Contrib. Astron. Obs. Skalnaté Pleso **48**, 302 – 304, (2018)

Transition disk stars in the NGC 2264 cluster - Accretion diagnostic

A. P. Sousa[1] and S. H. P. Alencar[1,2]

[1] *Departamento de Física-ICEx-UFMG Antônio Carlos, 6627, 31270-290. Belo Horizonte, MG, Brazil, (E-mail: alana@fisica.ufmg.br)*

[2] *Univ. Grenoble Alpes, IPAG, F-38000 Grenoble, France*

Received: December 25, 2017; Accepted: December 29, 2017

Abstract. Disk holes are inferred from infrared observations of T Tauri stars, indicating the existence of a transitional phase between thick accreting disks and debris disks. Using data from the observational multiwavelength campaign CSI2264, we analyzed 410 stars belonging to NGC 2264 and found about 7% transition disk candidates. We characterized these star-disk systems using accretion diagnostics and we compared them with star-disk systems with full disks and diskless. We were able to evaluate the influence of disk evolution on the observed accretion characteristics.

Key words: open clusters and associations: individual: NGC 2264 – stars: pre-main sequence – accretion, accretion disks

1. Overview and Results

Transition disks are systems with a hole in the inner disk that are characterized by a lack of emission, above the photospheric level, in near-infrared wavelengths and an excess of emission like thick disk in mid-infrared bands (Owen, 2016). We searched for transitional disk candidates belonging to the young stellar cluster NGC 2264 ($\sim$ 3 Myr and d $\sim$ 760 pc; Dahm, 2008) to characterize these systems in terms of accretion diagnostics, such as Hα emission and UV excess.

Our sample is composed of 410 stars that were observed with *Spitzer*/IRAC (Teixeira et al., 2012) and CFHT/Megacam (Venuti et al., 2014). We constructed SEDs (spectral energy distributions) of all these stars and modelled them with the Hyperion SED model (Robitaille, 2017). We found 28 transition disk candidates (stars with an inner hole according to the SED modelling and that have 24 μm flux above the photospheric level), 212 stars with a full disk and 170 diskless stars (see Fig. 1). This number of transition disks ($\sim$ 7 % of the total of 410 stars that we analyzed) confirms that the disk dispersal is rapid compared to the disk lifetime, as was also reported in the literature (Owen, 2016).

The Hα emission in a T Tauri star comes mostly from the accretion funnel, then this line is used as accretion diagnostics (White & Basri, 2003). In our sample, 82 % of the transition disk candidates are accreting, which shows the

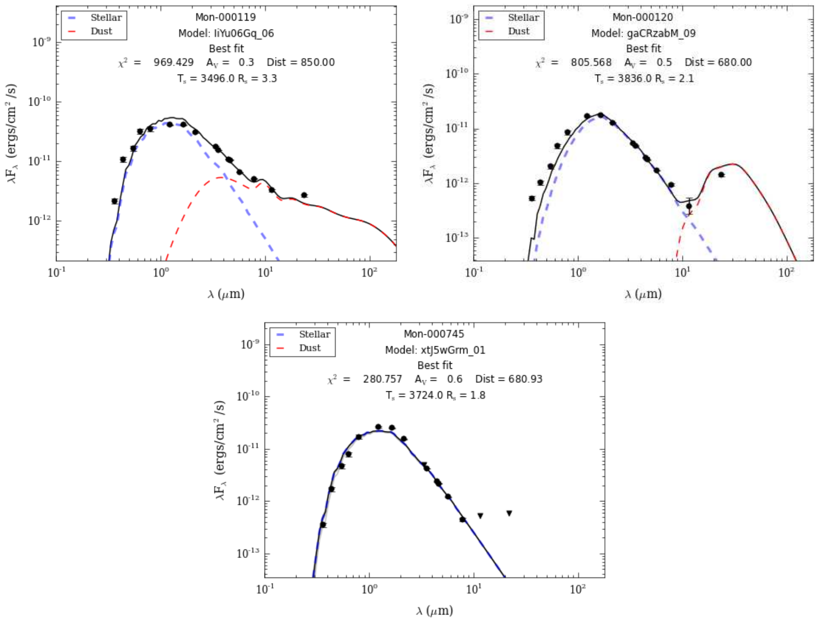

Figure 1. Examples of SEDs for systems with a full disk (left upper panel), a transition disk candidate (right upper panel) and diskless (lower panel). The circles show the observed data published by Rebull et al. (2002) and Wright et al. (2010). The black solid line is the best data fit and the dashed lines are stellar and dust emission components (Robitaille, 2017).

presence of a hole in a disk does not stop the accretion process. The UV excess above the photospheric level, in a T Tauri star, comes from hot spots, consequently the UV excess can also be used as a diagnostic for accretion (Venuti et al., 2014). We deduce from Fig. 2 that diskless systems do not have an UV excess, while full disk systems, which are expected to be accreting, have an UV excess. Transition disk candidates, in general, show an UV excess like full disk systems, and this is consistent with the picture of an active accretion. With the UV excess, Venuti et al. (2014) calculated mass accretion rates for the T Tauri stars in NGC 2264. We show in Fig. 2 that mass accretion rates for stars with transition and full disks are of the same level, the mean values are $(1.78 \pm 0.82) \times 10^{-8}\,M_\odot\,yr^{-1}$ and $(1.69 \pm 0.30) \times 10^{-8}\,M_\odot\,yr^{-1}$, respectively.

2. Conclusions

The presence of a hole in the inner disk does not stop the accretion process, because 82 % of transition disk stars are accreting and show Hα, UV excess and

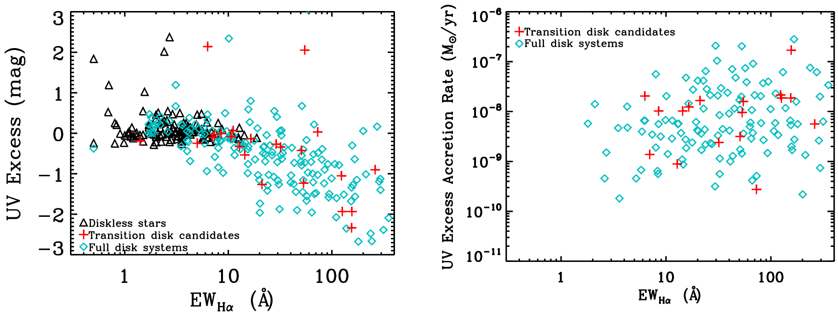

Figure 2. UV excess (left) and mass accretion rates (right) calculated by Venuti et al. (2014) as a function of the Hα equivalent width (Sousa et al., 2016; Dahm & Simon, 2005).

mass accretion rates at the same level as accreting systems.

Acknowledgements. The authors wish to thank Luisa Rebull for sharing with us the photometric data and CNPq, FAPEMIG and CAPES for funding this research.

References

Dahm, S. E. 2008, *The Young Cluster and Star Forming Region NGC 2264*, ed. B. Reipurth, 966

Dahm, S. E. & Simon, T. 2005, *Astron. J.*, **129**, 829

Owen, J. E. 2016, *PASA*, **33**, e005

Rebull, L. M., Makidon, R. B., Strom, S. E., et al. 2002, *Astron. J.*, **123**, 1528

Robitaille, T. P. 2017, *Astron. Astrophys.*, **600**, A11

Sousa, A. P., Alencar, S. H. P., Bouvier, J., et al. 2016, *Astron. Astrophys.*, **586**, A47

Teixeira, P. S., Lada, C. J., Marengo, M., & Lada, E. A. 2012, *Astron. Astrophys.*, **540**, A83

Venuti, L., Bouvier, J., Flaccomio, E., et al. 2014, *Astron. Astrophys.*, **570**, A82

White, R. J. & Basri, G. 2003, *Astrophys. J.*, **582**, 1109

Wright, E. L., Eisenhardt, P. R. M., Mainzer, A. K., et al. 2010, *Astron. J.*, **140**, 1868