

DISCOVERY OF A YOUNG STELLAR "SNAKE" WITH TWO DISSOLVING CORES IN THE SOLAR NEIGHBORHOOD

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*Thanks for useful comments and helps from Liu JiaMing, Tian Hao, Liu Chao,
Fang Min, Li Di, Zhao Hongsheng etc.*

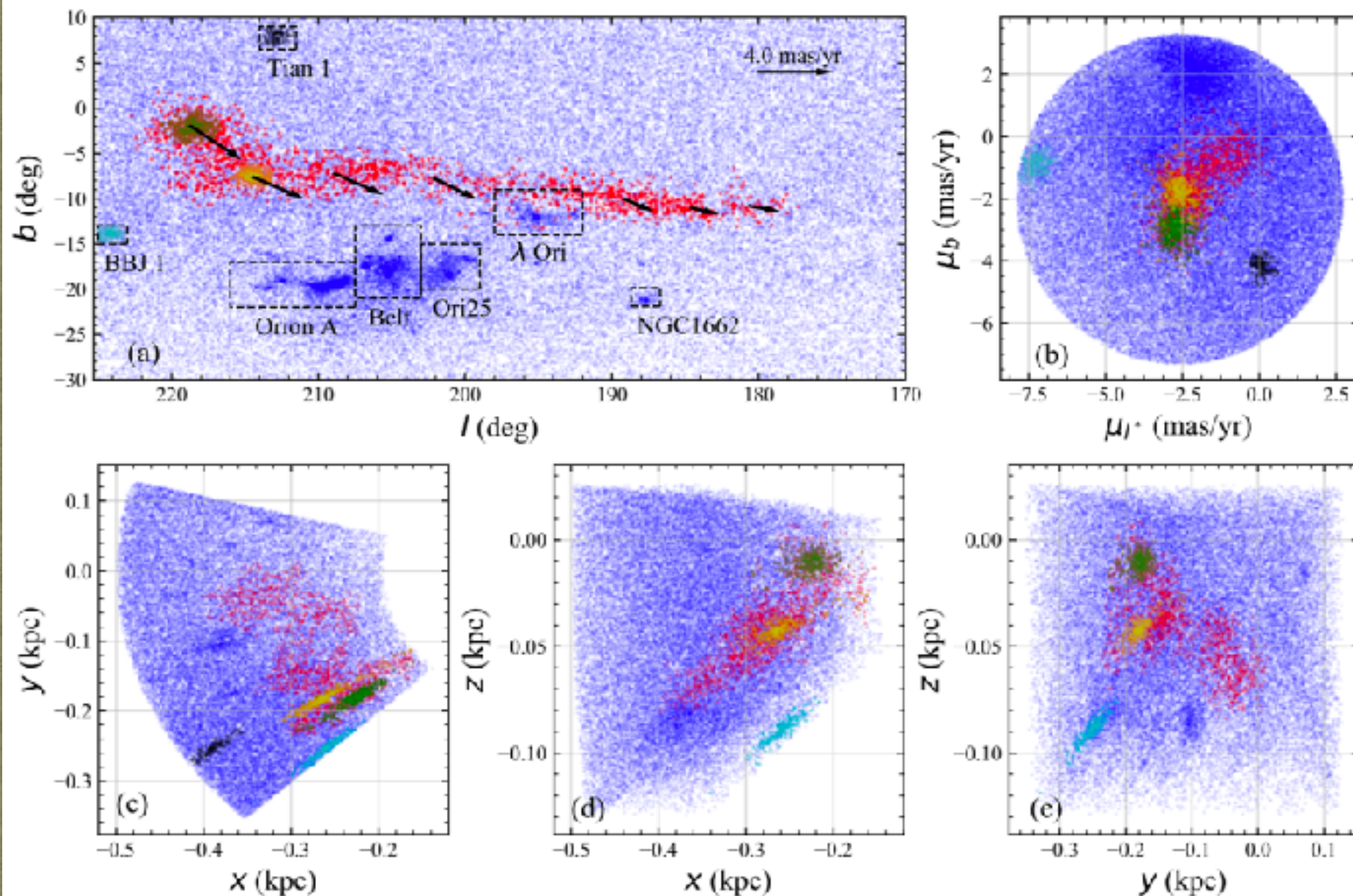
2020-11-27

OUTLINE

- **The Stellar “Snake” (arXiv:2005.12265, in press)**
- **The Properties of the Snake**
- **The Possible Explanations: Tidal Tail or Primordial Morphology?**

I want to be clear: this is good work that certainly deserves to be published in ApJ, but the novelty here is probably not an alternative form of tidal stripping. — The referee

THE STELLAR SNAKE



DATA:

The 5-D information (l , b , d , p_{ml} , p_{mb}) in the phase space from Gaia DR2

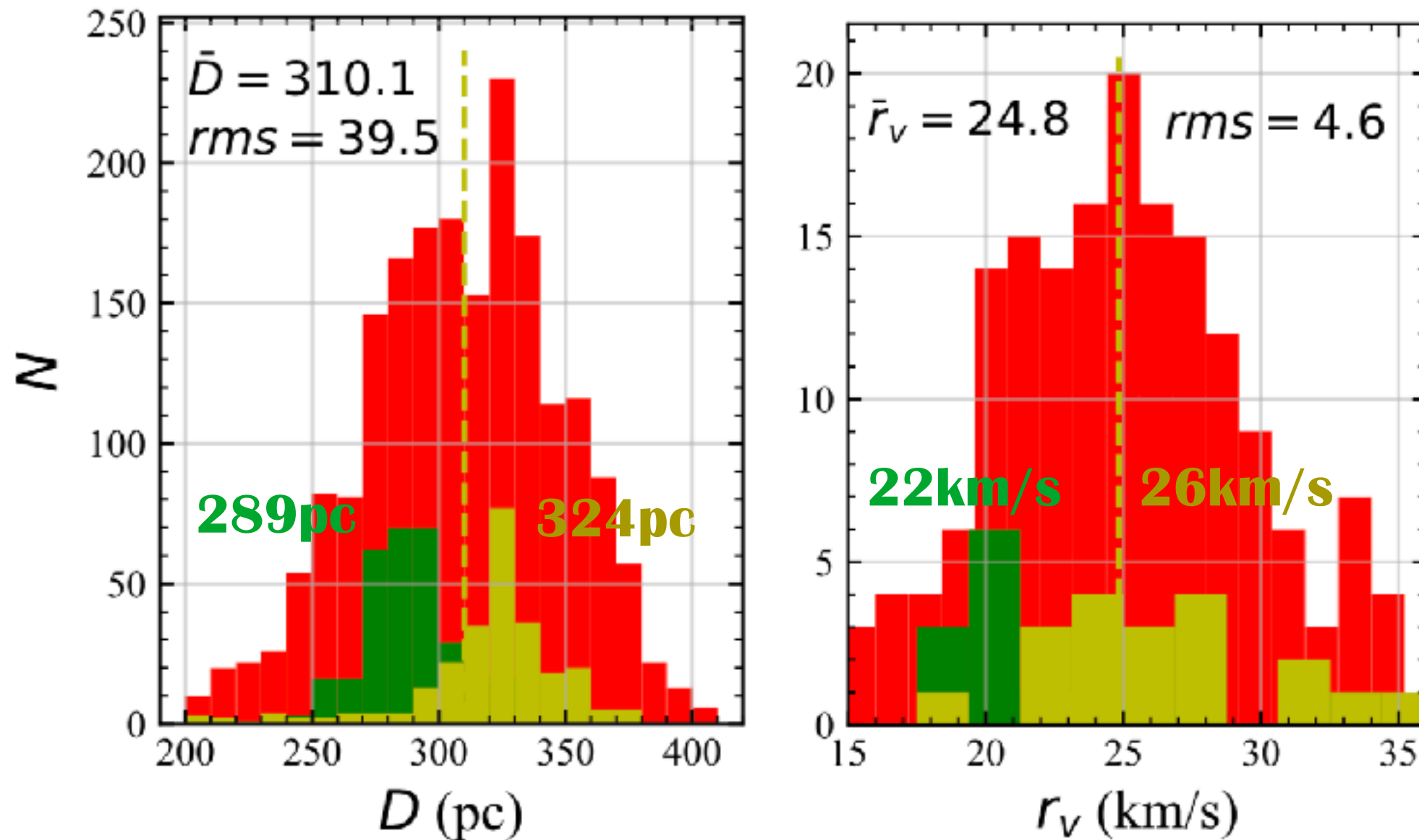
ALGORITHM:

Friend of Friend which is well implemented in “ROACKSTAR”

(Behroozi et al. 2013; Tian Hao 2017)

Two dissolving cores: the green and yellow

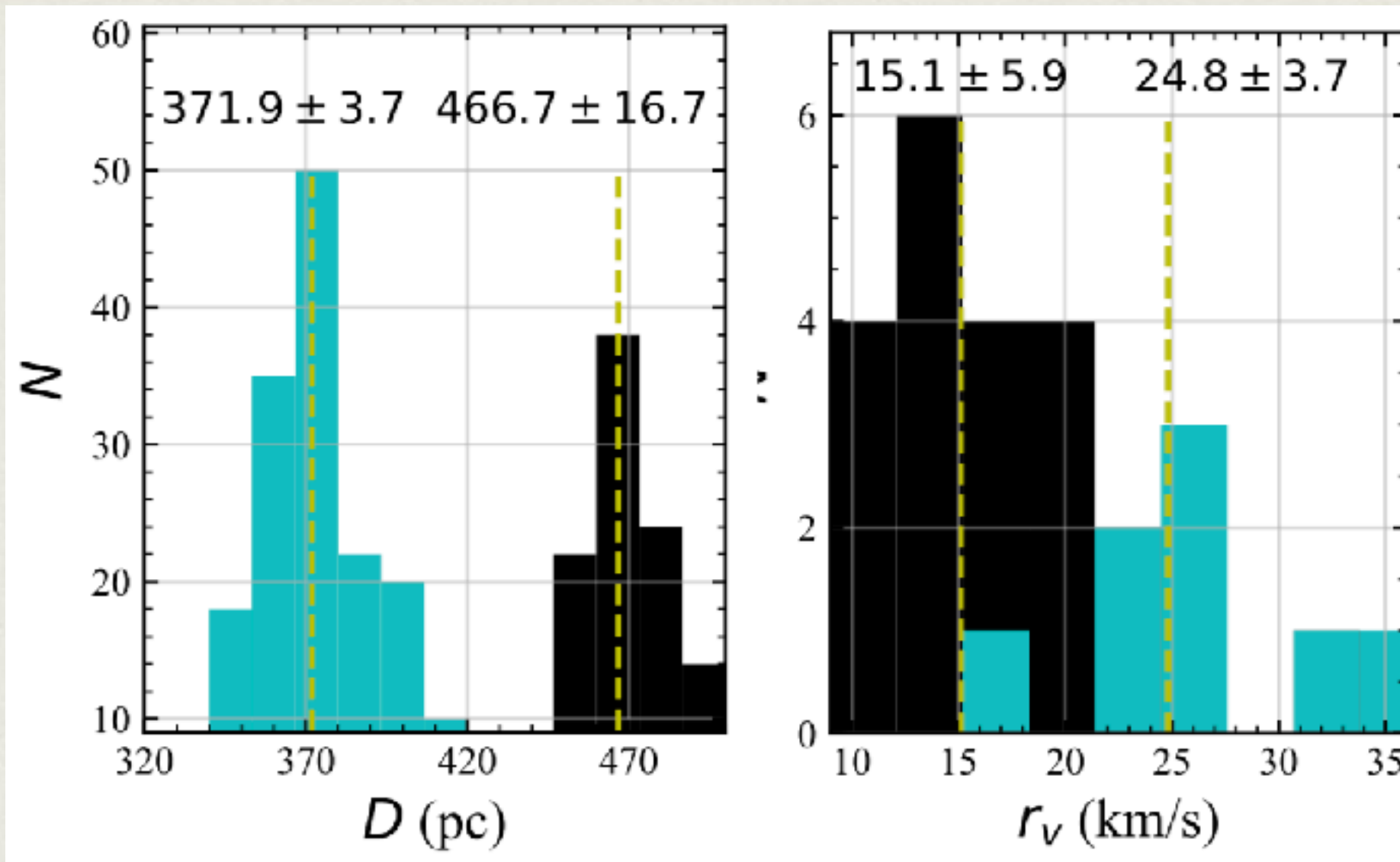
THE PROPERTIES (DISTANCE, VELOCITY)



**The r_v is from
Gaia, LAMSOT,
and APOGEE**

Two dissolving cores: the green and yellow

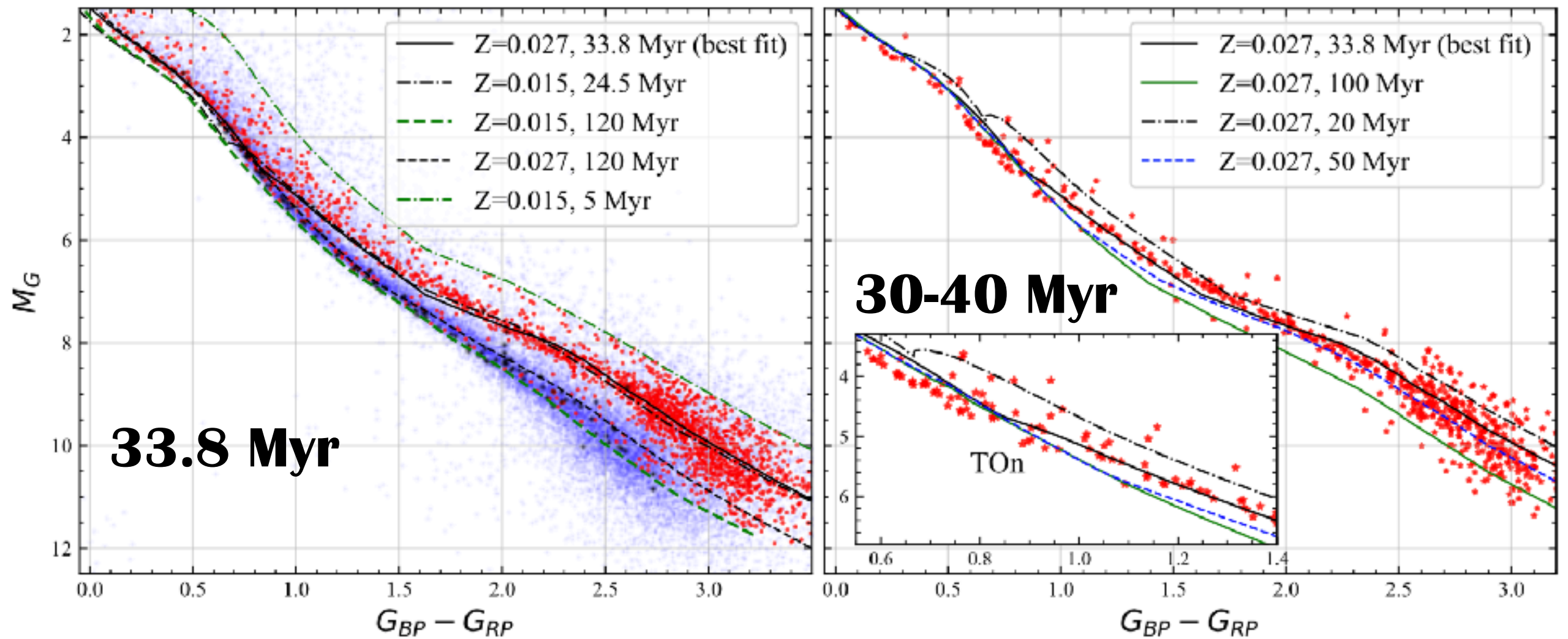
THE PROPERTIES (DISTANCE, VELOCITY)



**The rv is from
Gaia, LAMSOT,
and APOGEE**

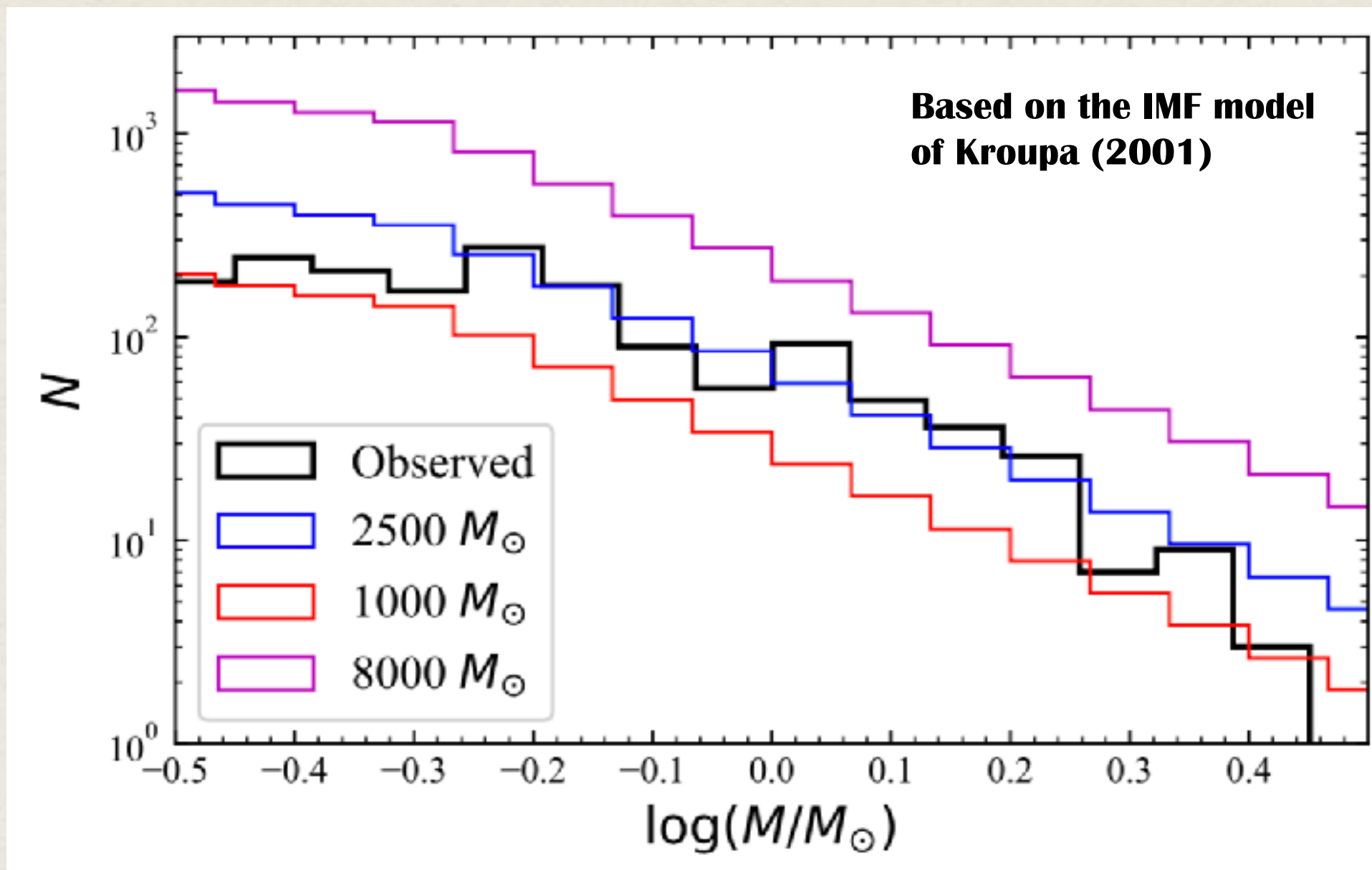
BBJ1 (cyan) and Tian 1 (black)

THE PROPERTIES (AGE)



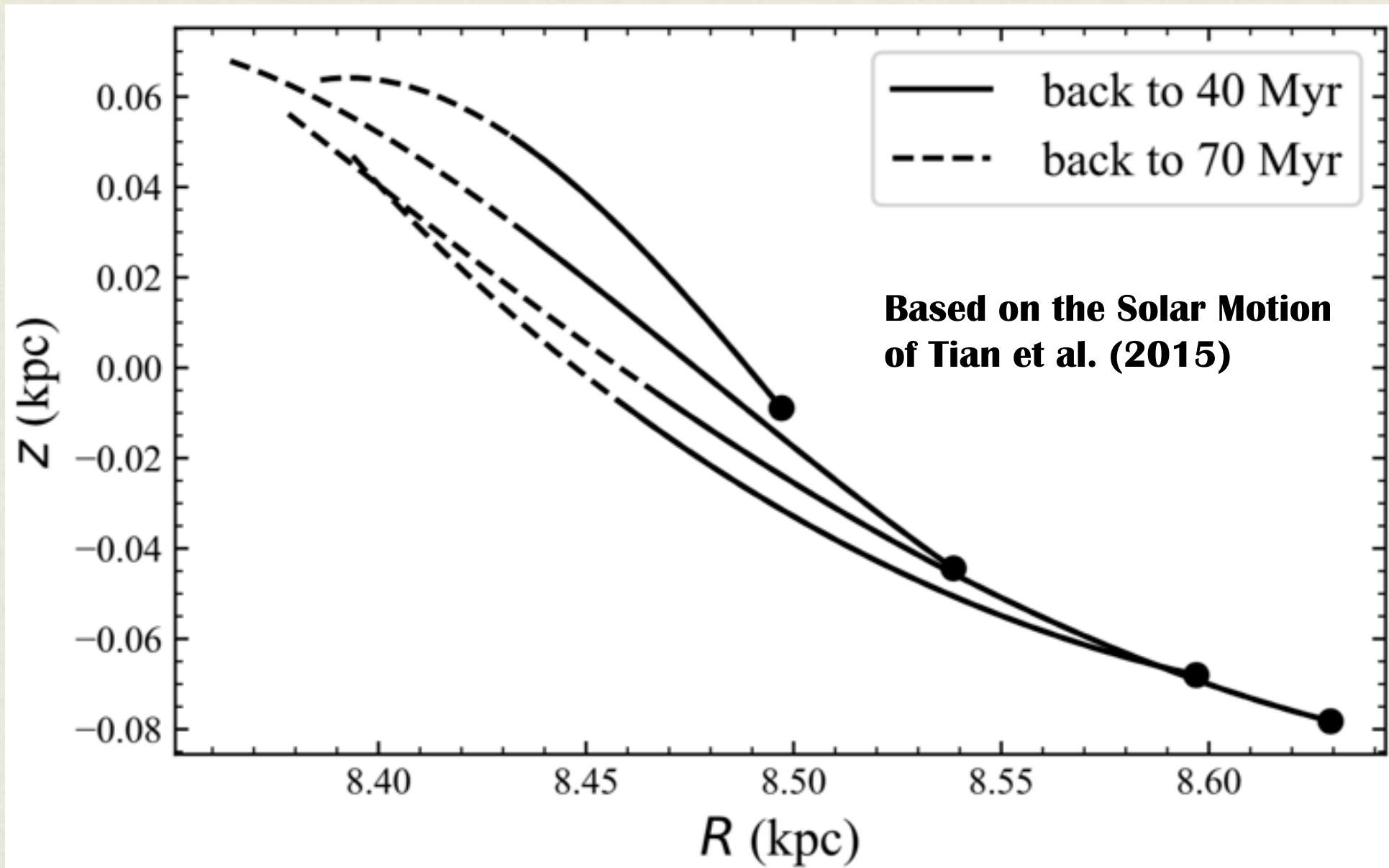
TECHNIQUES: Isochrone Fitting and “TOn”

THE PROPERTIES (TOTAL MASS)

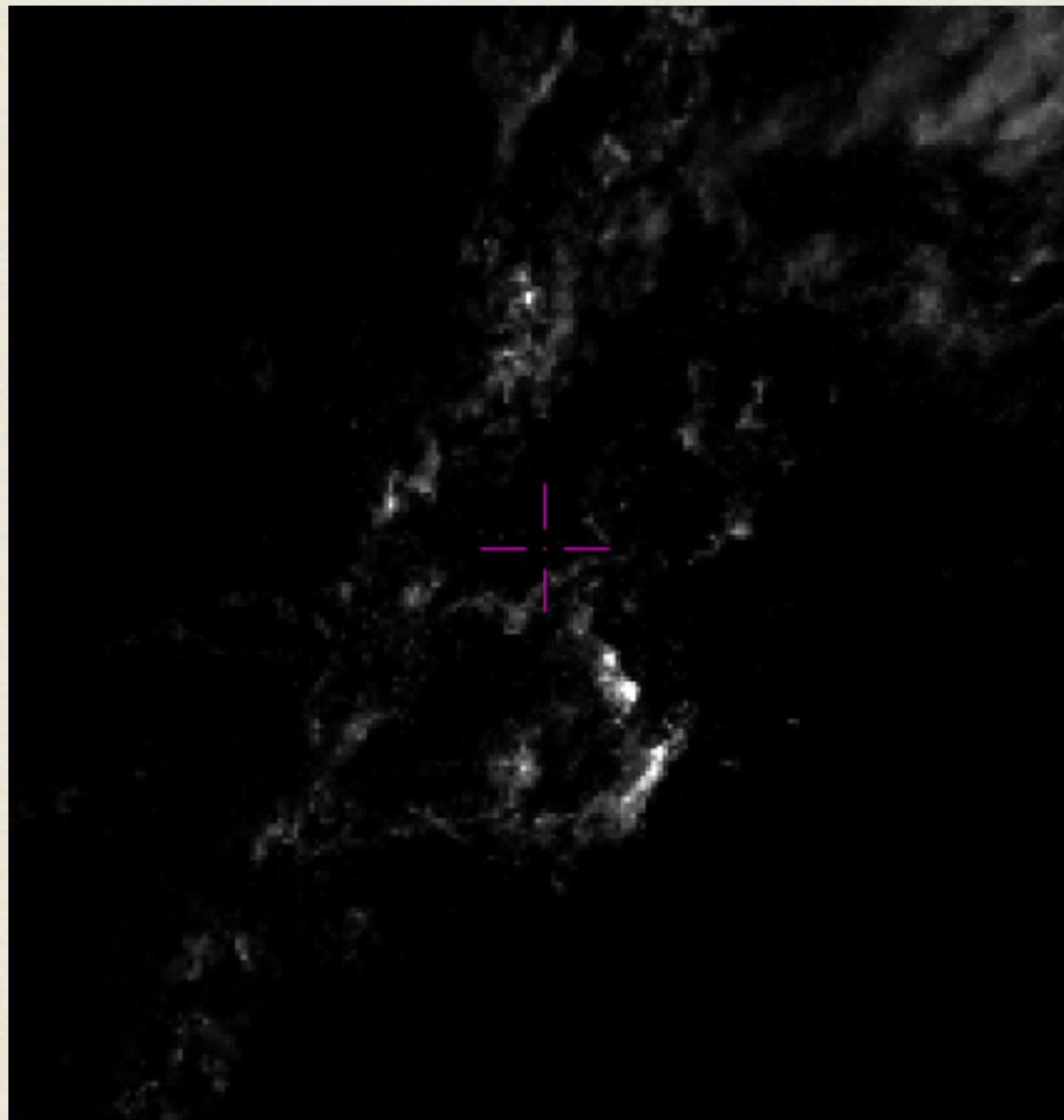


Total mass $\gg 2000 M_{\odot}$

THE PROPERTIES (ORBIT)

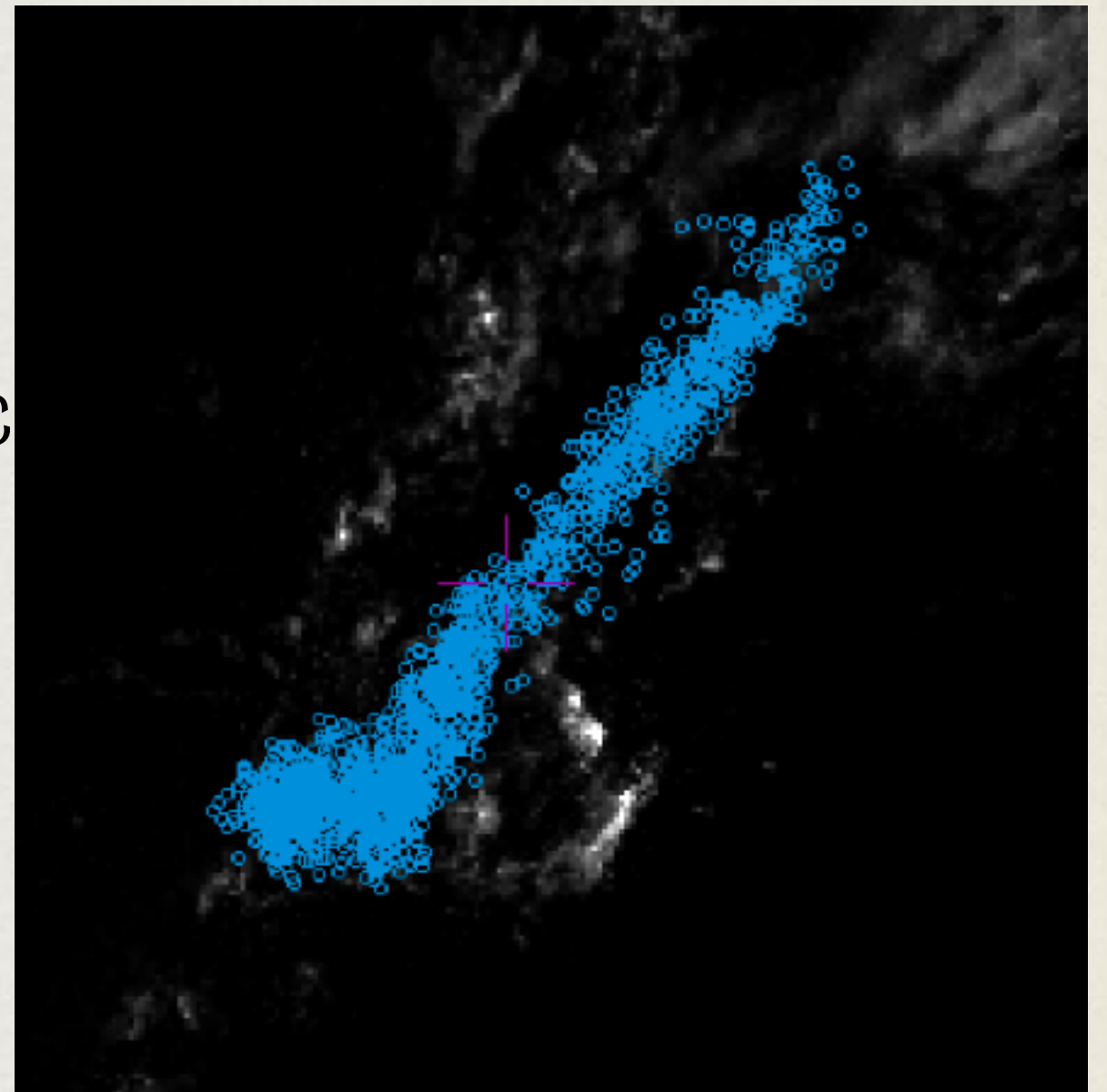


THE PROPERTIES (ENVIRONMENT)



RA

DEC

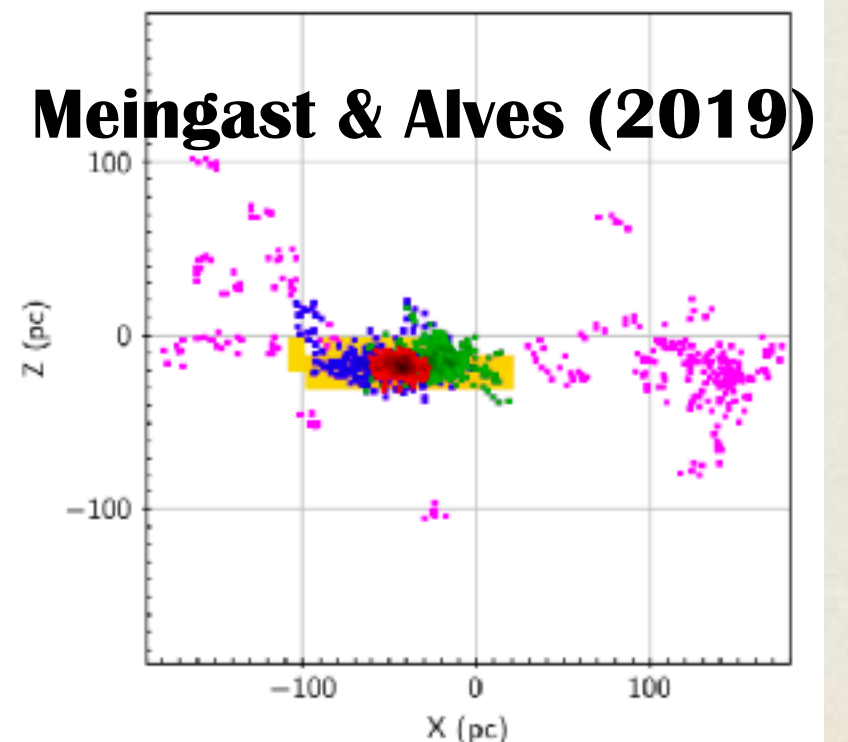
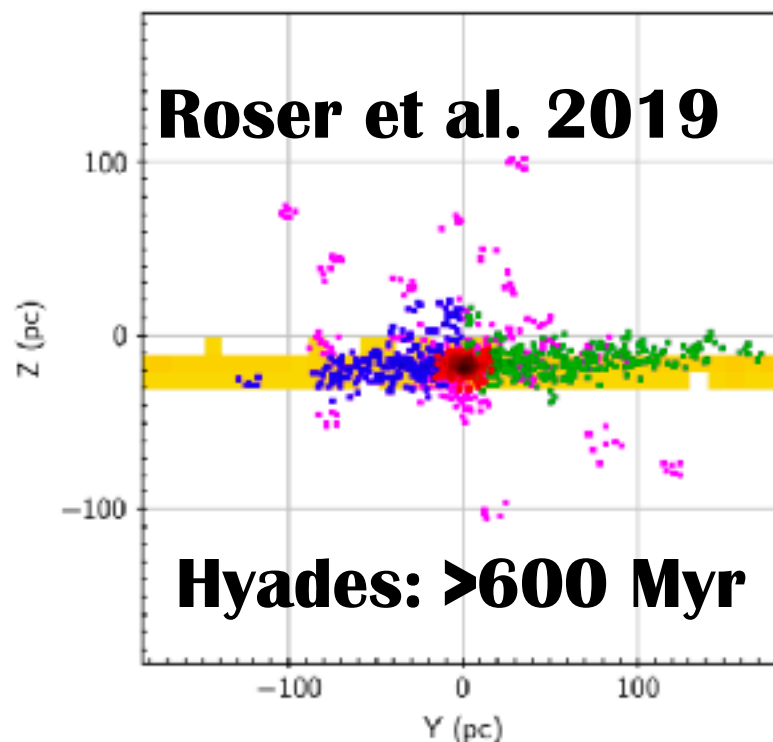
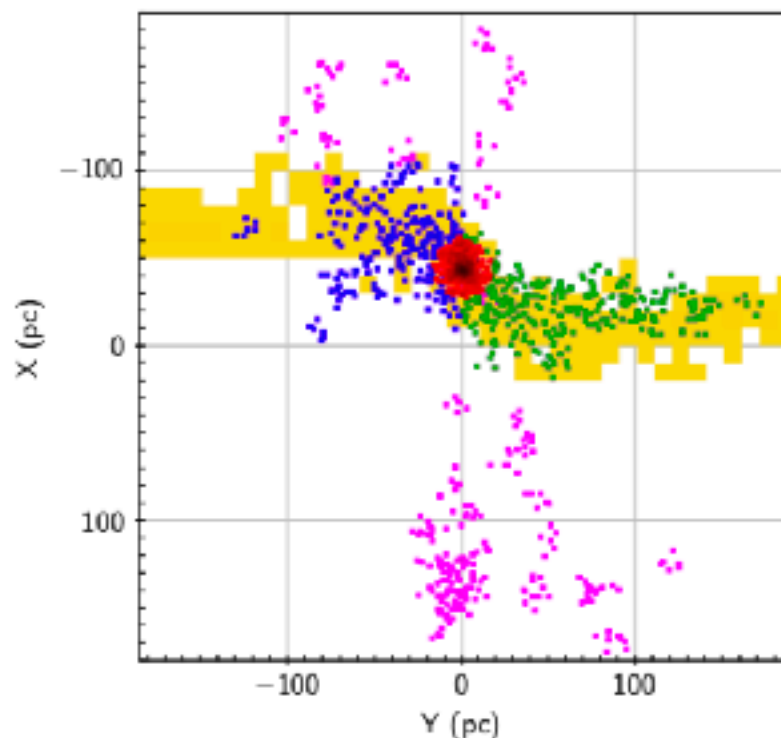
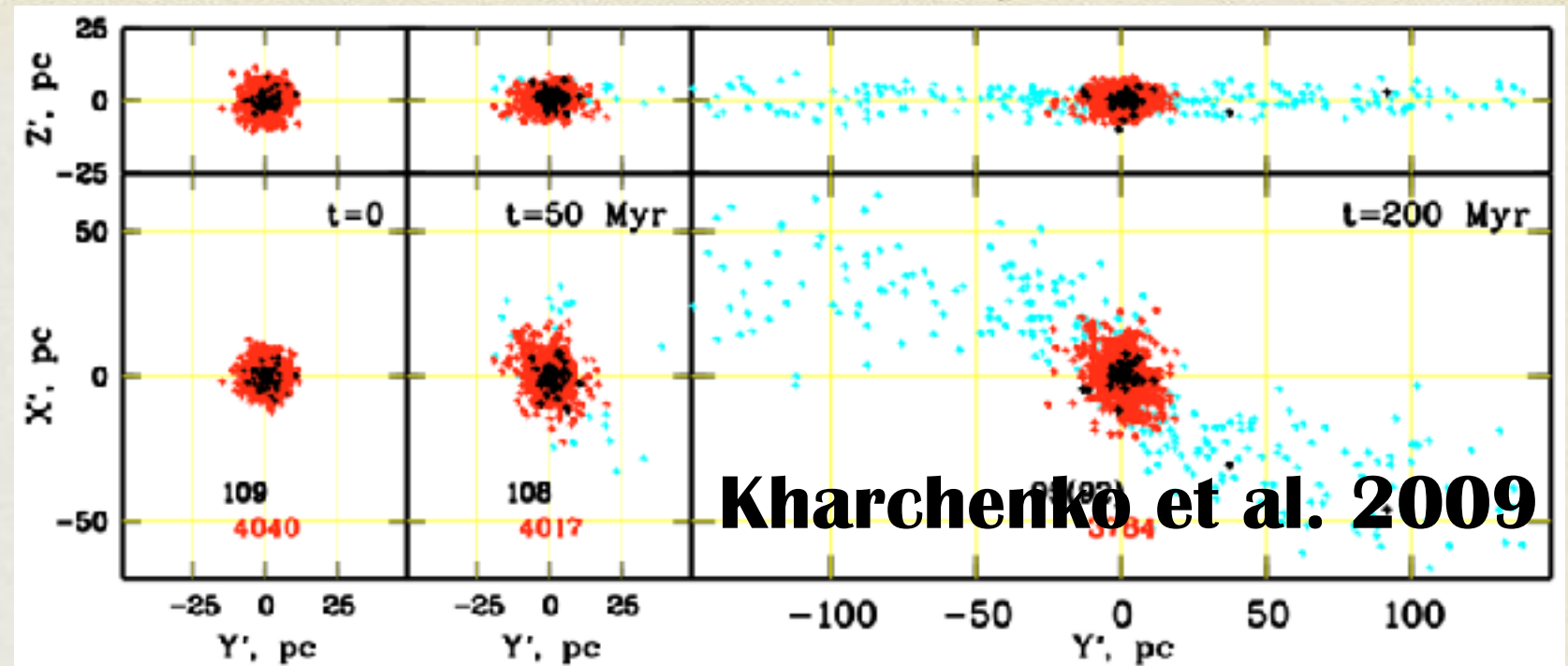


RA

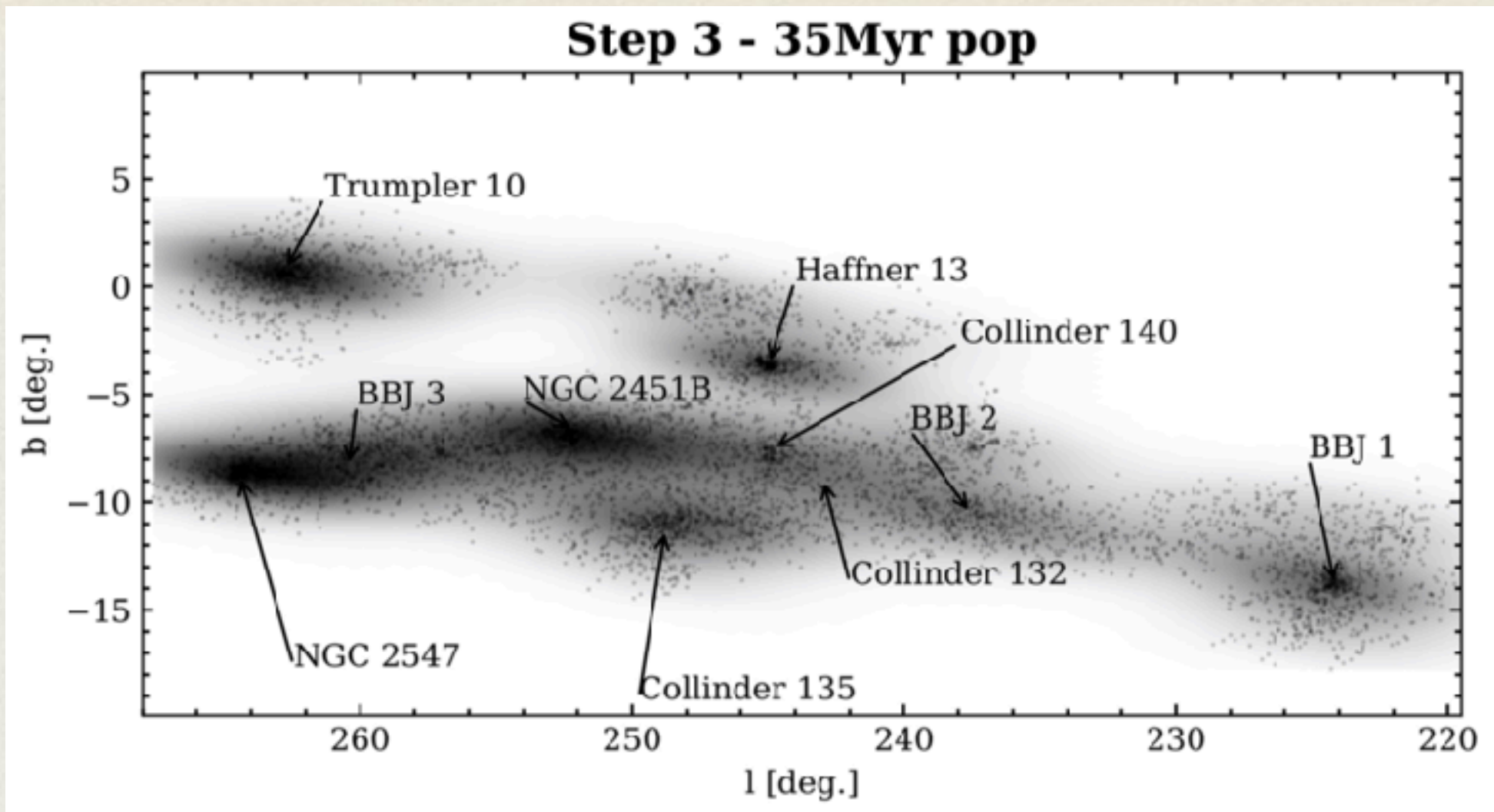
CO Galactic Plane Survey

THE EXPLANATIONS (TIDAL TAIL??)

Galactic gravitational tides, e.g., by passing molecular clouds, disk shocking, spiral arm passages, etc.



THE EXPLANATIONS (PRIMORDIAL MORPHOLOGY)

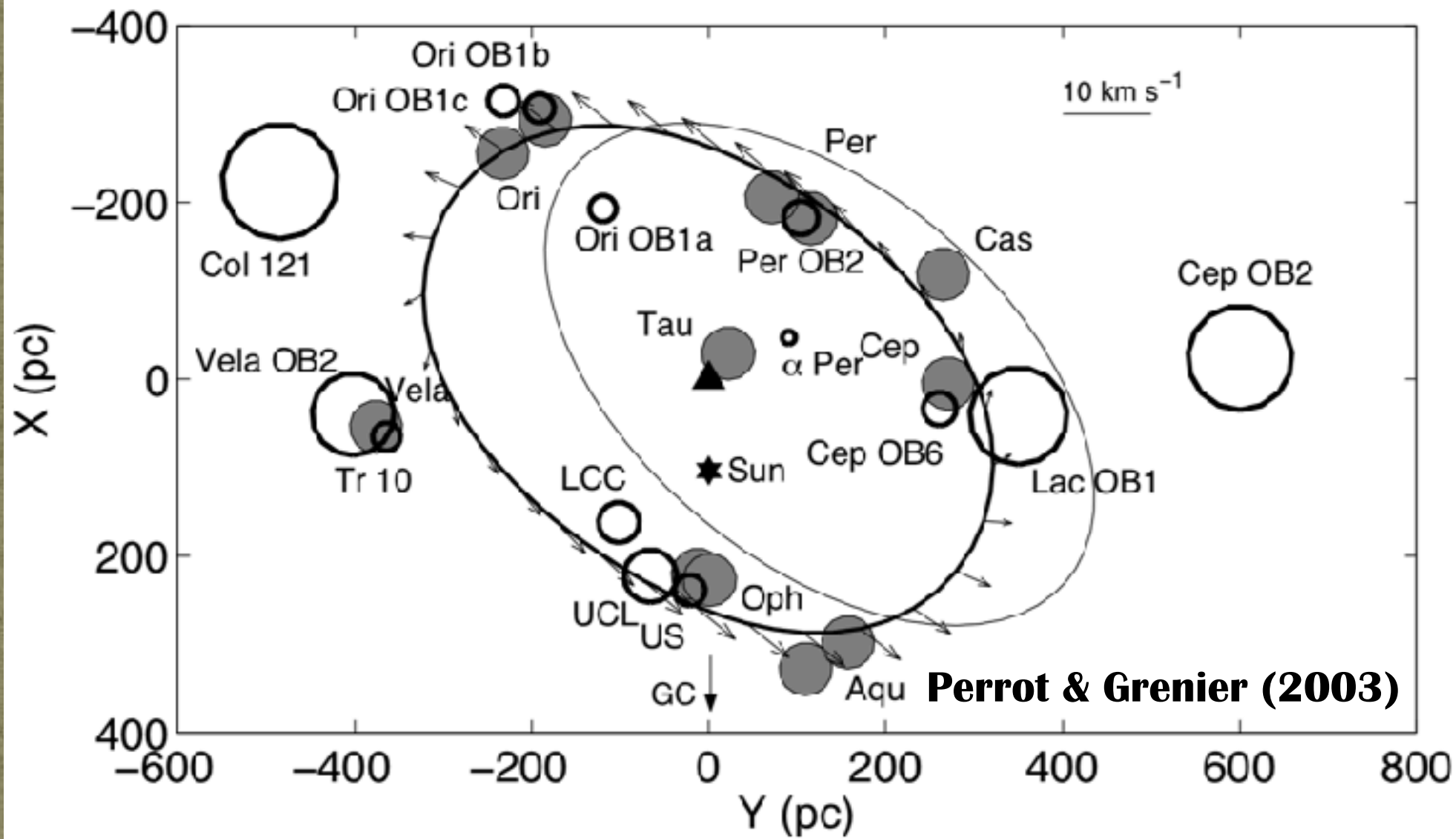


Uncovering a 260 pc wide, 35 Myr old filamentary relic of star formation

Beccari, Boffin, & Jerabkova (BBJ, 2020)

Giacomo Beccari,¹★ Henri M.J. Boffin,¹ and Tereza Jerabkova,^{1,2,3,4,5,6}

THE EXPLANATIONS (GOULD BELT)

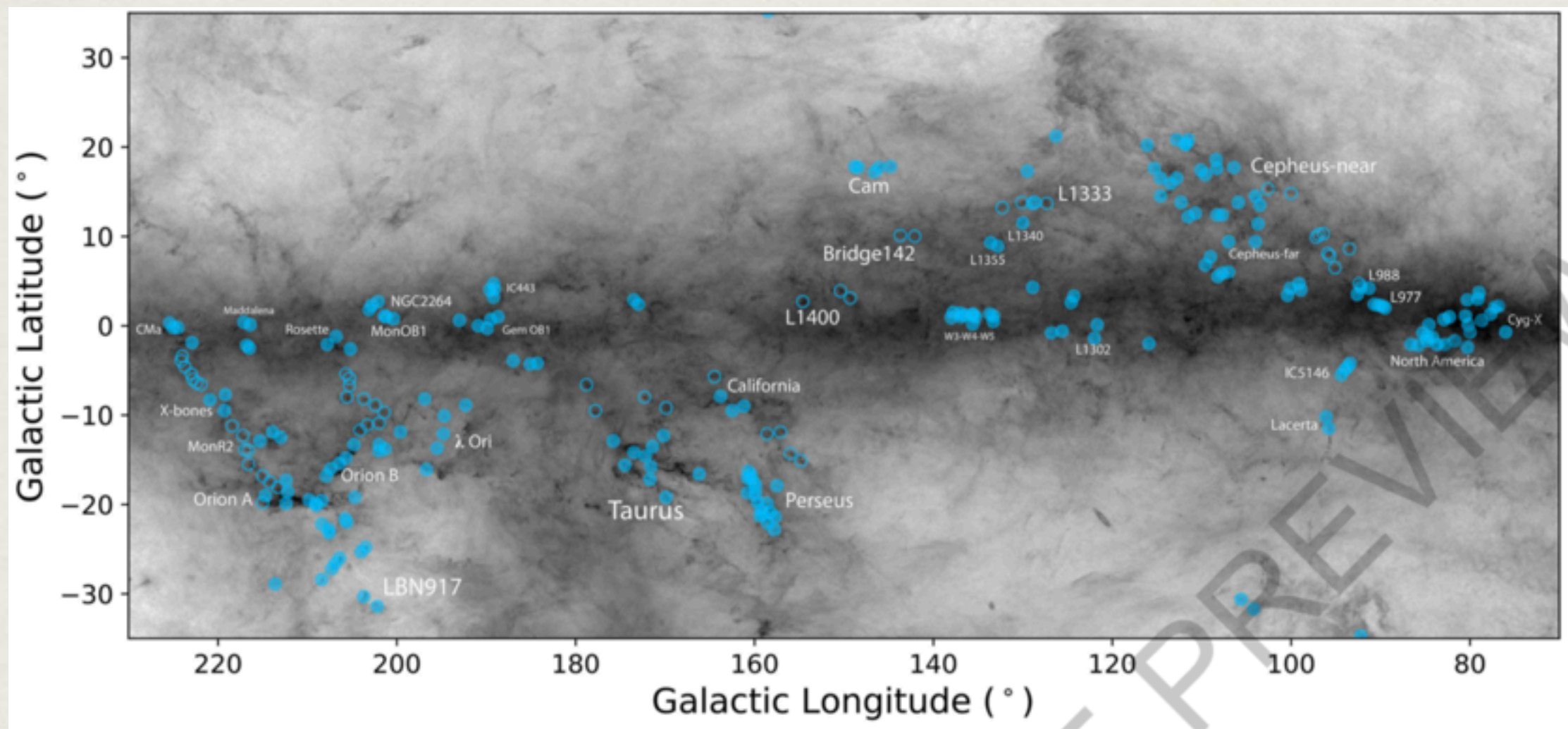


The Orion complex is thought to form part of the Gould Belt (Poppel 1997), but the oldest part was found to be only 21 Myr. (Kos et al. 2019)

Filled up the gap ?

Gould Belt is a large (~1 kpc), young (30-40 Myr), and ring-like structure tilted around 20 deg to the Galactic plane discovered by Herschel in 1847

THE EXPLANATIONS (RADCLIFFE WAVE)



Radcliffe Wave, i.e., a Galactic-scale gas wave in the solar neighborhood, discovered by Alves et al. (2020, Nature)

CONCLUSION

(TAKING HOME POINTS)

- 1. Discovery of a young (only 30-40 Myr) quasi-tidal tail (dubbed a stellar “snake”) nearby the region of Orion complex from Gaia DR2.**
- 2. Distance is about 310 pc; Both the length and width are over 200 pc, but the thickness is only about 80 pc; Mass $> 2000 M_{\odot}$; It only has one tail, but with two dissolving cores in its head.**
- 3. The mechanism of tidal tail has been basically ruled out. It is probably a primordial morphology.**
- 4. LAMOST MRS/APOGEE/GALAH is promising to answer the questions about snake’s formation.**