The Evolution of Debris Disks Around Solar Type Stars

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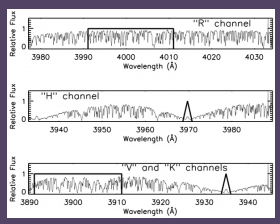
We determined the ages of stars using chromospheric activity…

Chromospheric Activity

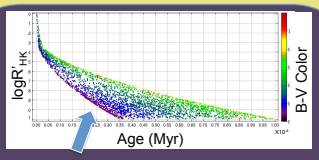
- As stellar rotation slows, the strength of the magnetic field decreases
- The magnetic field strength is observed as the flux of the CA II H&K emission cores
- This spectral information can be used to determine stellar age via the Rossby number



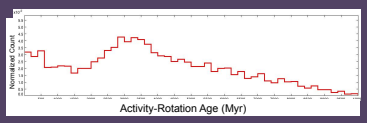
$\log R'_{HK}$

$\log R'_{HK}$ → P_{rot} → Age

The B-V color is incorporated to calculate a rotation period. Then, gyrochronology relations (Mamajek & Hilllenbrand 2008) were used to calculate an age.



By including information about the color of the stars, we can get a better estimate of the stellar age

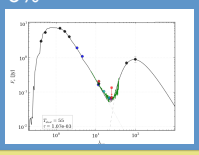


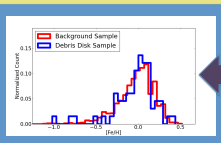
A smooth age distribution allows us to see trends in debris disk incidence, dust temperature, and dust mass.

…then searched for debris disks using the WISE All-Sky Survey

WISE All-Sky Survey

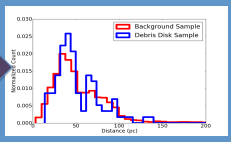
- WISE observed the sky at 3.4, 4.6, 12, and 22 microns
- Warm dust (or the Wein tail of cold dust) can be seen as an IR excess at 22 microns
- We searched through WISE data for over 3,000 stars and found an IR excess in ~100 - a detection rate of ~3%

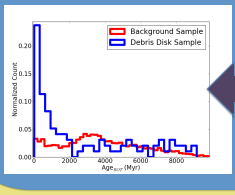




We did not find debris disks around especially metal rich stars…

…nor did we find debris disks around only the closest stars





We did find that (many) more debris disks were found around young stars (<1Gyr).

Future Work

- 18 stars were observed with Herschel in the far-IR
- We discovered 74 previously unreported debris disk candidates
- These stars have a single-channel excess at 22 microns
- Follow-up observations are needed to better understand the evolution of the dust temperature and mass

ALMA can be useful in detecting cold dust at long wavelengths – especially for those stars whose excesses have been confirmed with Herschel!

We find that the number of detected debris disks decreases with stellar age!

Mamajek, E. E., & Hillenbrand, L. A., 2008, ApJ, 687, 1264.; Wright, J. T., Marcy, G. W., Butler, R. P., Vogt, S. S., 2004, ApJS, 152, 261.; Wright, E., Eisenhardt, P., Mainzer, A., et al., 2010, AJ, 140, 1868.