Disk holes, corresponding to almost dust-free regions, are inferred from infrared observations of T Tauri stars. Future work is needed to establish the existence of a transitional phase between thick disks and debris disks, the so-called transition disks (Fig. 1) e.g., Andrews et al. (2011), Espaillat et al. (2008), Merin et al. (2010), Kepner et al. (2013). NGC 2264 is a young stellar cluster (~ 1 Myr and ~ 700 µy), where the star formation process is still happening. We searched for transitional disk candidates belonging to the NGC 2264 cluster to characterize the transition disk in terms of accretion diagnostics (Hα and excess in the ultraviolet) and disk parameter (excess in the infrared).

2 Observation

We used data from a coordinated synoptic investigation of NGC 2264 (CSI 2264) that was an international campaign which involved simultaneous and high-resolution observations (Cody et al., 2013), that included data from the CoRoT satellite (40 days 2011), VLTI FLAMES spectroscopic data during 20 days and a band photometry from Megacam (CIFHT). We also used data from catalog surveys, such as near-infrared photometry (JHK, 2MASS, UBVRI, optical photometry from Rebull et al. (2002), IRAC and MIPS data bands from the Spitzer Telescope and observation from The Wide-field Infrared Survey Explorer (WISE) performed at wavelengths 3.4, 4.6, 12.0 and 22.0 µm (Wright et al., 2010).

3 Sample of stars

We used the Hα and J-index (the slope of the spectral energy distribution between 1.1 µm and 2.2 µm). We selected 152 T Tauri stars with disk belonging to the NGC 2264 cluster and that have observation available at 22.0 µm or 24.0 µm. We constructed SEDs (spectral energy distributions) of all these stars and modelled them with the Hyperion SED model (Robitaille, 2017, 2011). We found 37 transition disk stars (stars with inner hole according to the SED modeling and that have 24.0 µm flux above photospheric level). 121 stars with a full disk and only a star as diskless (Fig. 2). Additionally, we used Hα stars classified as without inner disk according to the Hα index to compare the sample of stars without disk with disk in NGC 2264, which is about 40% as seen in Sung et al. (2009)). This number of transition disks (37%) of the total of 152 stars that are analysed can indicate that dispersal of disk is rapid compared to disk lifetime.

5 Accretion diagnostics

Low mass accreting stars are known as classical T Tauri stars (CTTs) and are characterized by emission lines (e.g. Hα, Hβ, Hδ) that vary in intensity and morphology as the star-disk system rotates, and UV excess above the photospheric emission (Fig. 4). When the accretion process ceases the stars are called weak line T Tauri stars (WTTSs).

Fig. 5 shows that 60% of the transition disk stars are accreting, which shows the presence of a hole in a disk does not stop the accretion process.

6 Conclusions

SED modelling shows that 5% of stars of the 152 stars of the NGC 2264 that we analysed presented inner disk holes. Then, transition disk systems are a rapid phase of disk evolution, as also reported in the literature.

The presence of a hole in the inner disk does not stop the accretion process, since 5% of transition disk stars belonging to the NGC 2264 cluster are still accreting, suggesting that gas is flowing through the hole.

Transition disk systems show Hα, UV excess and mass accretion rates at the same level as accreting systems.

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