

IPHAS A-type Stars with Mid-IR Excesses in Spitzer Surveys

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Abstract. The Isaac Newton Photometric H-Alpha Survey (IPHAS) provides $(r'-H\alpha)-(r'-i')$ colors, which can be used to select AV0-5 Main Sequence star candidates (age~20-200 Myr). By combining a sample of 23050 IPHAS-selected A-type stars with 2MASS, GLIMPSE and MIPS GAL photometry we searched for mid-infrared excesses attributable to dusty circumstellar disks. Positional cross-correlation yielded a sample of 2692 A-type stars, of which 0.6% were found to have 8- μ m excesses above the expected photospheric values. The low fraction of main sequence stars with mid-IR excesses found in this work indicates that dust disks in the terrestrial planet zone of Main Sequence intermediate mass stars are rare. Dissipation mechanisms such as photo-evaporation, grain growth, collisional grinding or planet formation could possibly explain the depletion of dust detected in the inner regions of these disks.

Keywords. Stars: circumstellar matter; Planetary systems: proto-planetary disks

From the observed colors in the $(r'-H\alpha)-(r'-i')$ plane, we identify 23050 early A-type main sequence (MS) star candidates in the Isaac Newton Photometric H-Alpha Survey (IPHAS, Drew *et al.* 2005). Positional cross-correlation with the 2MASS and GLIMPSE catalogs led to a sample of 2692 candidate A-type stars with fully sampled 0.6 to 8 μ m SEDs. Optical classification spectra obtained of 10 of the systems confirmed that all but one were main sequence A-type stars, the exception being an A5Ia super-giant. We searched for stars with 8- μ m excesses by looking for unusually large $(K-8)$ colors. 17 stars (0.6%) were found to have 8- μ m excesses above the expected photospheric value (Hales *et al.* 2009). Free-free emission from ionized gas can cause mid-IR excesses around B stars. However, these stars will also show prominent $H\alpha$ emission (Uzpen *et al.* 2008), while our IPHAS-based color selection method ensures that stars in our sample have undetectable levels of $H\alpha$ emission. Therefore the mid-IR excesses in our sample are most likely to originate in a disk of warm dust located close to the central stars ($r < 1$ AU). 10 out of the 17 excess stars had been covered by *Spitzer* MIPS GAL survey fields, of which 5 had detectable excesses at 24 μ m. For sources with excesses detected in at least two mid-IR wavelength bands, blackbody fits to the excess SEDs yielded temperatures ranging from 270 to 650 K, and bolometric luminosity ratios comparable to those of warm debris-disk systems, similar to β Pictoris.

References

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