they are embedded inside evaporating gaseous globules (EGGs) and exhibit outflow activity in the form of Herbig-Haro objects, evidencing the ongoing accretion process onto the protostars.

The disks are detected with peak signals about $50\sigma$ and $100\sigma$, and both are resolved with an average de-convolved size of $0.05'' \times 0.03'' \approx 120$ AU $\times 70$ AU at the Carina distance of 2300 pc (Smith & Brooks 2008). From the millimeter fluxes, we derive masses $M_{\text{disk}}$ of about $50 M_{\text{Jup}}$ and $30 M_{\text{Jup}}$ for 104-593 and 105-600, respectively. These values are on the upper end of the typical $M_{\text{disk}}$ distribution found in Class I sources in less hostile environments as Taurus and Orion (see Williams & Cieza 2011, and references therein). The disks are considered protoplanetary since the measured masses are well above the minimum $M_{\text{disk}}$ of about 10 $M_{\text{Jup}}$ required for a pre-solar nebula to develop a planetary system (Weidenschilling 1977). Additionally, since the minimum timescale to form planets is $\sim 1 - 2$ Myr (Lissauer et al. 2009; Najita & Kenyon 2014), the Carina population is old enough to be plausible that young planets are forming within these EGGs ($\sim 1 - 4$ Myr; Smith & Brooks 2008).

No millimeter emission was detected above the 4$\sigma$ threshold in a section of the Tr 14 cluster. These thresholds yield an upper limit of $\sim 7 M_{\text{Jup}}$ to the mass of any disk that might be present, which is roughly similar to the median mass of $\sim 5 - 8 M_{\text{Jup}}$ for Class II disks (see Williams & Cieza 2011). The

REFERENCES