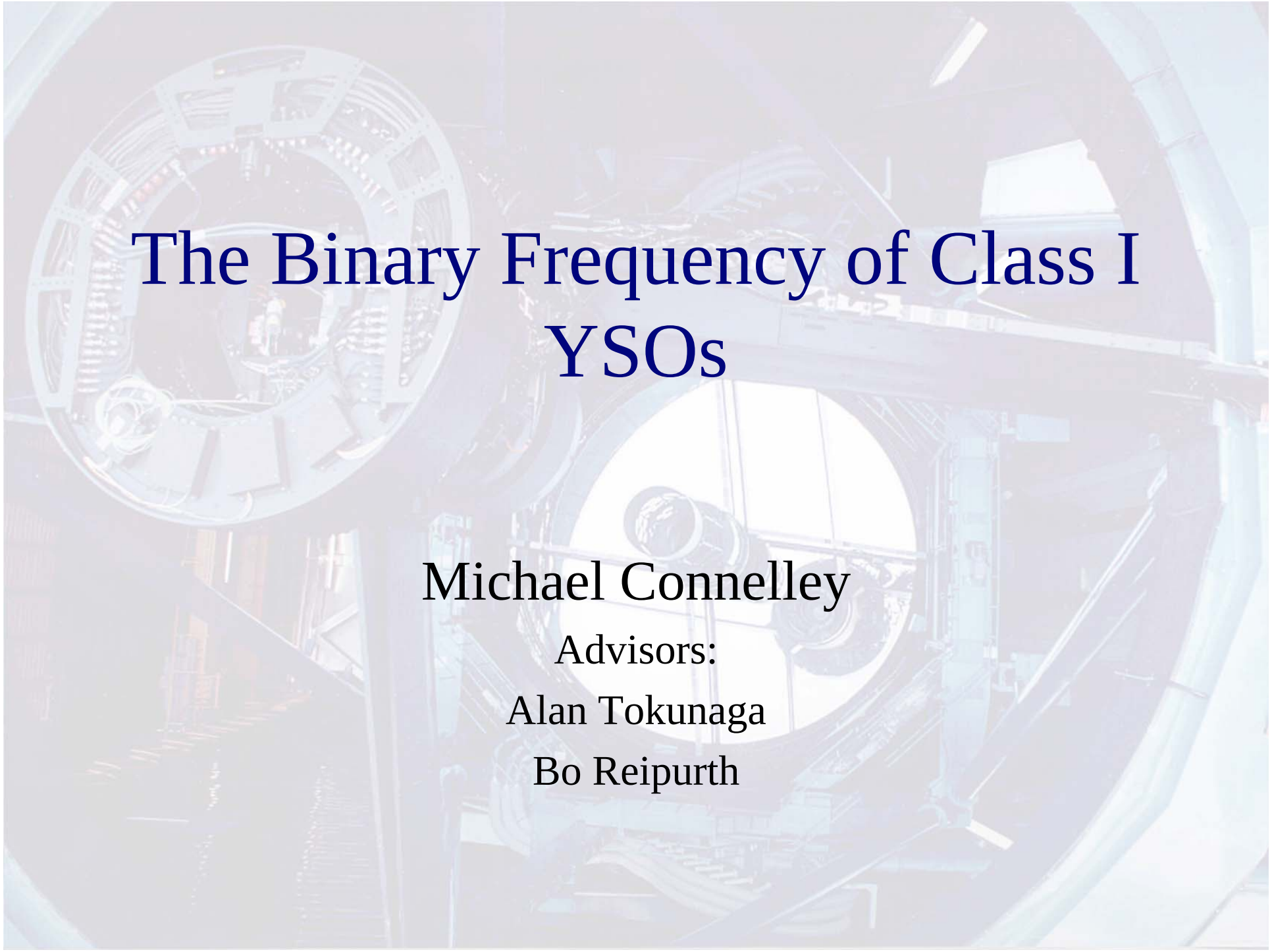

The Binary Frequency of Class I YSOs

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Advisors:

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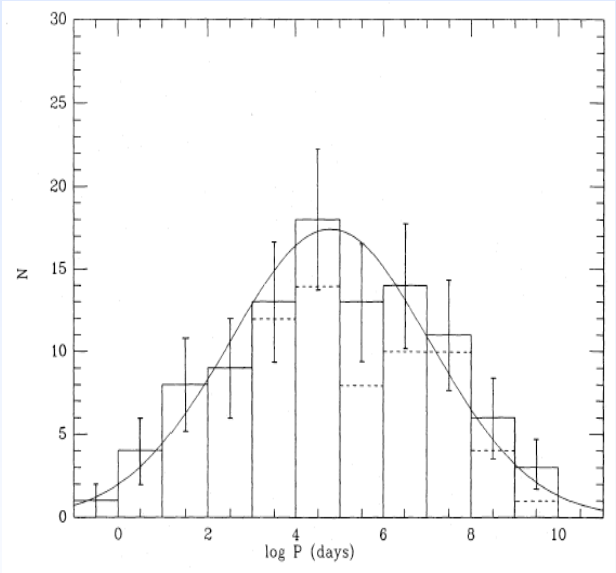
Overview

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

Background

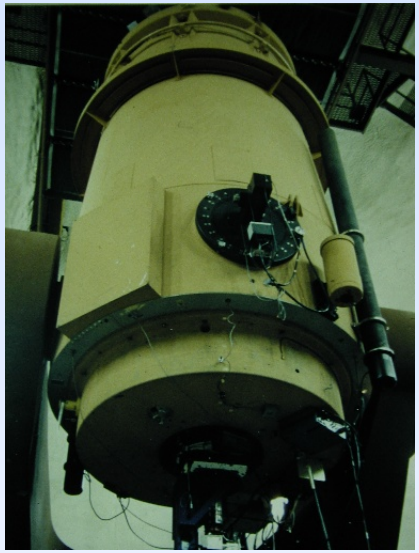
- 60% of main sequence G stars are binaries, T Tauri stars may have a binary excess.
- Main sequence separation and eccentricity distributions are consistent with simulations with a high initial binary frequency.
- Reipurth (2000) found that ~80% of HH sources are binaries.
- Our Goal: To probe the initial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



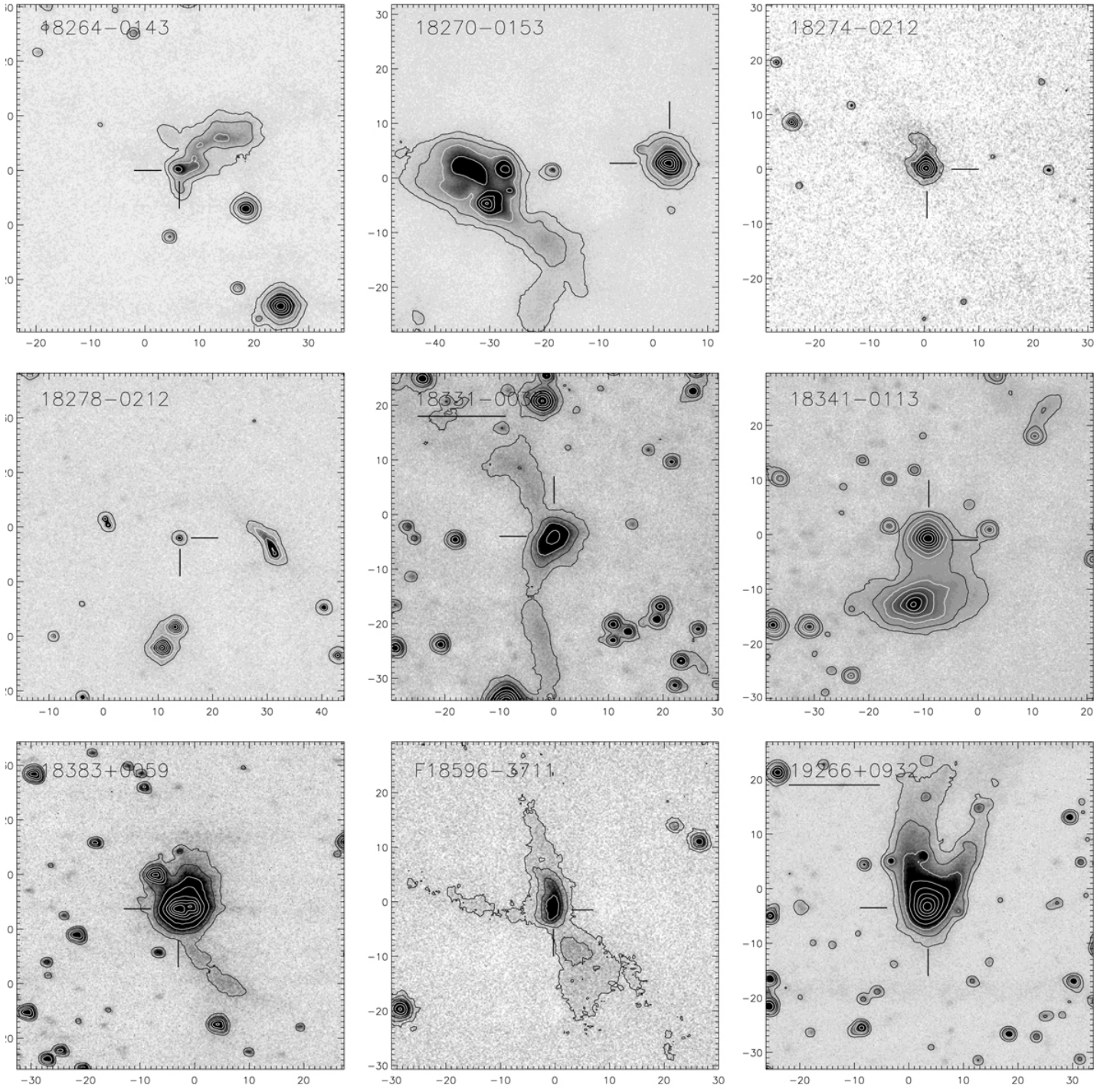
- Observed 197 targets with the UH2.2m telescope at K-band
- Purpose:

 - 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

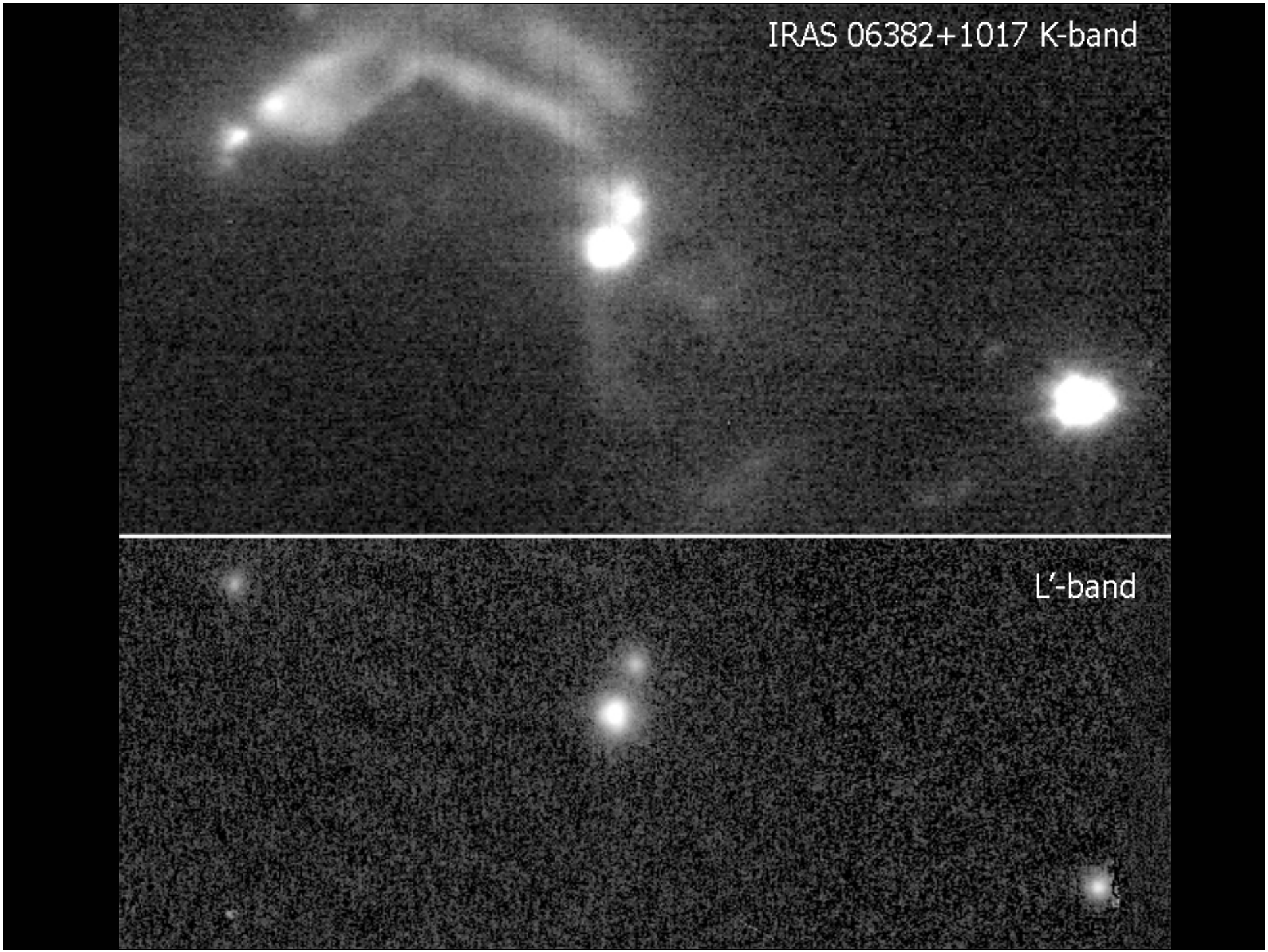
 - Conduct a preliminary search for wide binaries

- Found 106 reflection nebulae, 43 of which are new


18264−0143
18270−0153
18274−0212
18278−0212
18331−005
18341−0113
18383+0059
F18596−3711
19266+0932

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 $\Delta L'=4$ 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


IRAS 06382+1017 K-band
L'-band

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- Search for binaries with separations from ~60 AU to 3000AU, as faint as $\Delta L' = 4$ magnitudes fainter than the primary star
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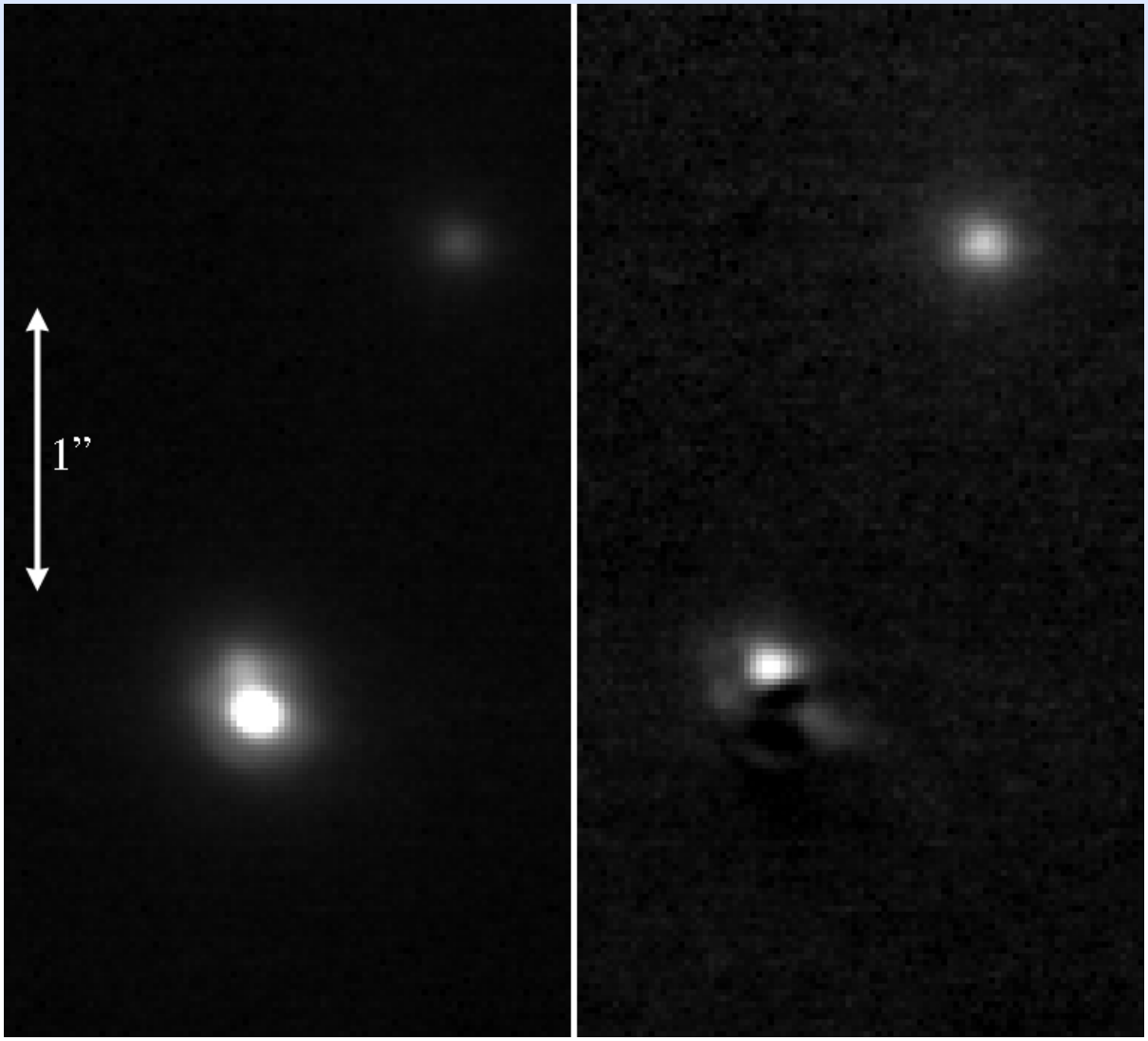
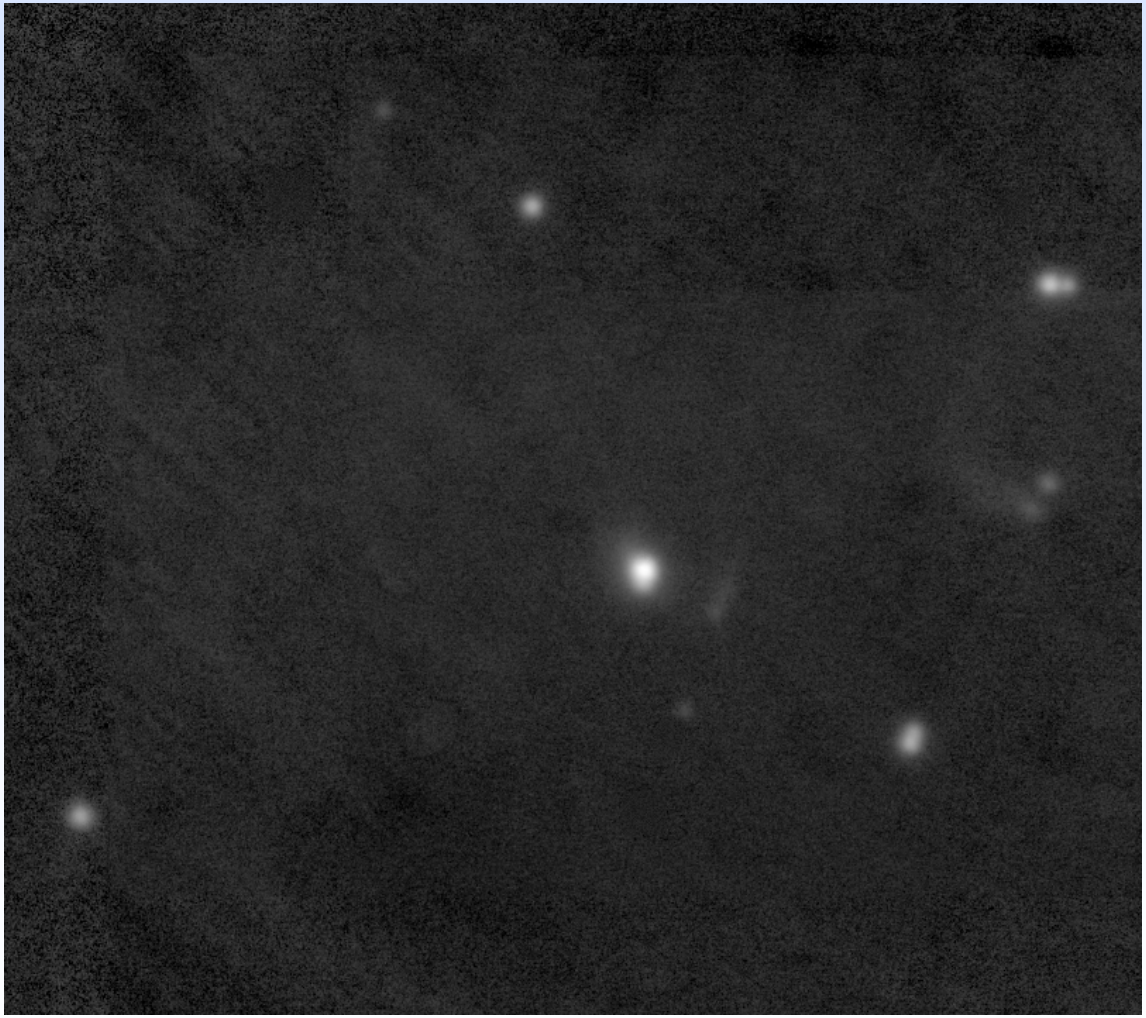
- Recent AO observations on ~30 targets with CIAO
- Median FWHM @ L' = 0.34", 0.13" with AO

IRAS 06382+1017



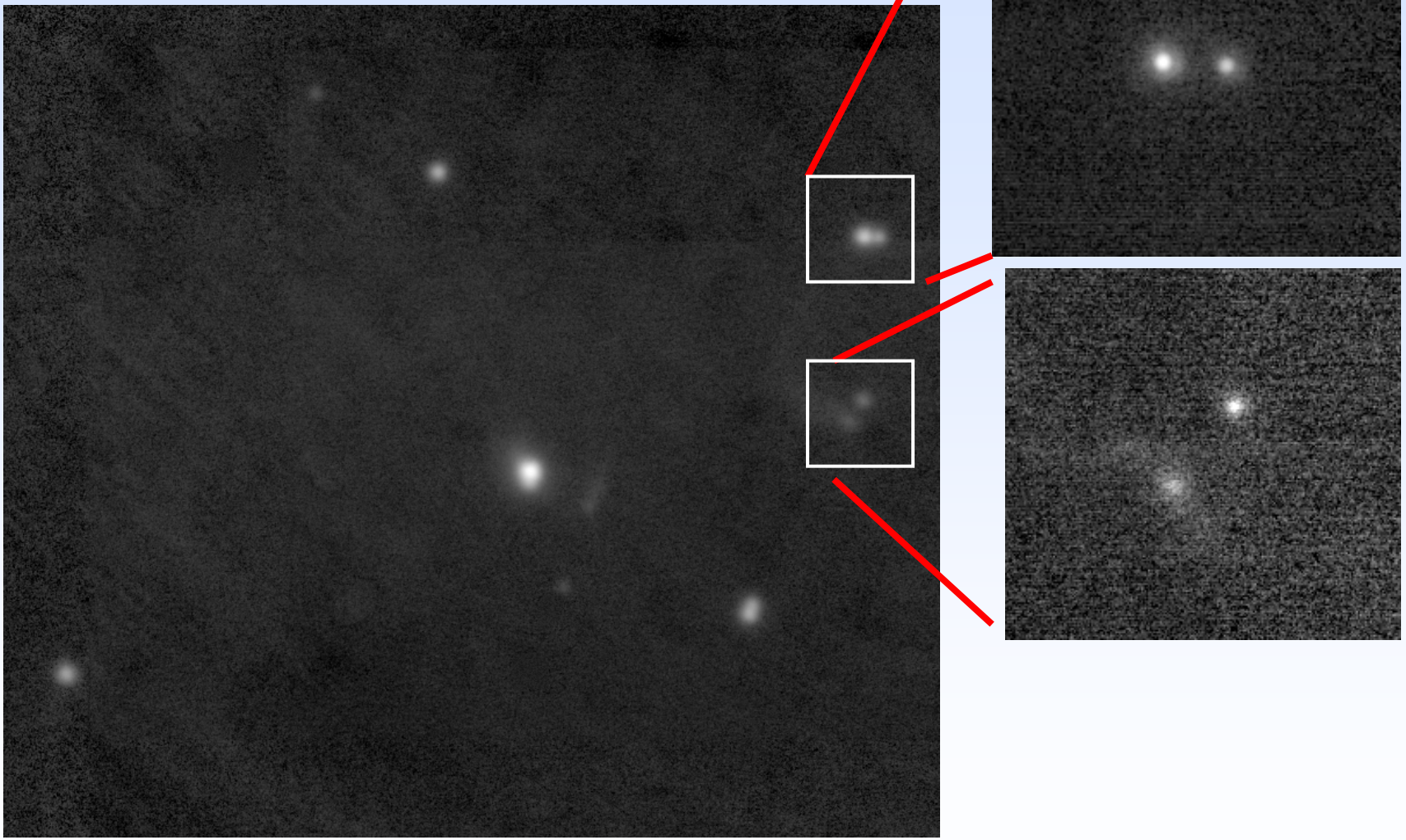
- L’
- FWHM=0.15”
- 1.8” and 0.17” companions

IRAS 22376+7455

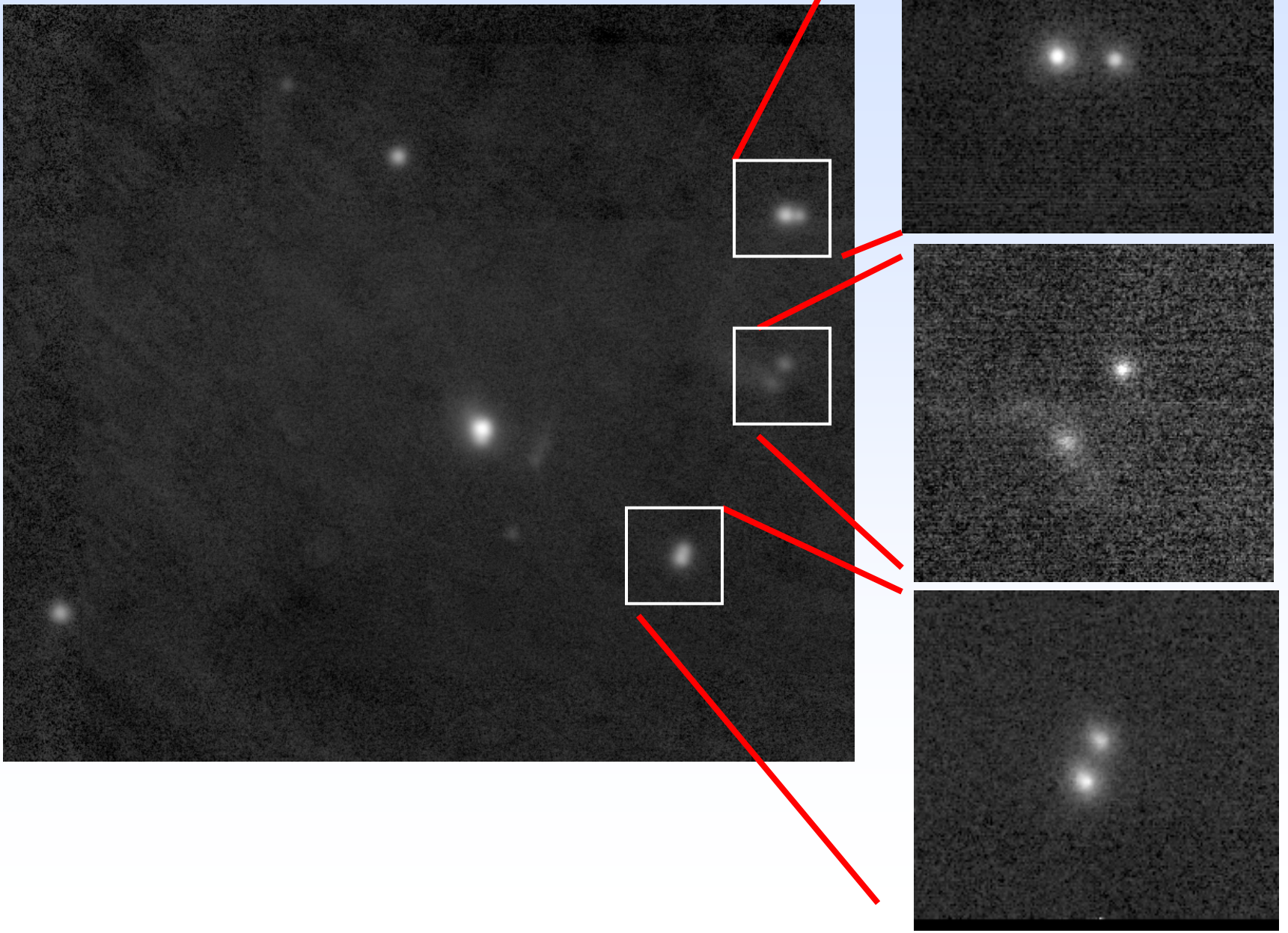


IRAS 22376+7455

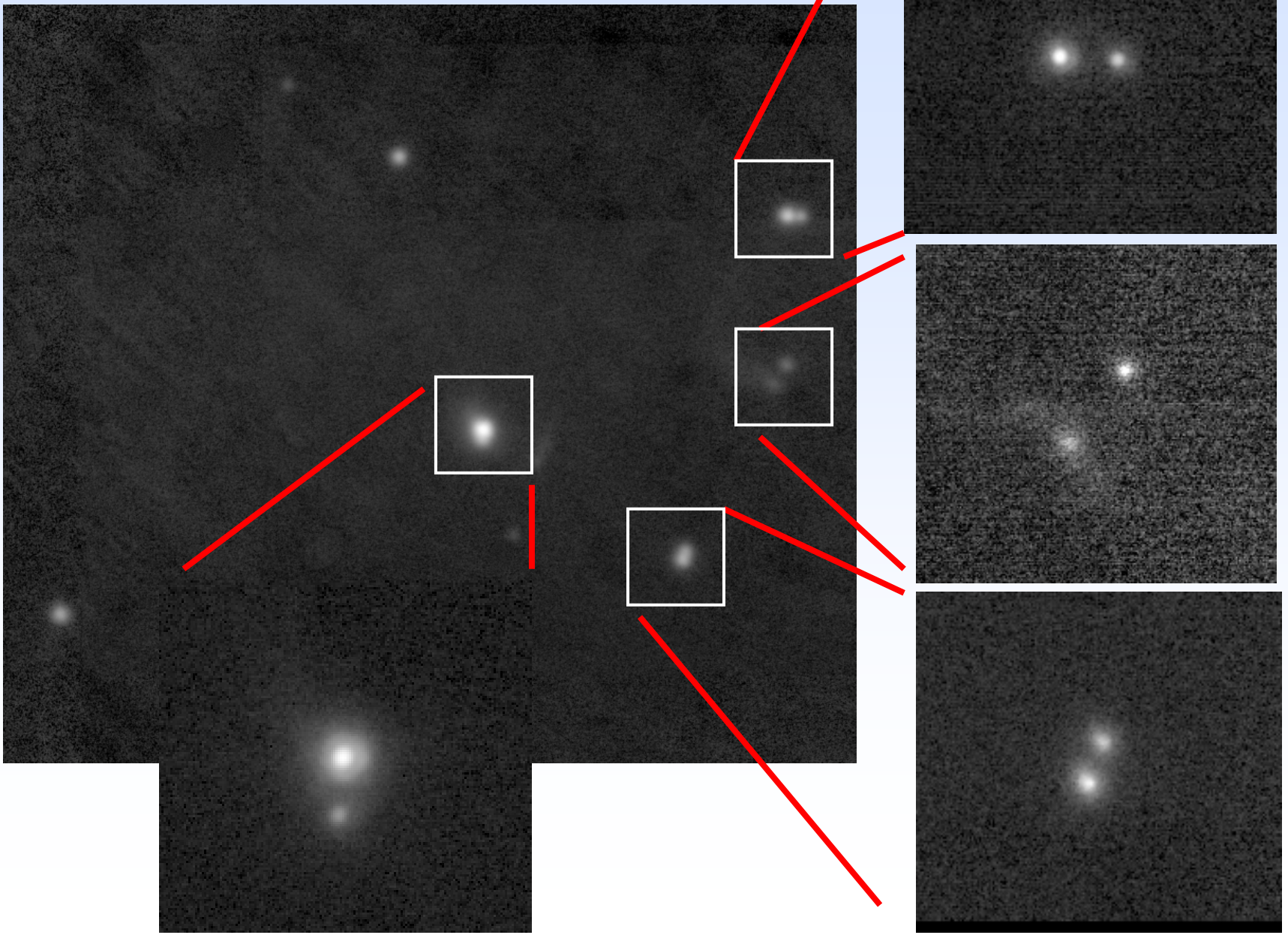
IRAS 22376+7455

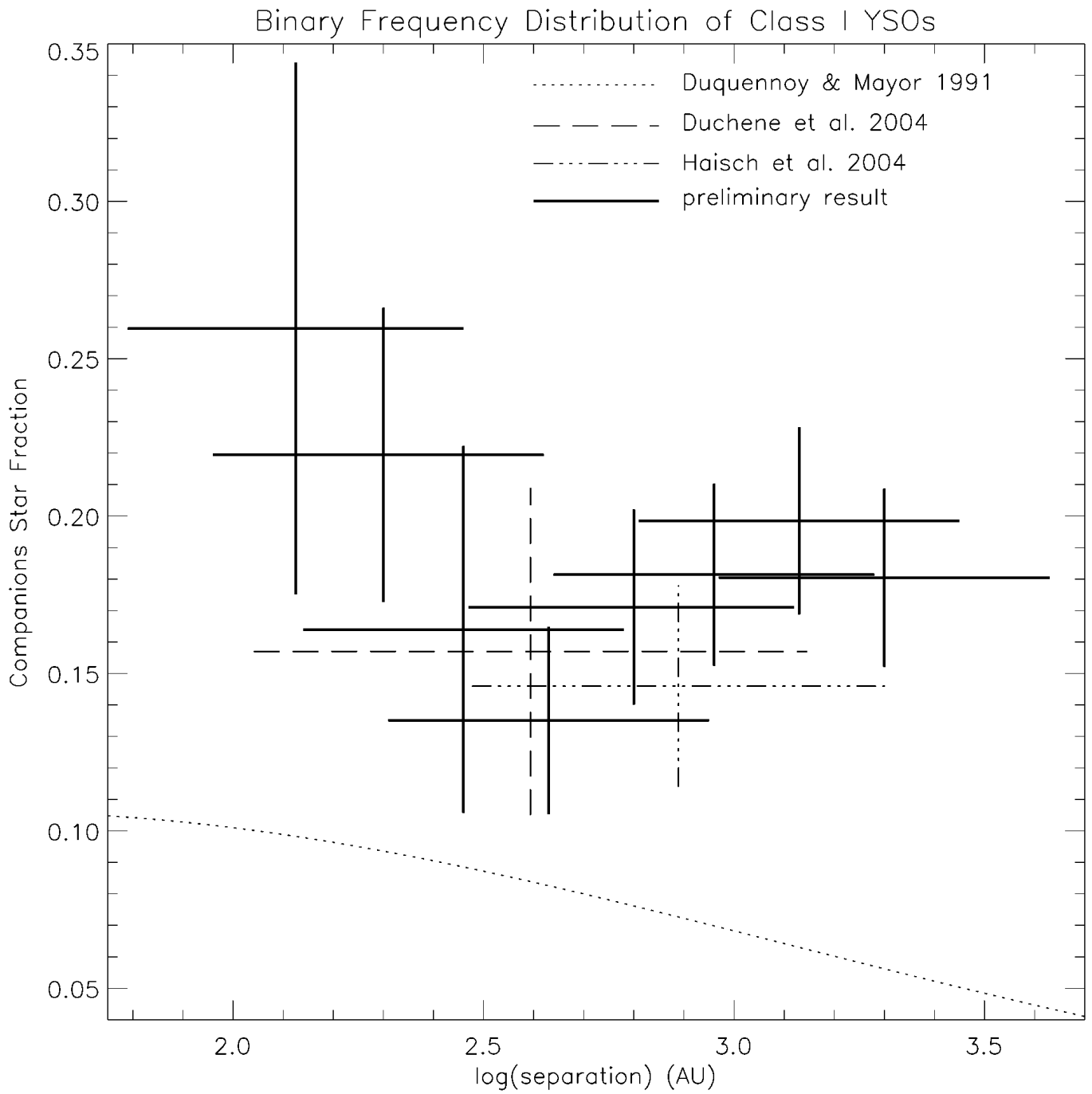


IRAS 22376+7455



IRAS 22376+7455




Binary Frequency Distribution of Class I YSOs
Duquennoy & Mayor 1991
Duchene et al. 2004
Haisch et al. 2004
preliminary result
Companions Star Fraction
0.35
0.30
0.25
0.20
0.15
0.10
0.05
2.0
2.5
3.0
3.5
log(separation) (AU)

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