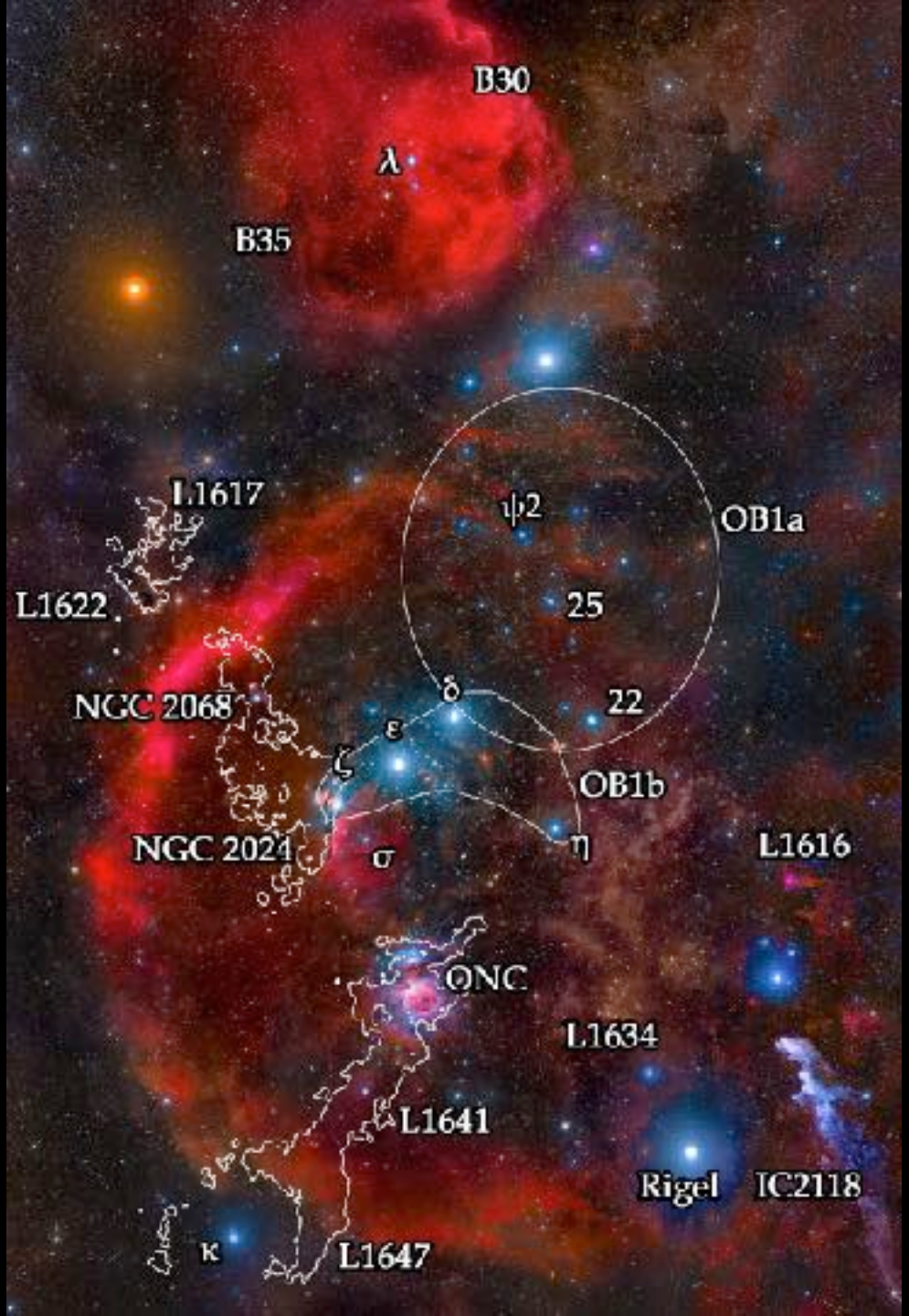
Towards the six-dimensional view of the Orion Complex

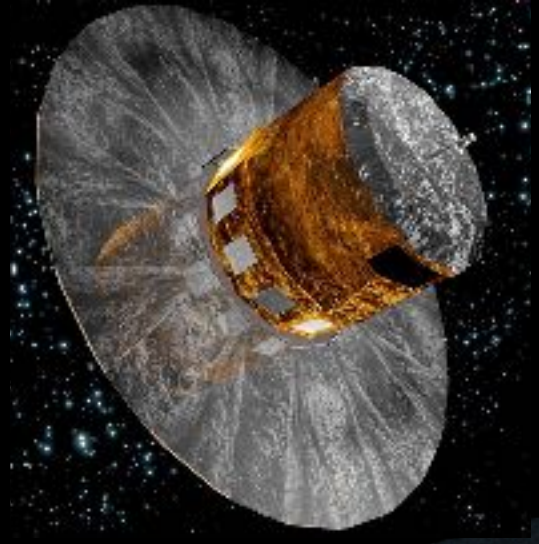
Marina Kounkel,
APOGEE
Collaboration

Orion Molecular Cloud Complex

20° ~150 pc

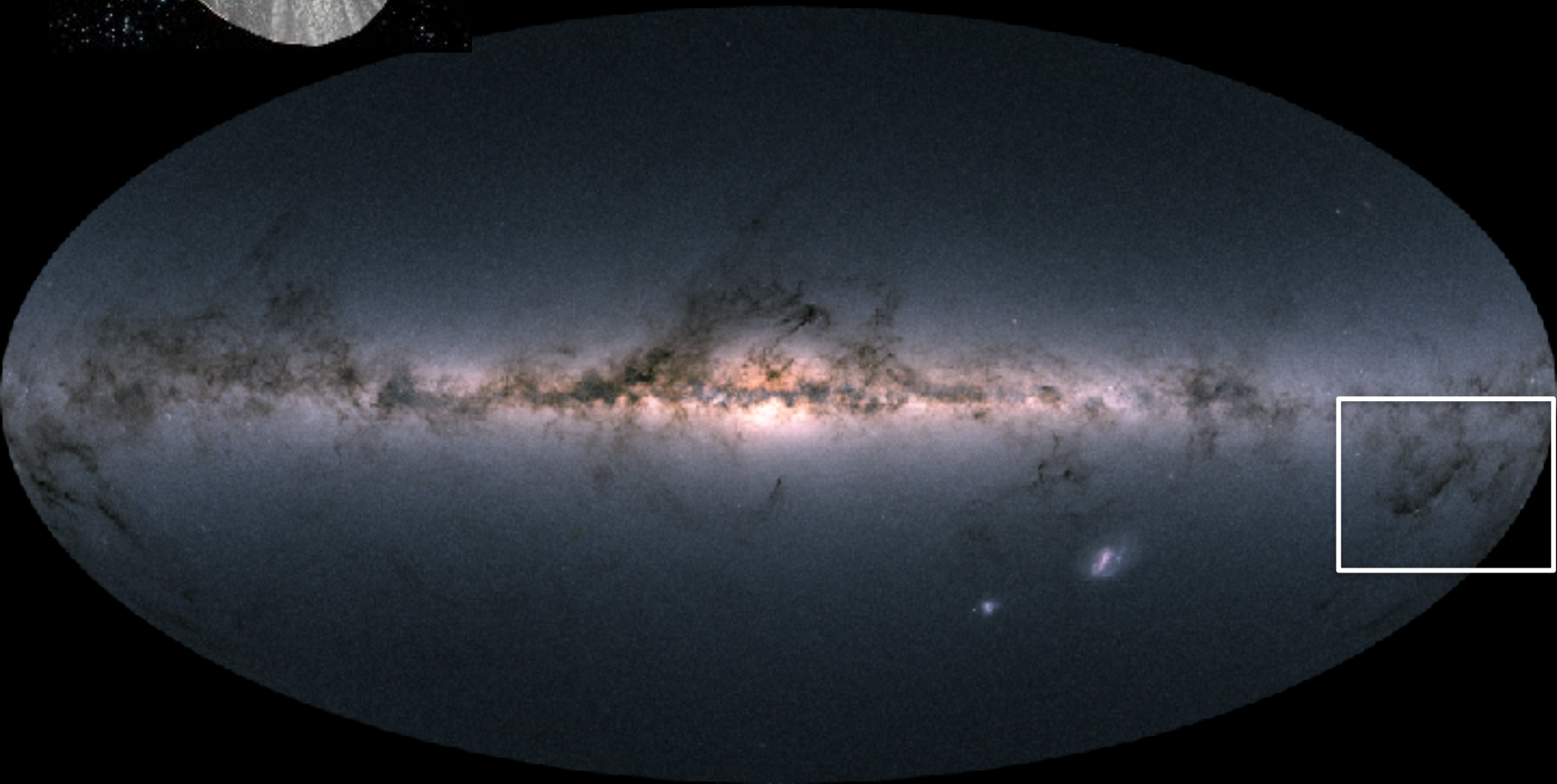
- Multiple stellar populations
- Age range from < 1 to >10 Myr





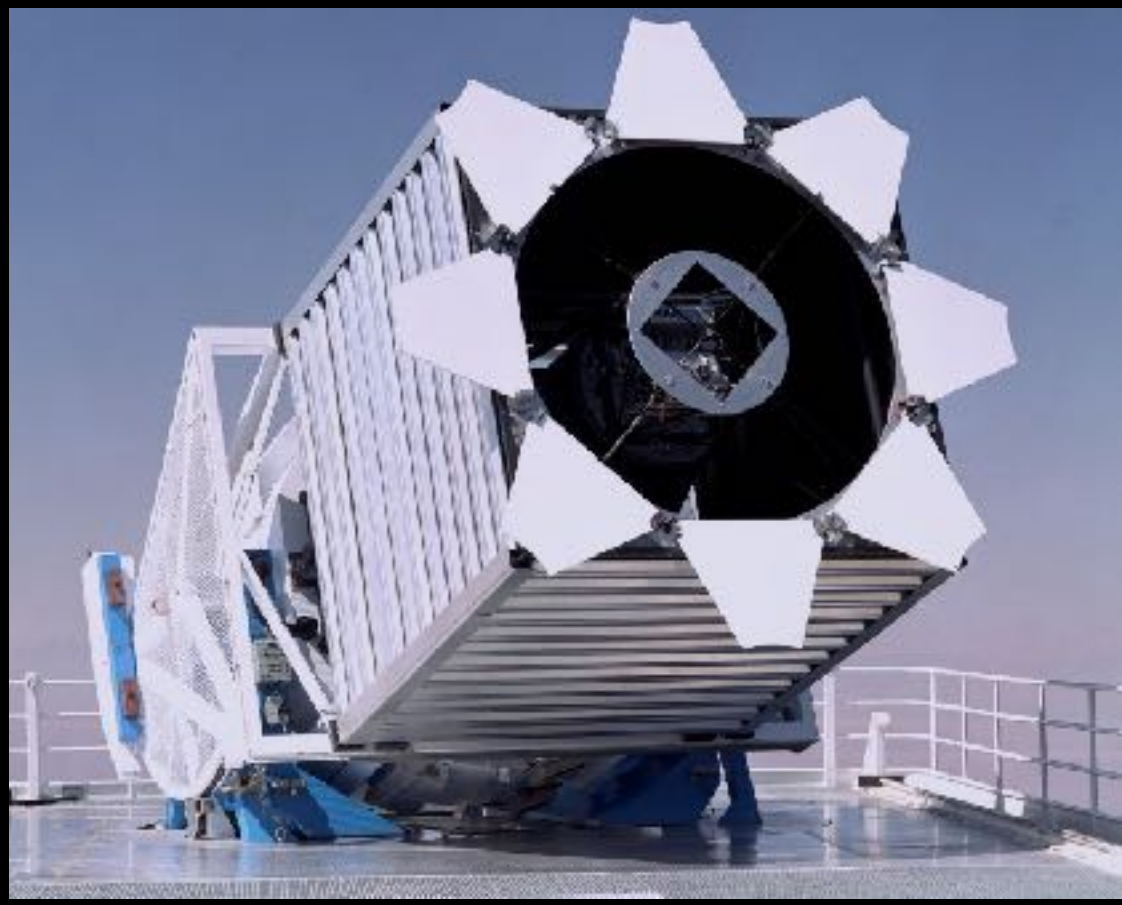
Gaia

- σ_{dist} < 10 pc
- σ_{μ} < 0.3 km/s



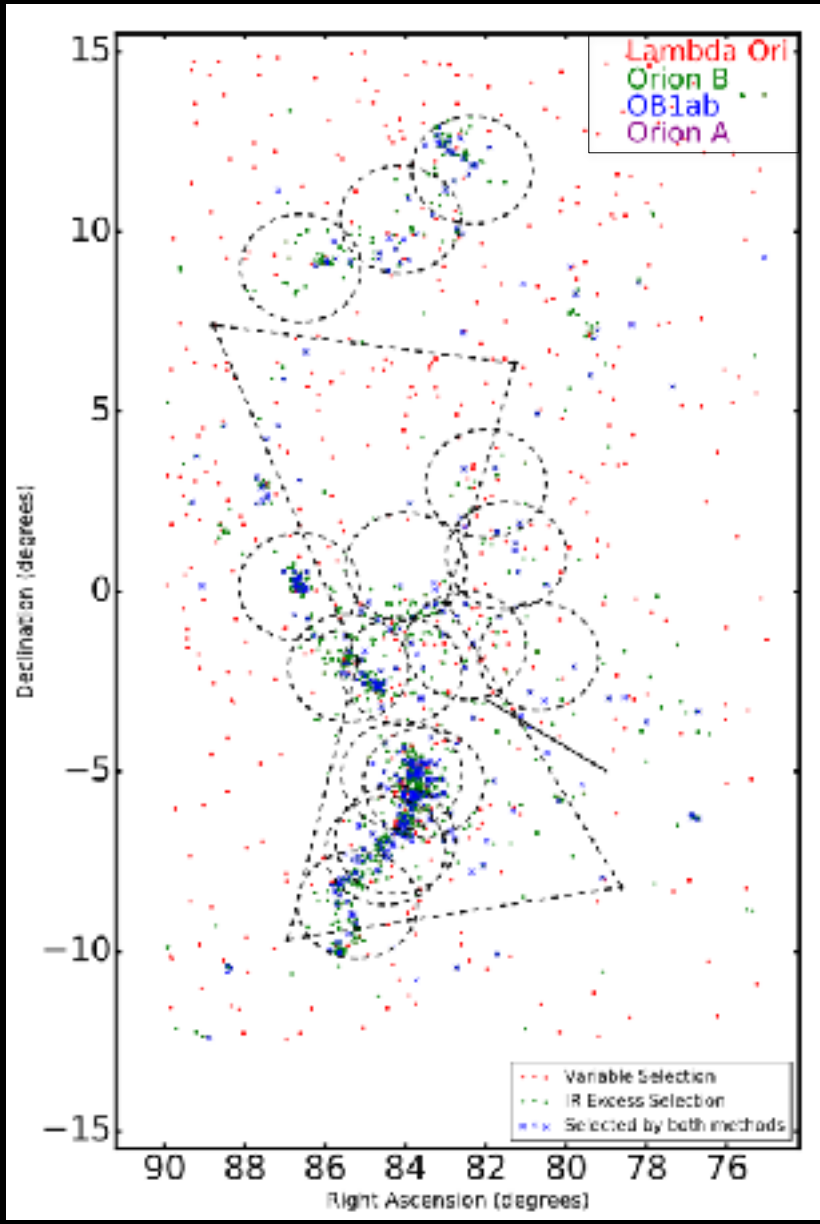
APOGEE

- SDSS 2.5 m telescope
- Multi-object spectrograph
- 3 degree FOV
- 300 fibers
- H-band
- R ~22,500



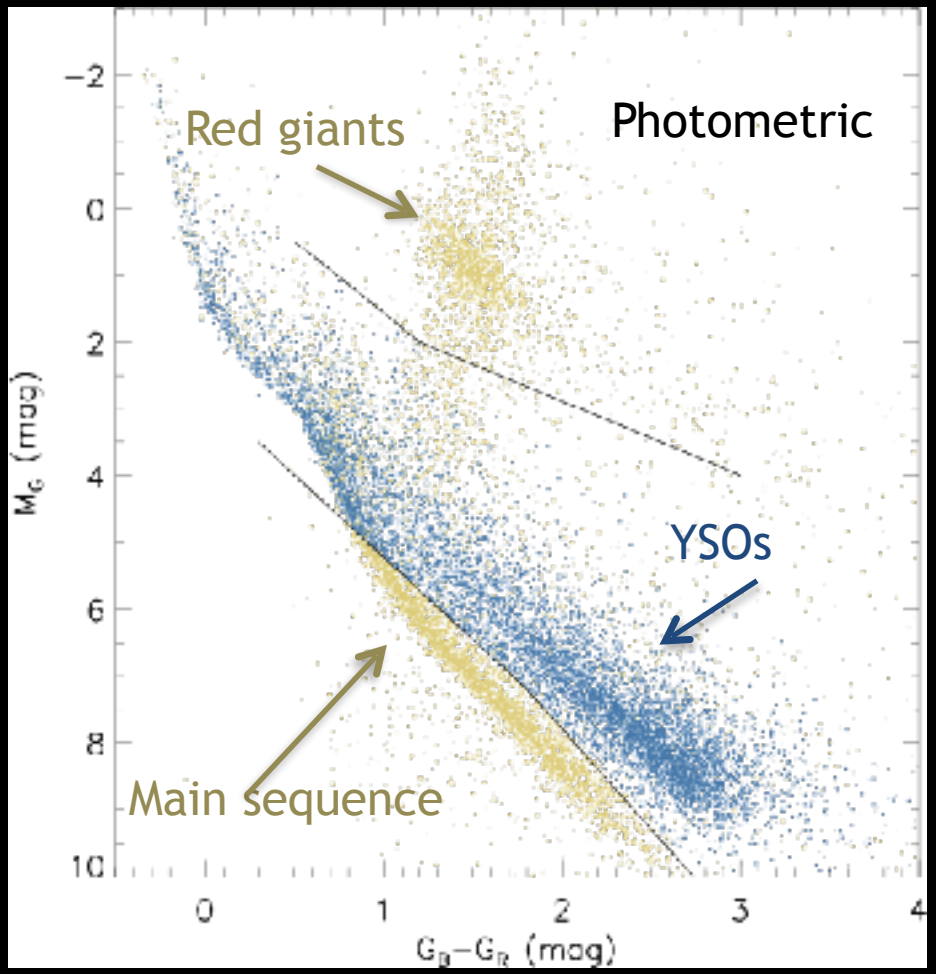
APOGEE Young Cluster Survey - Orion

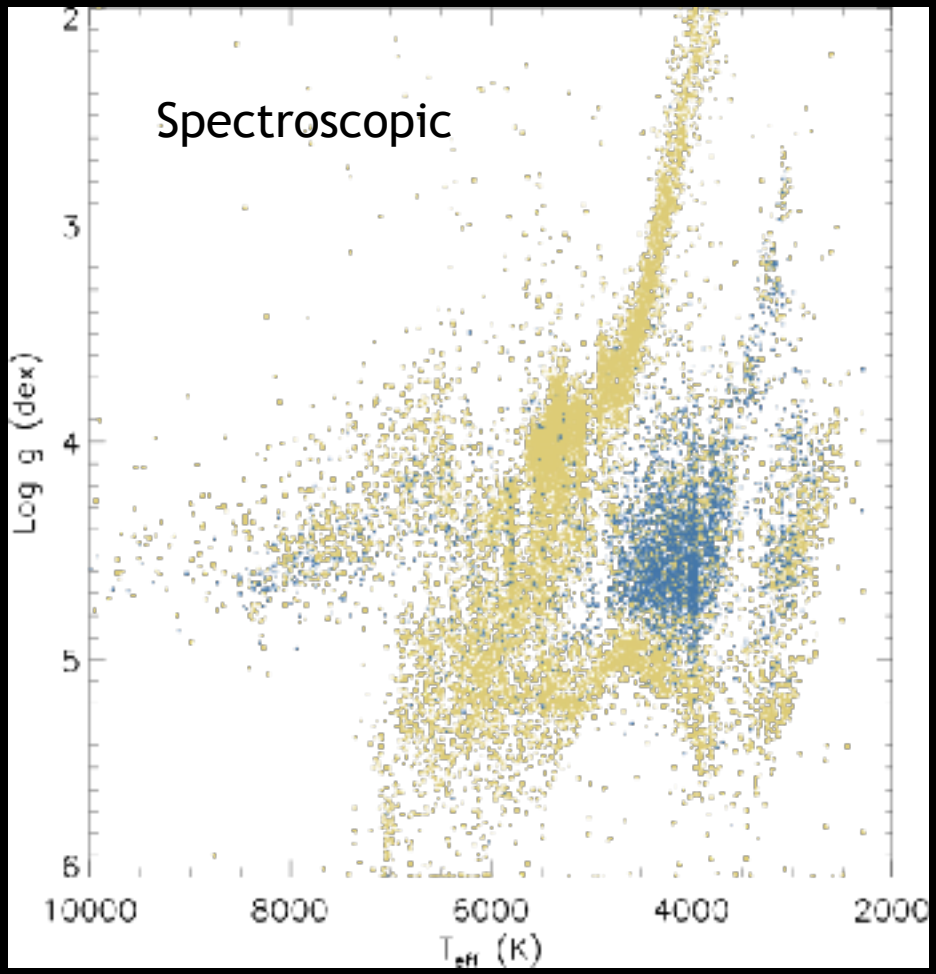
- ~23,000 spectra
- ~9000 sources
- Uniform target selection
  - IR excess
  - Variability
  - Previous YSO identification

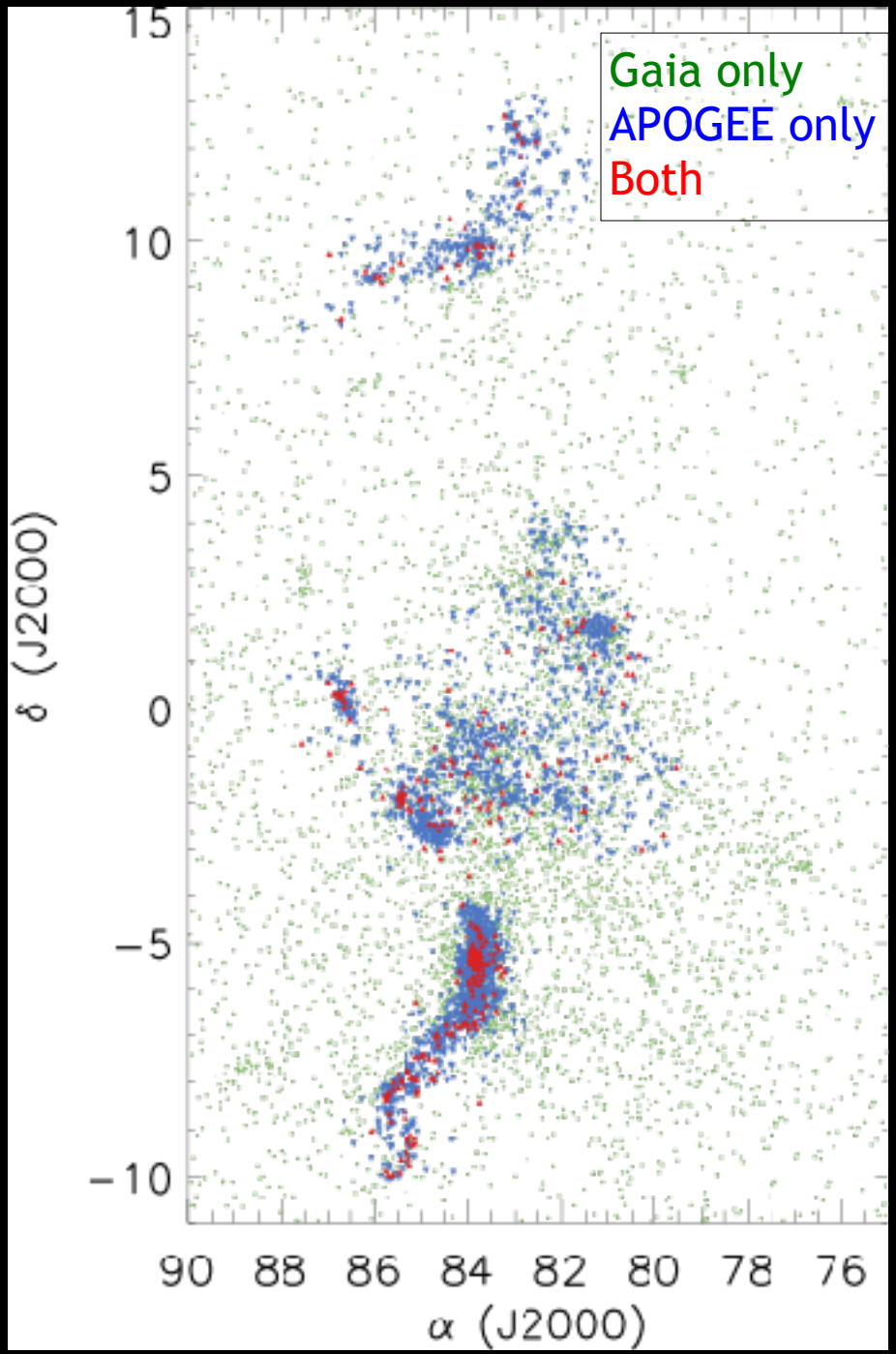


Cottle et al. 2018

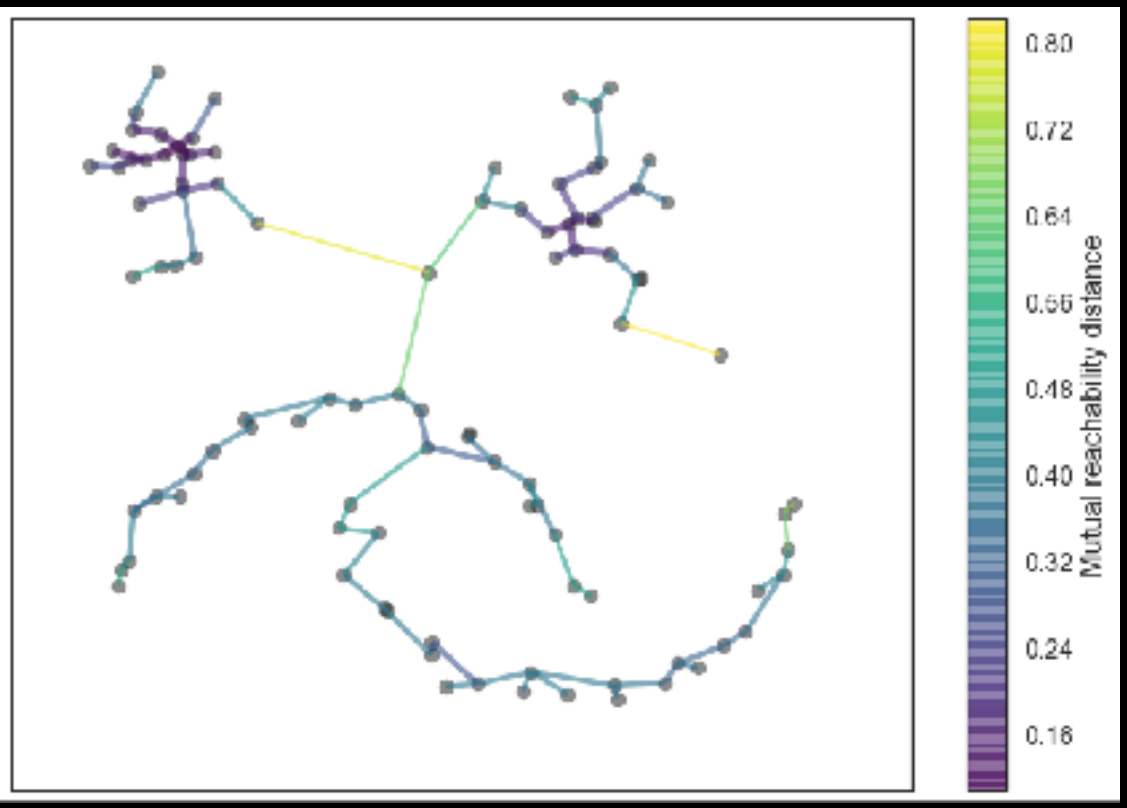
Color cuts


Red giants
Photometric
YSOs
Main sequence
M_G (mag)
$G_B - G_R$ (mag)


Spectroscopic
Log g (dex)
T_{eff} (K)

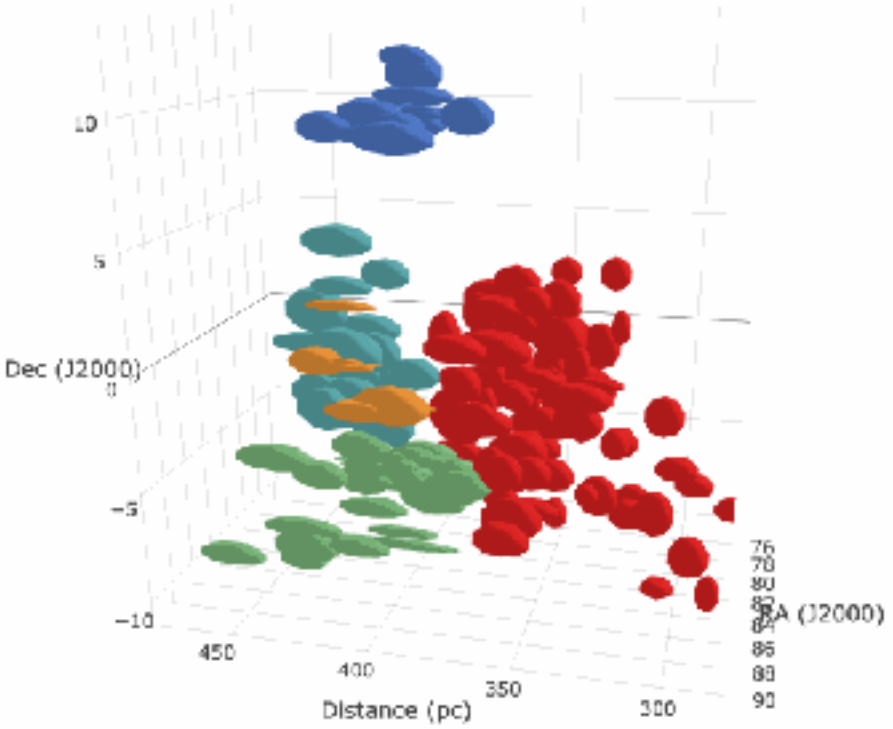

Gaia only
APOGEE only
Both
15
10
5
0
−5
−10
δ (J2000)
90
88
86
84
82
80
78
76
α (J2000)

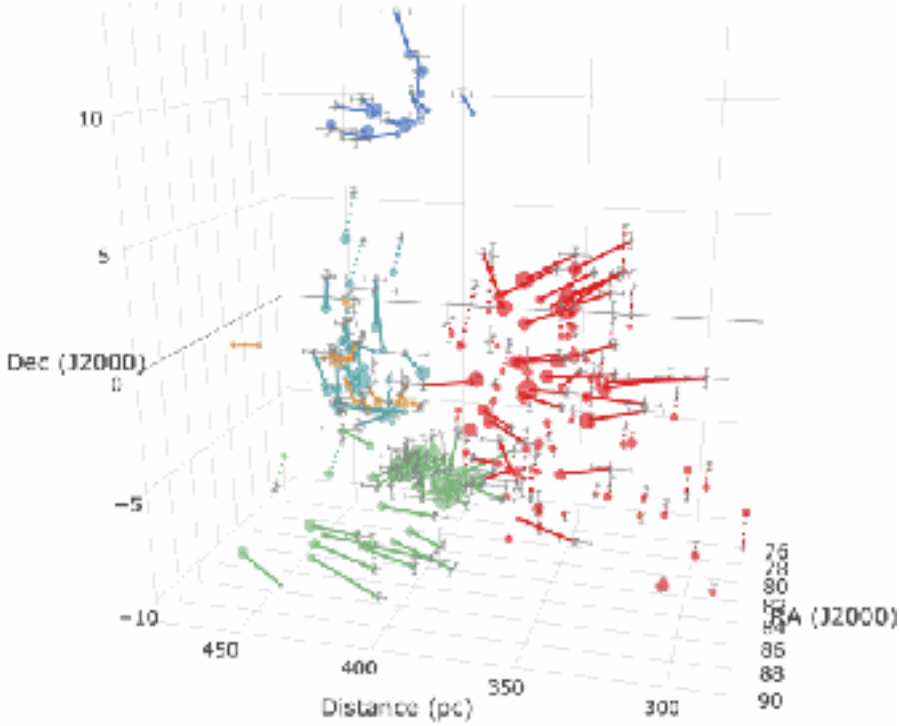
Hierarchical clustering



- Measure distance between all points
- Construct a minimum spanning tree
- Determine the appropriate place to cut the branches

6D structure





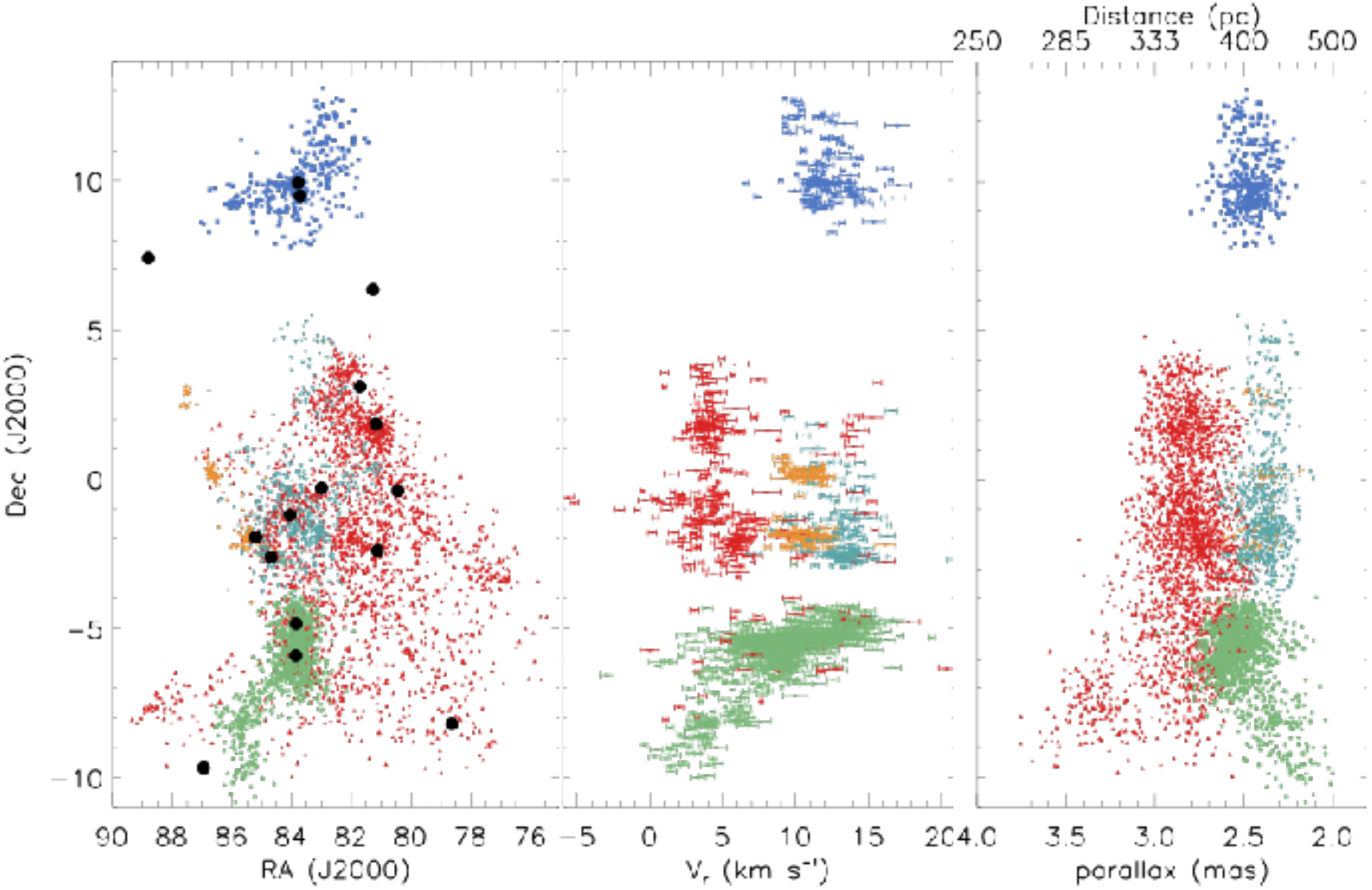
Orion A
λ Ori

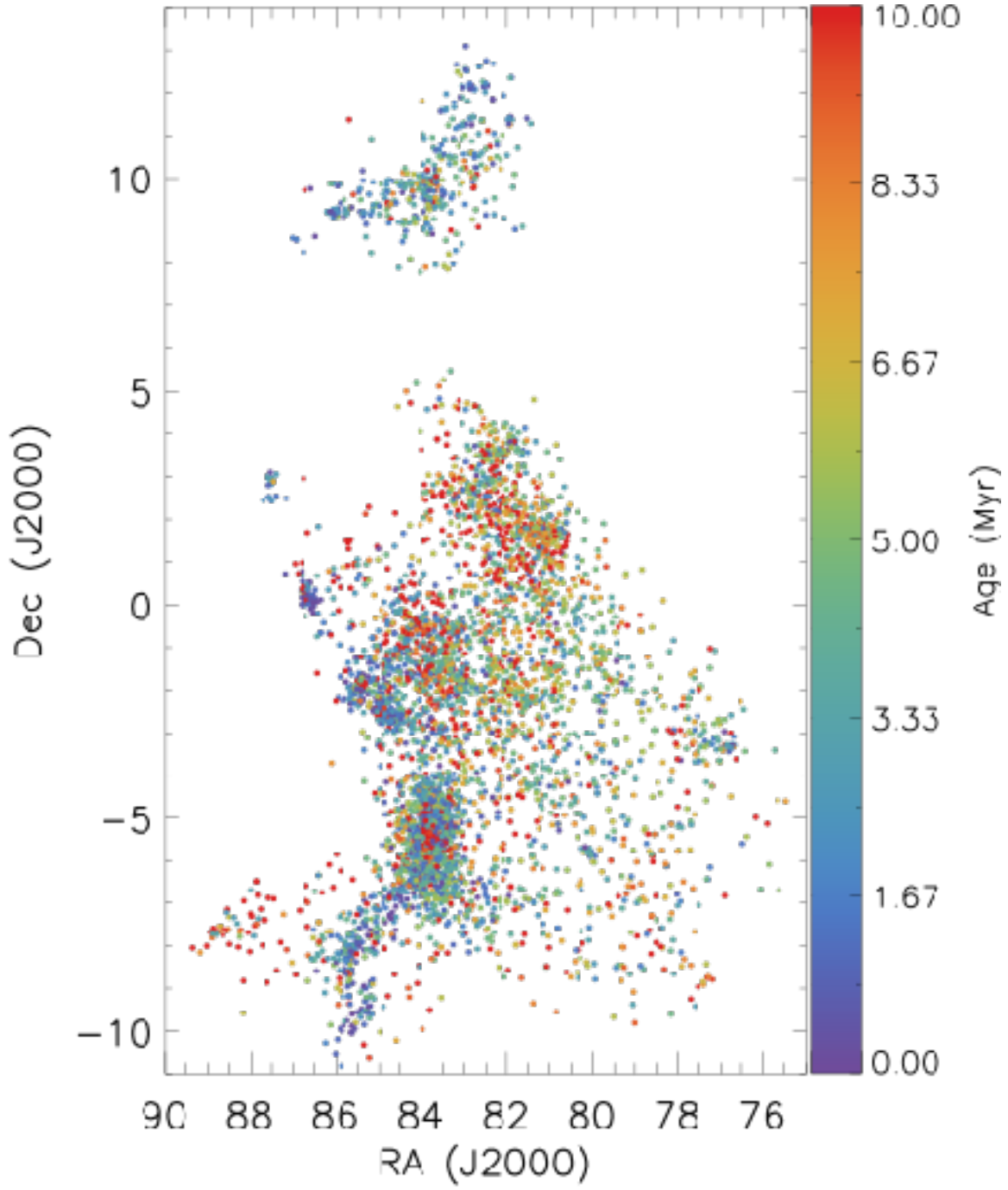
Orion B

Orion C

Orion D

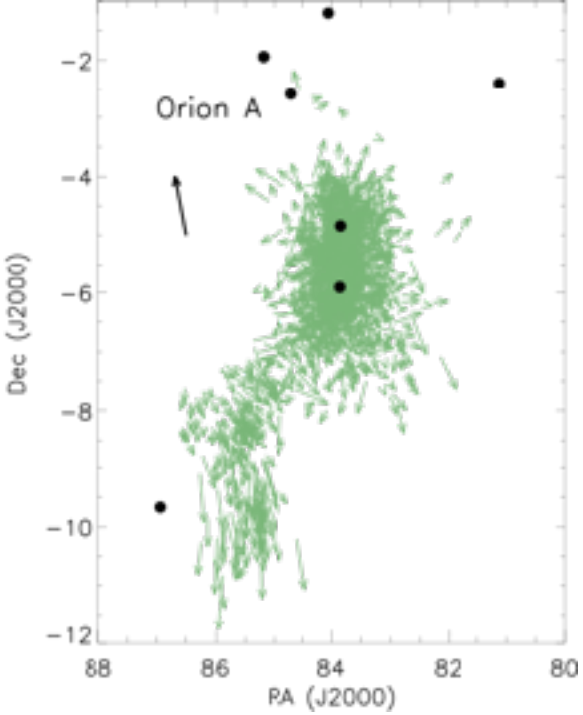
Orion Complex

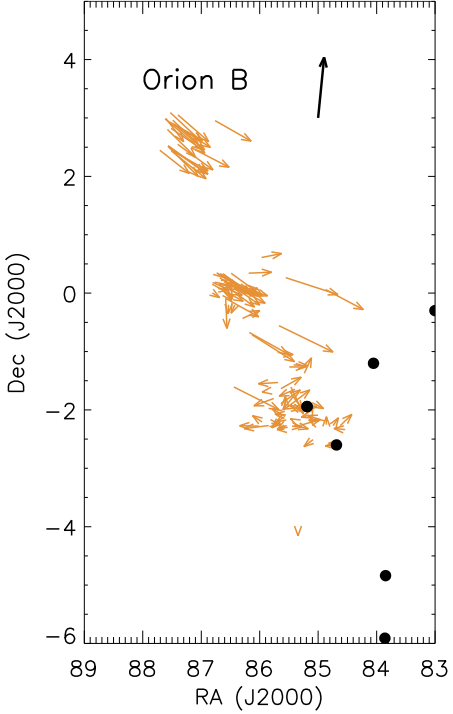


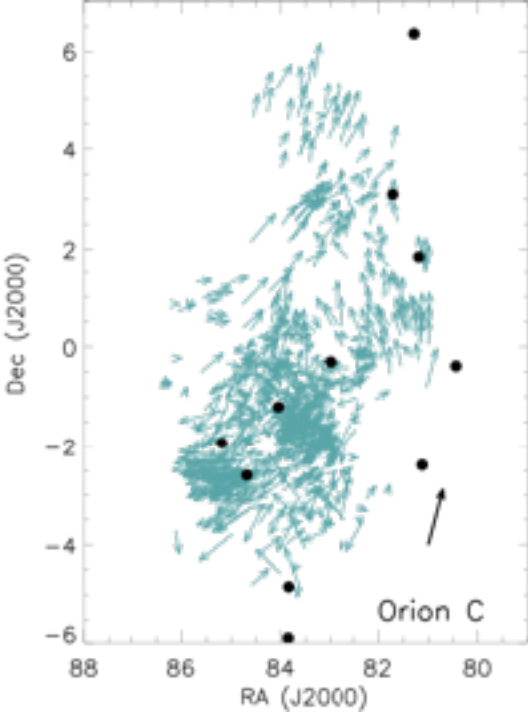


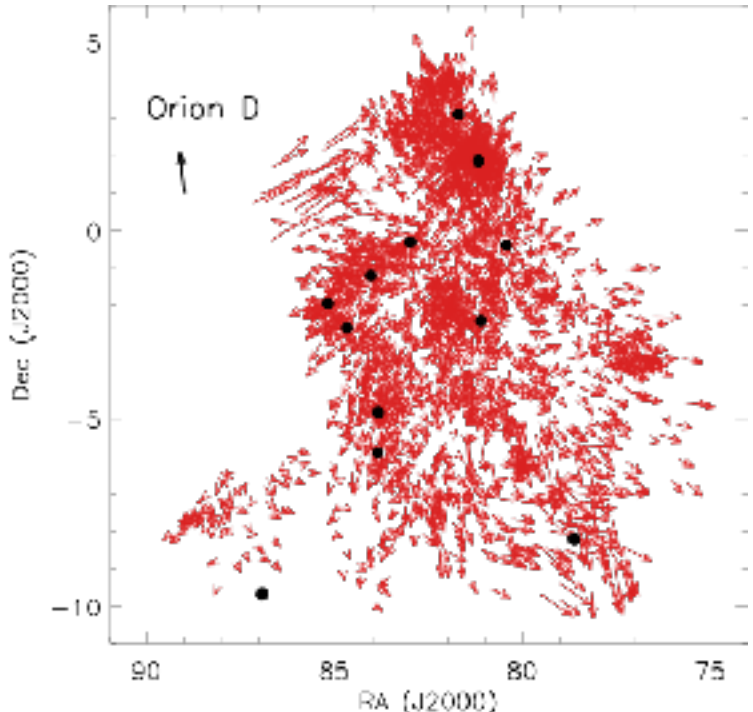
Distribution of ages

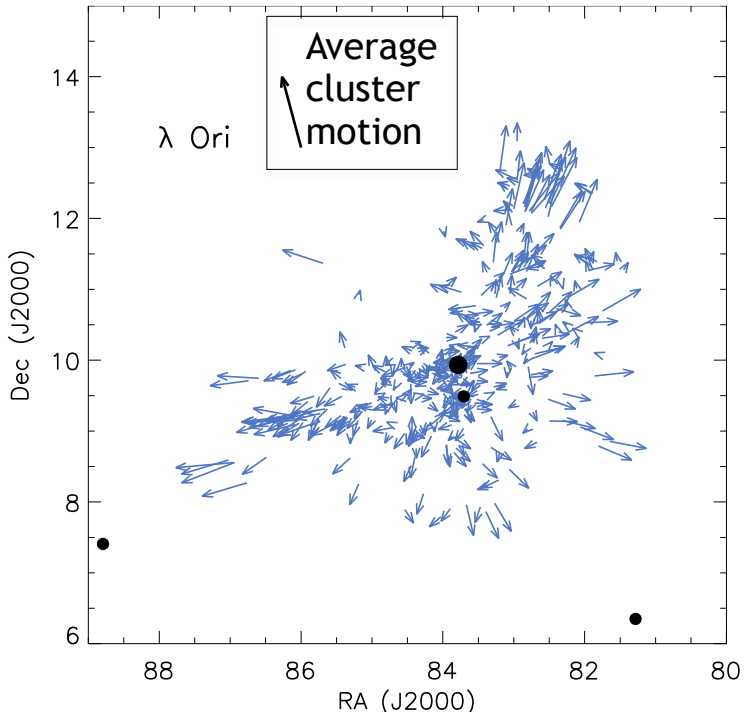
Proper Motions





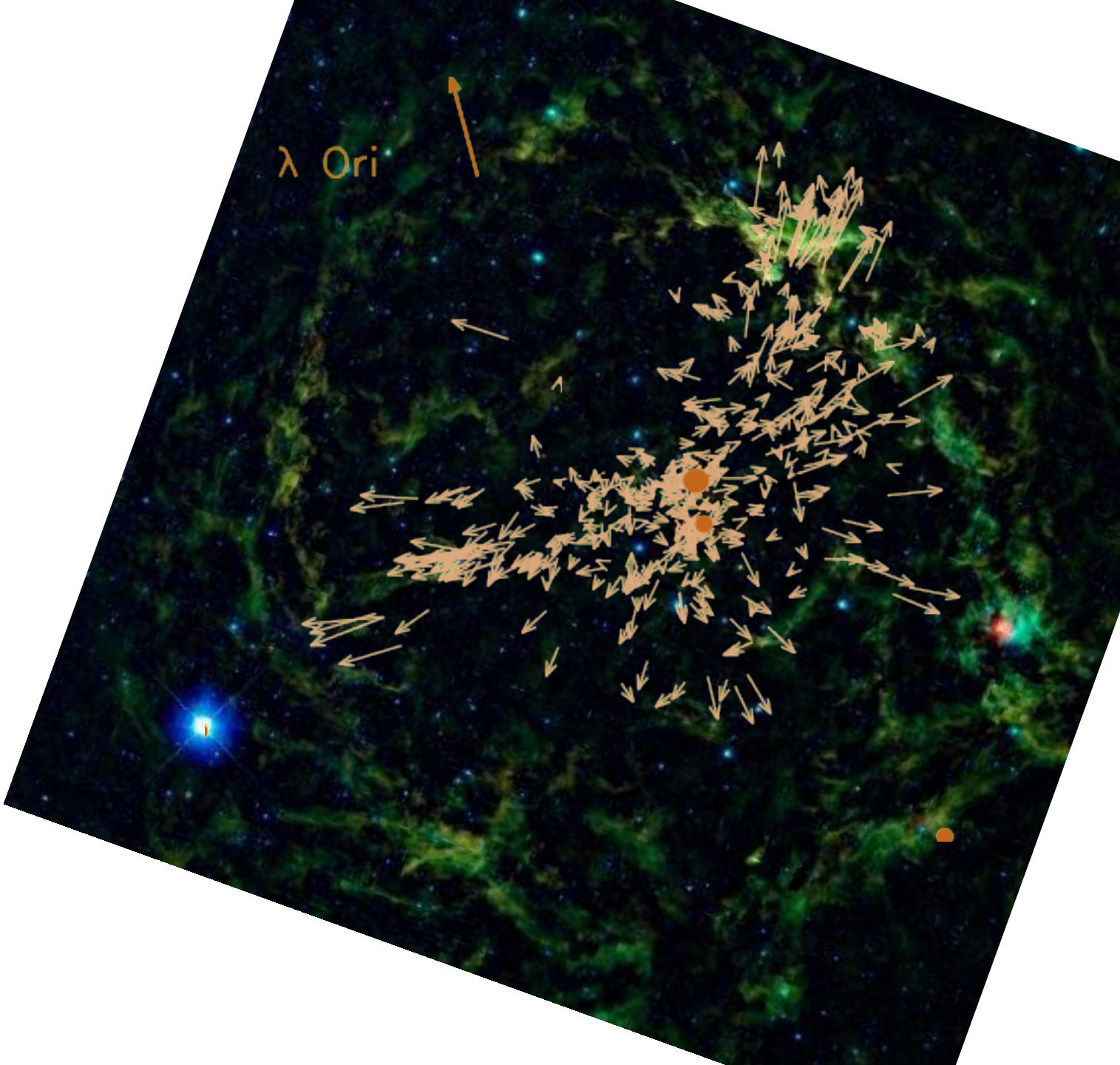






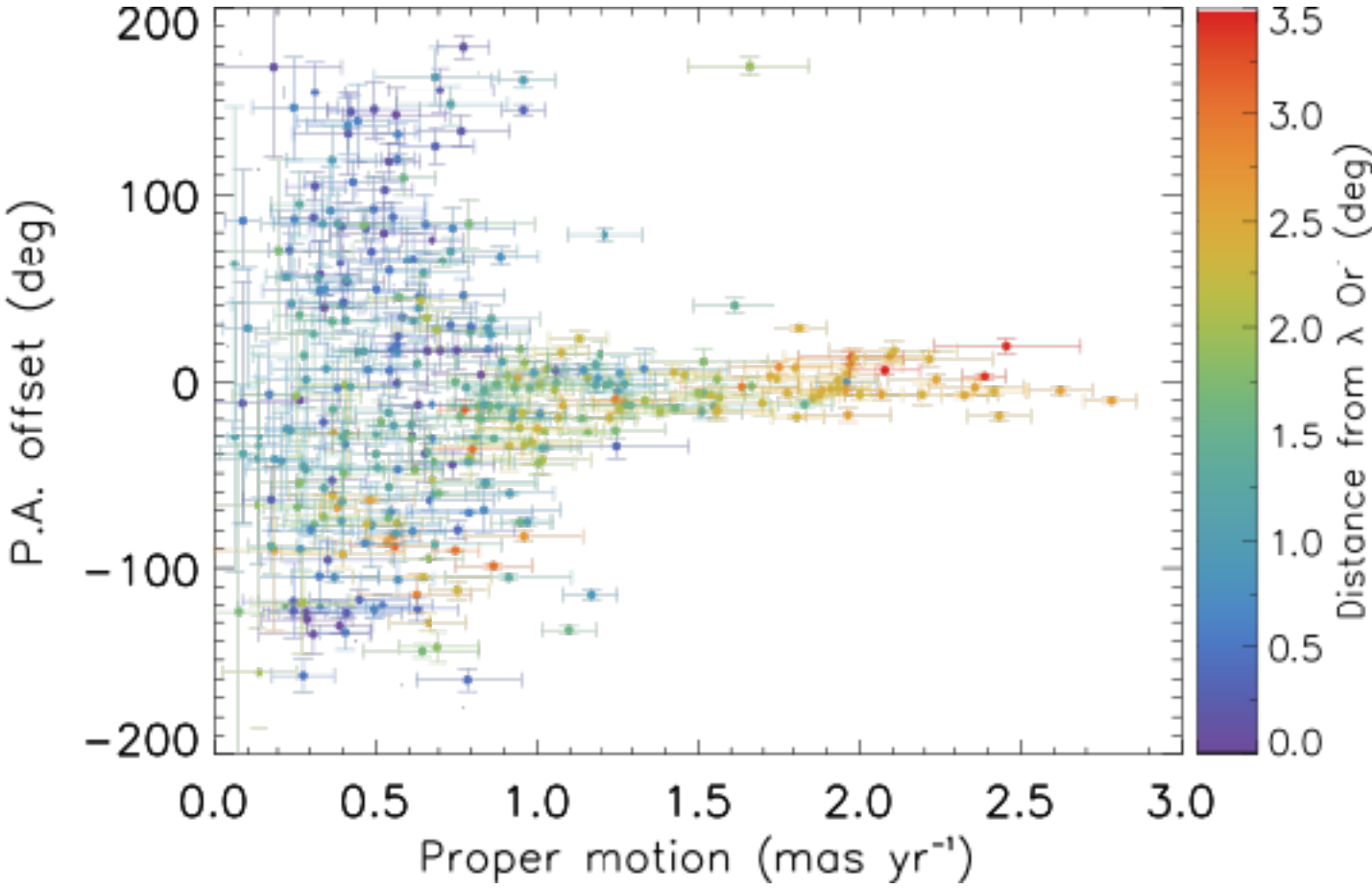
λ Ori

- Supernova occurred in λ Ori
- Central cluster age ~5 Myr
- Ages near the edge ~ 2 Myr

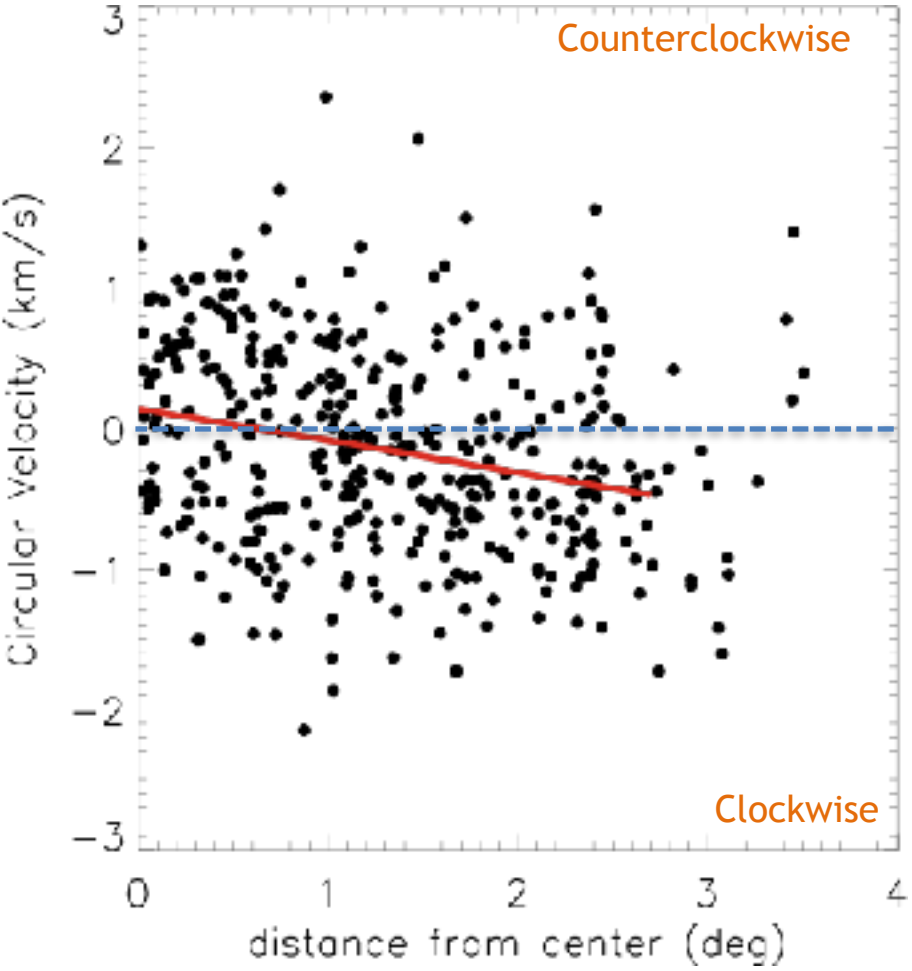


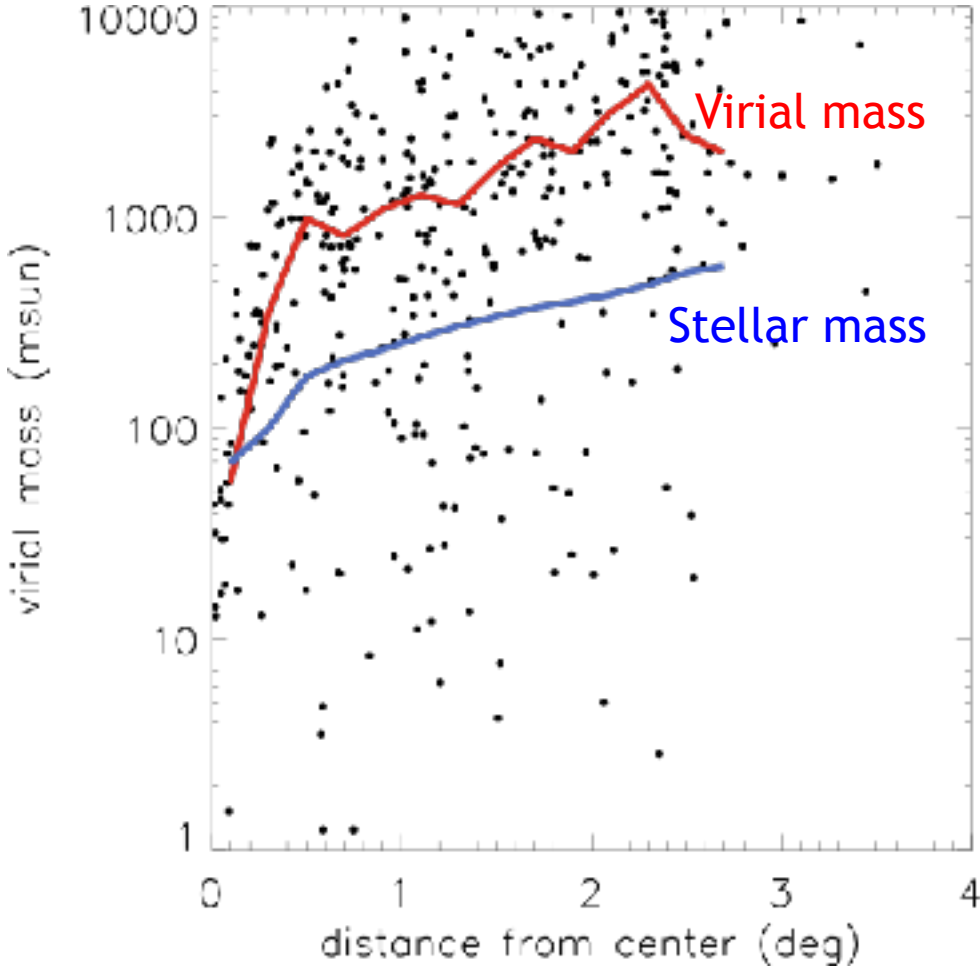
λ Ori

- Supernova occurred in λ Ori
- Central cluster age ~5 Myr
- Ages near the edge ~ 2 Myr
- Stars within 1.5 deg are virialized
- Further than that they are moving radially
- Expansion age of 4.8 Myr



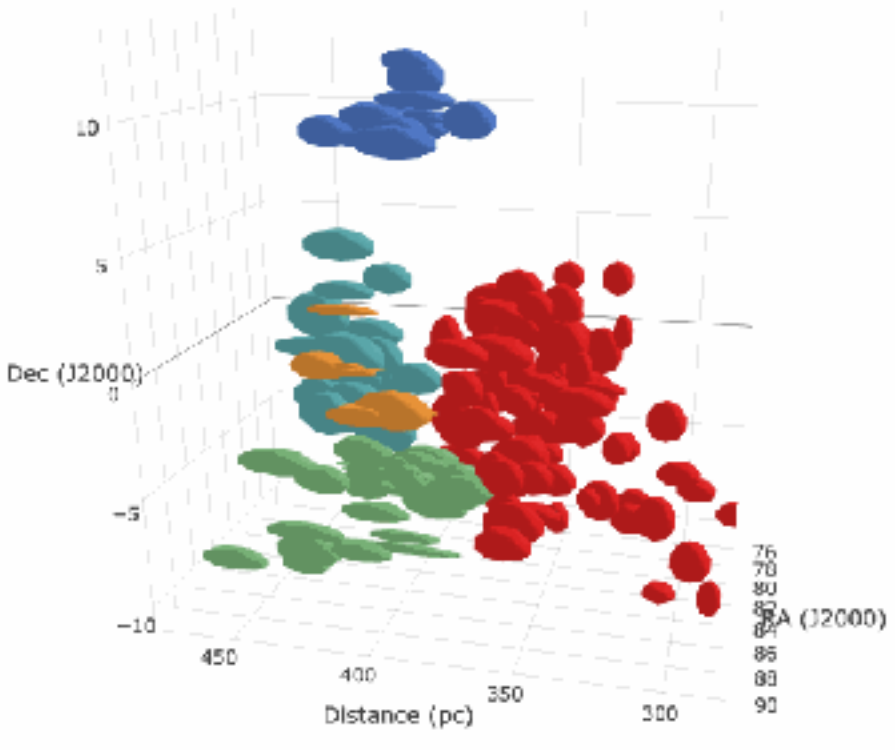
Circular velocity component

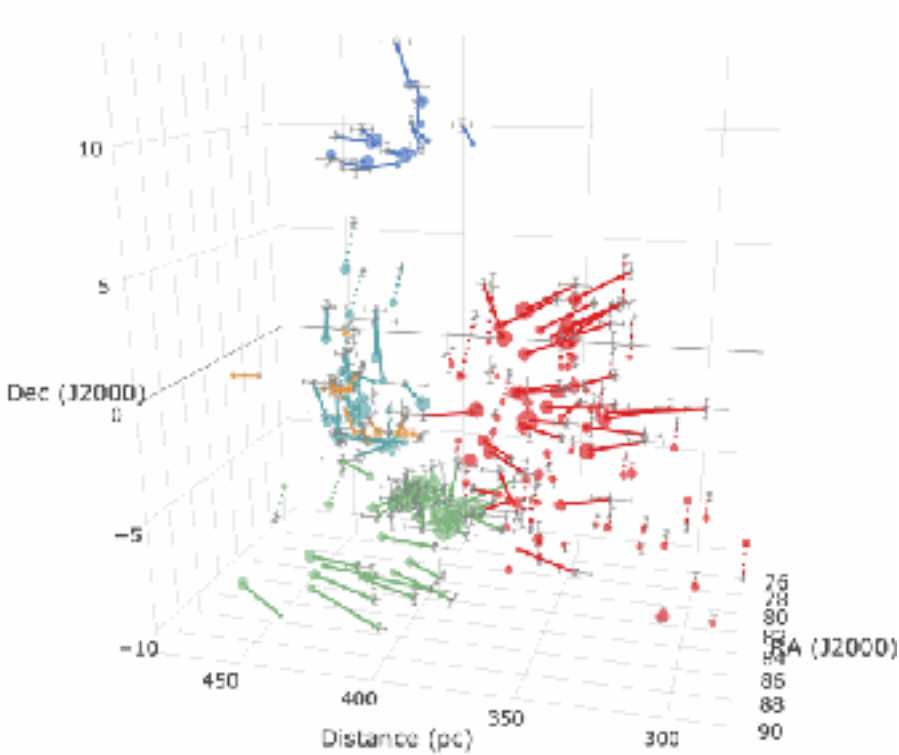




APOGEE Collaboration at CS20

- Kevin Covey (Th 16:50, star cluster splinter)
  - Accretion, ages, and multiplicity in the first 125 Myrs: A systematic view from the APOGEE-2 Young Cluster Survey
- Genaro Suárez (Poster 292)
  - System IMF of the 25 Orionis Stellar Group
- Serena Kim (Poster 160)
  - Probing Effect of External UV Radiation on Young Stellar and Substellar Mass Objects


10
5
0
−5
−10
Dec (J2000)
450
400
350
300
Distance (pc)
RA (J2000)


10
5
0
−5
−10
Dec (J2000)
450
400
350
300
Distance (pc)
RA (J2000)