TRANSITIONAL DISKS AROUND YOUNG LOW MASS STARS

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RESUMEN
Se ha encontrado una población de discos circunestelares jóvenes que presenta Distribuciones Espectrales de Energía (SEDs, en inglés) diferentes a los discos típicos, mostrando un defecto de emisión en el infrarrojo cercano, y un exceso a longitudes de onda del infrarrojo medio. Estas SEDs han sido interpretadas como producidas por discos con agujeros centrales, los cuales se han clasificado como “Discos en Transición”. Estos discos se consideran la conexión evolutiva entre los discos completos encontrados frecuentemente en torno a estrellas jóvenes T Tauri y Ae de Herbig, y los discos de escombros que rodean a algunas estrellas de la secuencia principal. En esta contribución resumimos las características observadas/inferidas en estos discos en transición, así como algunos de los modelos propuestos para explicar su peculiar geometría.

ABSTRACT
A population of young circumstellar disks have different Spectral Energy Distributions (SEDs) with respect to typical disks, showing a deficit of emission in the near-IR and an excess at mid-IR wavelengths. These SEDs have been interpreted as produced by disks with inner holes, which have been classified as “Transitional Disks”. These disks are considered the evolutionary link between the full disks typically found around the young T Tauri and Herbig Ae stars, and the debris disks, found around some main sequence stars. In this contribution we summarize the observed/inferred characteristics of these transitional disks and also some of the models proposed to explain their peculiar geometry.

Key Words: accretion, accretion disks — infrared: stars — planetary systems: formation — planetary systems: protoplanetary disks — stars: pre-main sequence

1. GENERAL
Stars form in dense molecular cores which suffer gravitational collapse. A by-product of this process is the formation of a circumstellar disk by the core material with higher angular momentum. In these disks, the angular momentum is transported outwards by viscosity, probably turbulent, allowing matter to be accreted by the central star. This is why they are generally called “accretion disks”. In early evolutionary states, these disks are optically thick in the Rosseland mean optical depth, from the magnetospheric radius (2–5 $R_*$, Muzerolle et al. 2001) to a few AU. However, their outer radii extend to hundreds of AU, as measured in disk images at different wavelengths (e.g., Rodríguez et al. 1994; O’Dell 1998). Their SEDs are characterized by excess of emission with respect to the stellar photosphere, from UV to millimeter wavelengths. These disks transfer mass to their central stars with accretion rates typically between $10^{-9}$ and $10^{-7} M_\odot$ yr$^{-1}$, as measured from the UV-optical emission excess observed in their spectra (Calvet & Gullbring 1998; Gullbring et al. 2000; Hartmann et al. 1998). The process of angular momentum and mass transportation in a disk leads to a decrease of its mass accretion rate with time (e.g., Hartmann et al. 1998). This effect should be combined with other mechanisms, as dust growth and disk clearing, in order to explain the observed evolution of the fraction of stars surrounded by disks (Calvet et al. 2005a; Sicilia-Aguilar 2006; 2007). These young disks (less than few Myrs old), hereafter “full disks”, are though to be a natural place to eventually form a planetary system.

The discovery of a cold dusty disk around the main sequence star Vega using IRAS (Aumann et al. 1984) started the study of the “debris disks”. These are old disks, believed to be continuously replenished of dust by collisions between the building blocks of planets, i.e., the planetesimals (e.g., Lagrange et al. 2000; Zuckerman 2001). They show substructure, as holes and rings, (e.g. Schneider et al. 1999; Weinberger et al. 1999; Golimowski et al. 2006) probably reflecting the gravitational interaction between the dust and bigger bodies.

It seems just natural to think that full and debris disks are causally connected. The present contribution attempts to summarize in part the quest of finding this connection.