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DIVERSITY OF PROTOPLANETARY DISKS IN STELLAR CLUSTERS: THE SIGMA ORIONIS CLUSTER

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The σ Orionis cluster is a natural laboratory to study stars and protoplanetary disks in the first stages of their evolution. This cluster is relatively near (distance $\sim$ 400 pc) and the extinction is low ($A_V \lesssim 0.5$ mag) and thus enable us to study young stars in a entire range of masses, from its most massive central star, the star σOri AB (O9.5 type star), to the lowest mass objects, such as brown dwarfs and free-floating planets. Recently, we have obtained the largest and most homogeneous spectroscopic characterization to date of stars that belong to this cluster. This information is a corner stone to derive stellar parameters. Of particular interest are stars that exhibit infrared excesses produced by protoplanetary disks. Since the σ Orionis cluster has an evolutionary stage in which one third of its members still have disks and additionally the mechanisms of disk dispersal have affected substantially this disk population, we observe large diversity of protoplanetary disks. Particularly, we can observe: optically thick full disks, pre-transitional disks, transitional disks, homogeneously depleted disks (evolved disks) and second generation debris disks (Figure 1).

Using IRAC and MIPS observations more than 100 stars bearing protoplanetary disks have been detected in the σ Orionis cluster (Hernández et al. 2007). In this contribution, we present an overview of the latest results of an ongoing study of the disk population in the σ Orionis cluster combining Hershel-PACS observation and theoretical models of disk evolution. On the other hand, high resolution observations reveal a group of stars with optically thick flared disks without accretion or accretion below the detectable level of the criteria based on the width of the Hα line. In order to get a better understanding of how disks evolve from optically thick full disks to debris disks, we need to understand the different structures produced by disk dispersal processes.

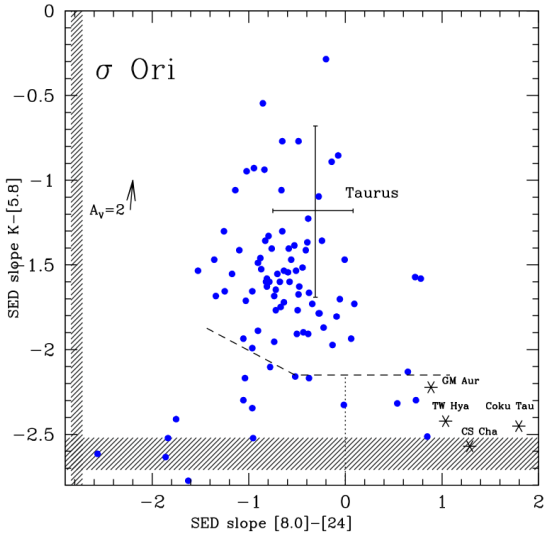

Fig. 1. SED slopes from K-[5.8] and [8.0]-[24] colors for disk-bearing stars of the σ Orionis cluster. For reference, we display the location of five transitional disk objects (GM Aur, TW Hya, CS Cha, Coku Tau/4). Photospheric limits are indicated with the shadow regions. Dashed line represents the lower boundary of primordial disks from (Luhman et al. 2010). This line is used as a reference to separate stars bearing optically thick disks from other types of disks: transitional disk candidates ($\sim$below the limit with SED slope [8.0]-[24] > 0), pre-transitional disk candidates ($\sim$below the limit with SED slope [8.0]-[24] ~ 0), and evolved disk systems ($\sim$below the limit with [8.0]-[24] < 0). Early-type stars near the photospheric region of K-[5.8] are likely debris disk systems. The overall disk population of the σ Orionis cluster has less disk emission than the younger disk population of Taurus (the median population represented by the large error bar).

REFERENCES

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