The Binary Frequency of Class I YSOs

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Overview

• The motivation behind this work
• Sample Selection
• K-band survey
• Survey for binaries
• Class I binary frequency distribution
Background

- 60% of main sequence G stars are binaries, T Tauri stars may have a binary excess.
- Main sequence separation and eccentricity distributions are consistent with simulations with a high initial binary frequency.
- Reipurth (2000) found that ~80% of HH sources are binaries.
- Our Goal: To probe the initial binary frequency distribution by measuring the binary frequency distribution of a sample of very young stars.
Sample Selection

- Selected all sources in the IRAS catalog with increasing flux with wavelength
- Visually inspected ~12,000 DSS fields to exclude galaxies, PN, evolved stars, etc.
- Selected sources in nearby clouds based on visual appearance
- Used 2MASS data to find red near-IR counterparts to the IRAS sources; some are too faint to be seen by 2MASS
- Number of Class I candidates = 267, median distance = 470pc, median spectral index = +0.85,
K-band survey

• Observed 197 targets with the UH2.2m telescope at K-band

• Purpose:
  - Find fainter near-IR counterparts,
  - Study the circumstellar environment at higher angular resolution than 2MASS to see how it would affect our search for binaries
  - Conduct a preliminary search for wide binaries

• Found 106 reflection nebulae, 43 of which are new
Survey for Binaries

• Searched for visually resolved binaries at L’
  - Seeing is better --> higher angular resolution
  - Much less confusion w/ nebulosity than at K
  - Only bright objects can be readily seen
• Search for binaries with separations from ~60 AU to 3000AU, as faint as ΔL’=4 magnitudes fainter than the primary star
• Observed with UKIRT, IRTF, UH2.2m, and Subaru
• Recent AO observations on ~30 targets with Subaru
• Median FWHM @ L’ = 0.34”, 0.13” with AO
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IRAS 06382+1017

- L’
- FWHM=0.15”
- 1.8” and 0.17” companions
IRAS 22376+7455
IRAS 22376+7455
Summary

• Compiled a new sample of over 250 candidate Class I YSOs, mostly within 1kpc.

• Observed 106 reflection nebulae, 40% of which are new.

• Measured the Class I binary frequency distribution from 60AU to 3000AU

• Initial binary frequency is very high

• Initial binary frequency distribution may be narrower than the main sequence distribution