Galactic Science with eRosita Targets

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Young field stars in the solar vicinity

- Would we expect them to exist?
- Why do we care?
- Work based on TYCHO/HIPPARCOS and ROSAT
- The outlook for eRosita + GAIA

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Where do field stars come from, anyway?

- Open clusters:
  - Few per cent of galactic star forming rate (e.g. Lamers & Gieles 2006)

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Where do field stars come from, anyway?

- Open clusters:
  - Few per cent of galactic star forming rate (e.g. Lamers & Gieles 2006)
- Isolated star formation
  - No convincing evidence
  - The 'isolated' T Tauri star TW Hya turned out to be part of an association (de la Reza et al. 1989)

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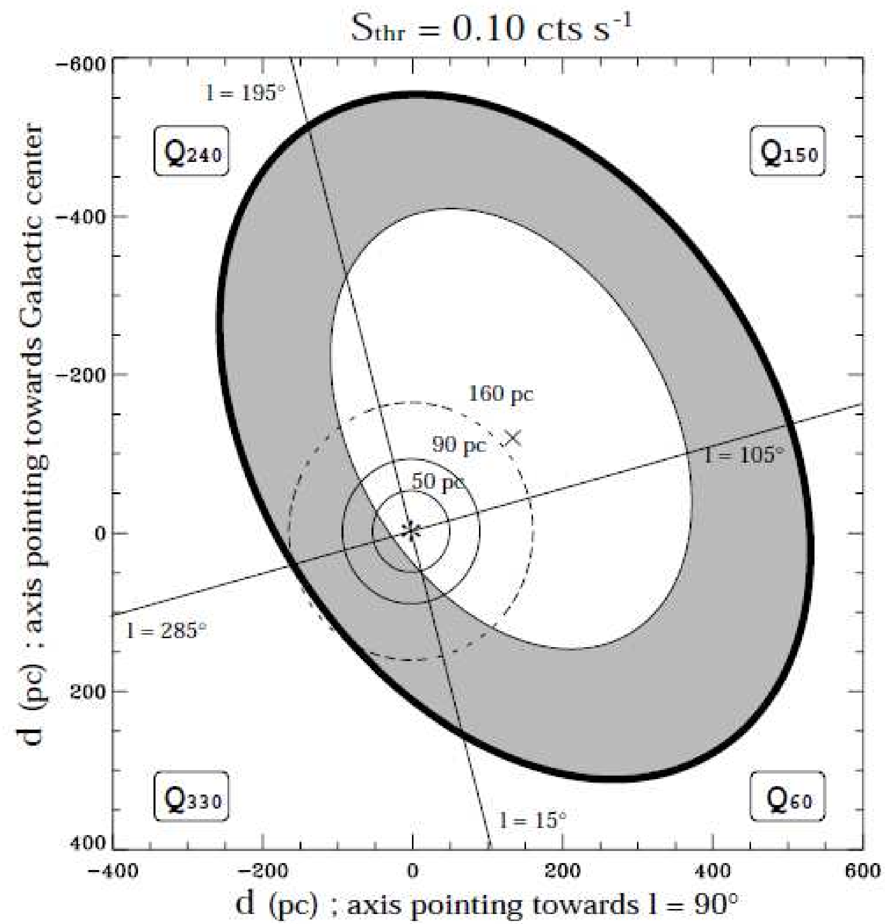
- How does this happen? What is the typical timescale?
- The Sun resides (by chance) within the Gould Belt star forming complex
  - GB structure might resemble a truncated disk rather than a thin belt (Guillout et al. 1998)
  - Sun is presumably located close to the inner edge of the GB

How can we find young stars in the field?

- Late-type stars show stellar magnetic activity like the sun
  - Spots
  - Ca H+K emission
  - Coronal X-ray emission
- Magnetic activity caused by dynamo mechanism driven by rotation
- Young stars rotate faster $\Rightarrow$ **X-ray bright**

Late-type stars in the Gould Belt



Guillout et al. 1998

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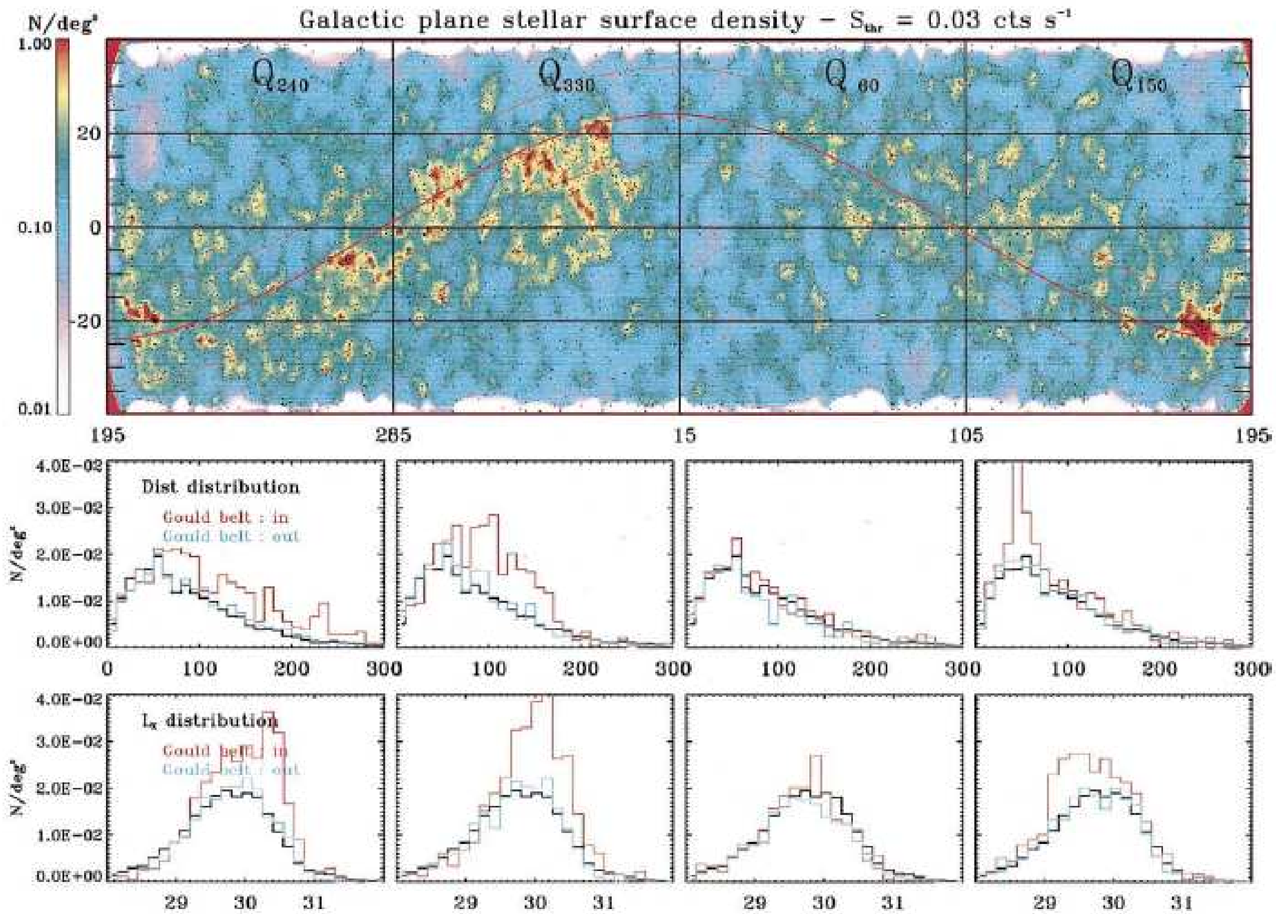

Guillout et al. 1998

Why do we care?

- Dispersal of young stars into the field
  - How many are there?
  - From where do they come?
  - What are their ages?
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- Dispersal of young stars into the field
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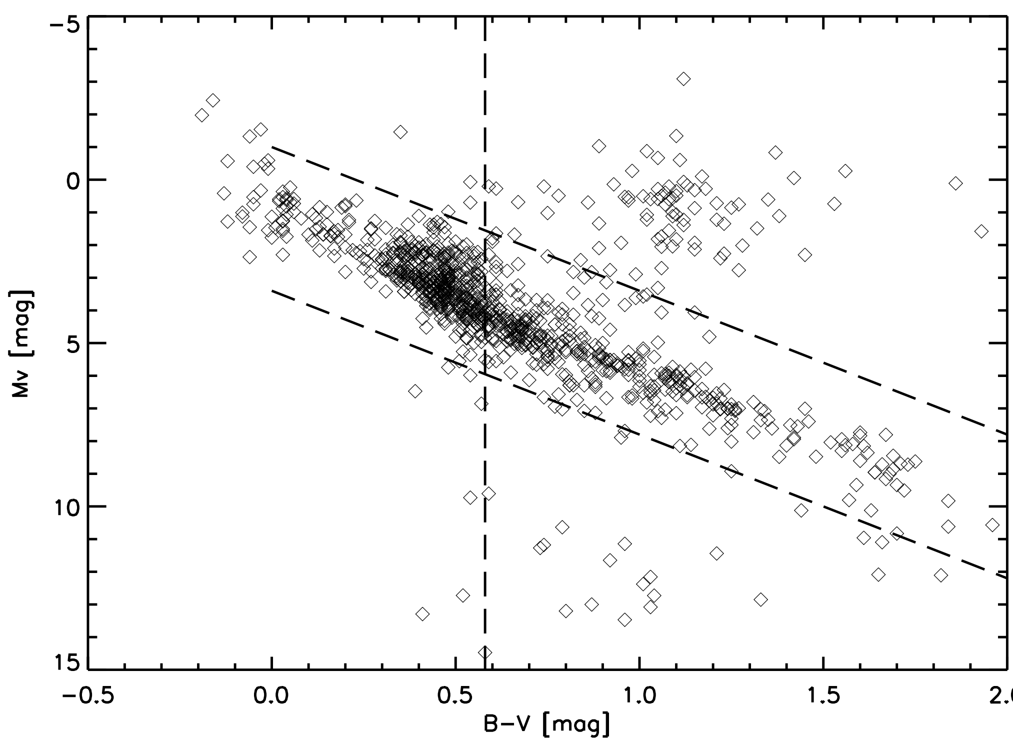
- Targets for follow-up studies
  - Disks
  - Doppler tomography / differential rotation
  - Direct imaging of planets / brown dwarfs

TYCHO/HIPPARCOS and ROSAT

- Cross-correlate TYCHO and ROSAT to select candidates
  - (B-V) $>$ 0.54, corresponding to $\approx$ F8
  - Parallax errors better than 3.5 σ and close to main sequence



The candidates

- 754 stars
  - Mostly G stars (TYCHO magnitude limit)
  - 473 earlier than K0, 257 K stars, 24 M stars
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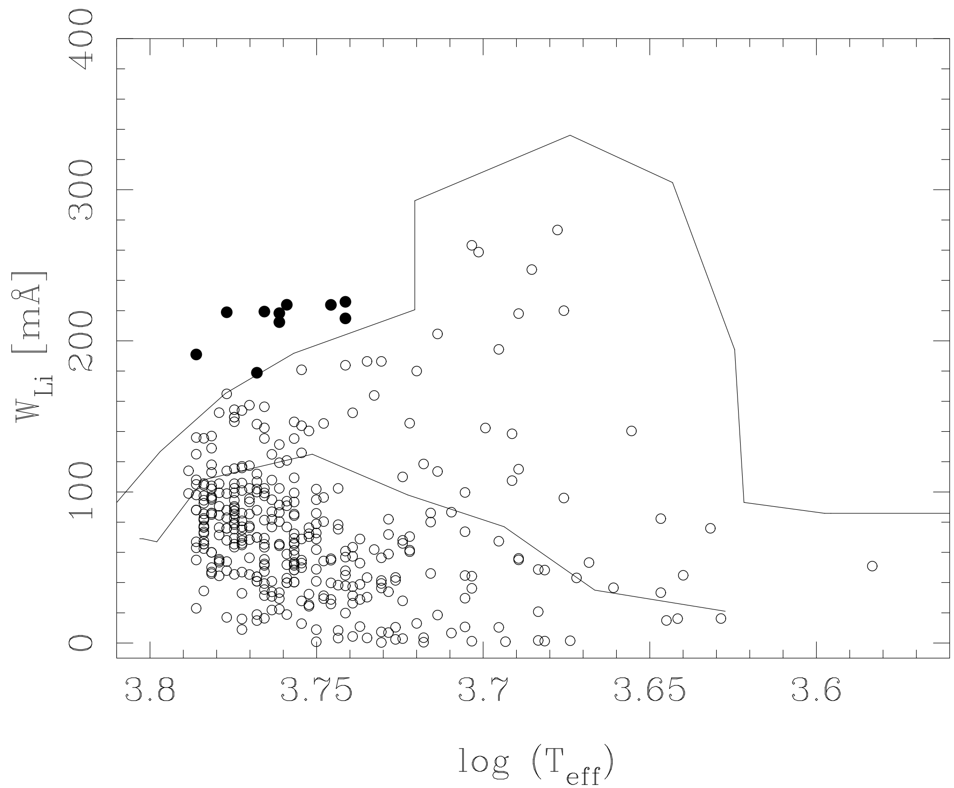
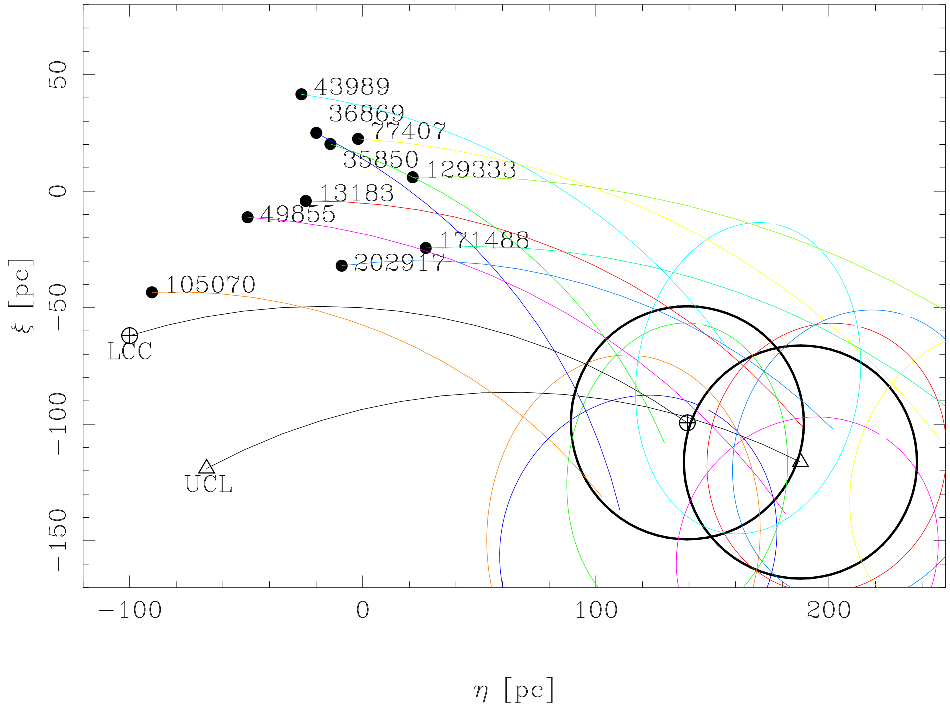
  - Distances peaked at 20-30 pc
- Spectroscopic follow-up
  - KPNO (0.9 m Coudé feed, R=25000)
  - ESO (1.52 m, FEROS, R=48000)
  - Calar Alto (2.2 m, FOCES, R=40000)
  - $\approx$ 5 weeks of observations in 3 years
  - 748/754 stars observed

W_{Li} vs. log(T_{eff})



Wichmann R., Schmitt J.H.M.M., and Hubrig S. 2003

Backtracking



Wichmann & Schmitt 2003

eRosita + GAIA

- GAIA goes much deeper than HIPPARCOS
- eRASS vs. RASS: 20-30 times higher sensitivity at $0.3 - 2$ keV
  - ZAMS G-type stars detectable at 250 pc
  - Covers GB from centre to outer rim and beyond
  - Early M-type stars detectable at distance $\lesssim$ 50 pc
- Need spectroscopic follow-up to find the youngest stars!

The case for 4MOST

- We expect $\approx$ 18000 G-type candidate stars at $\lesssim$ 250 pc
- Several thousands of K and M-type candidates at closer distances
- Sparse sample for spectroscopic follow-up

$\Rightarrow$ No meaningful way to do this as a standalone project

Spectroscopic follow-up

- Lithium $\lambda 6707$
  - Accurate determination of equivalent width $\Rightarrow$ R $\gtrsim$ 20000
- Rotational velocities
  - With R = 20000 we can resolving $v \sin i \gtrsim 15$ km/s
- Accurate RV determination required for UVW velocities

Summary

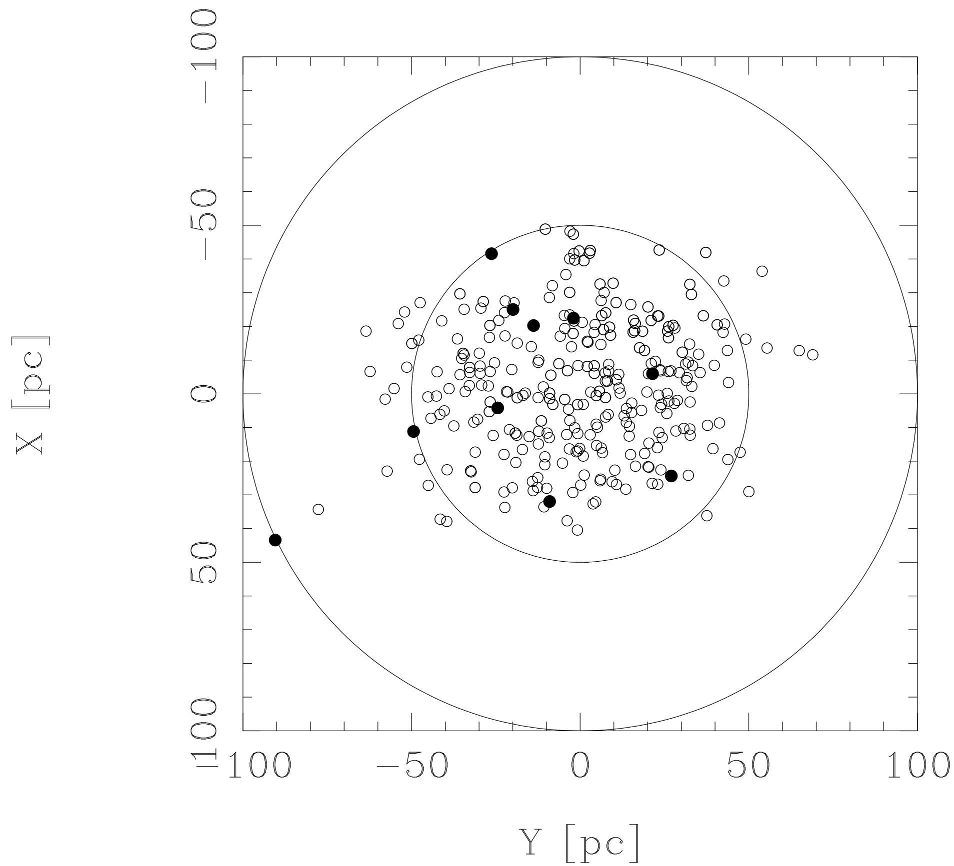
- Large number of targets ($\approx$ 30000)
  - Nearby K and M type stars spread over whole sky, G type stars expected to have flattened distribution, enhancement towards Sco-Cen expected.

  $\Rightarrow$ Zero to a few targets per square degree

- Magnitude range $\approx 9 - 15$
- R = 20000 required

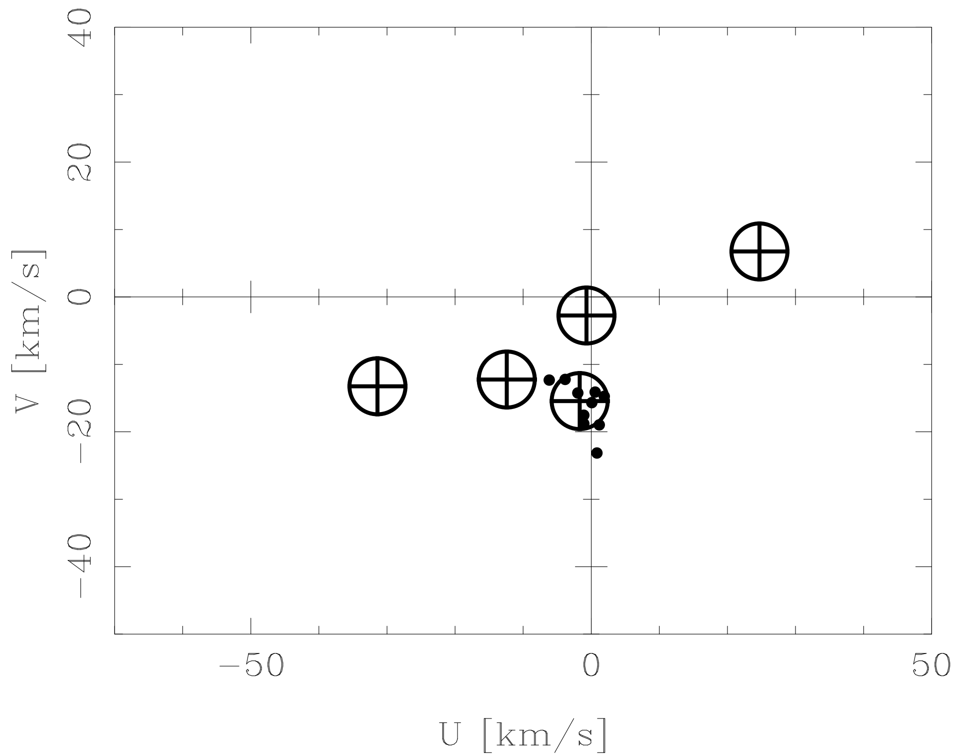
$\Rightarrow$ Well suited as 'filler' for a 4MOST high-res capability

Spatial distribution



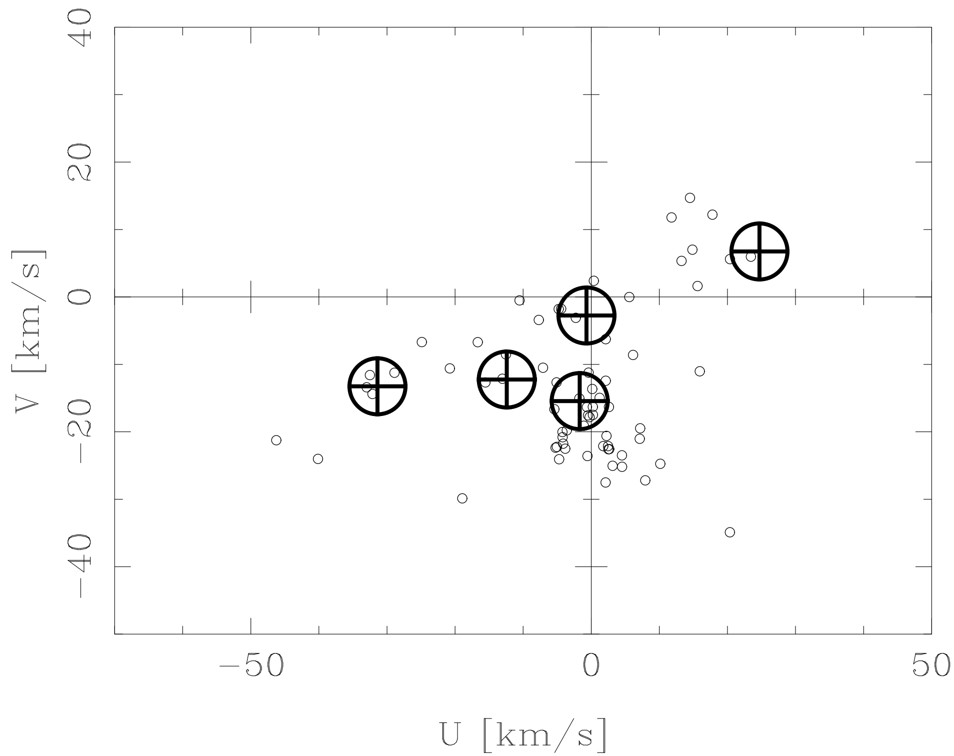
Galactic centre down, galactic rotation towards right

Kinematics - ZAMS stars

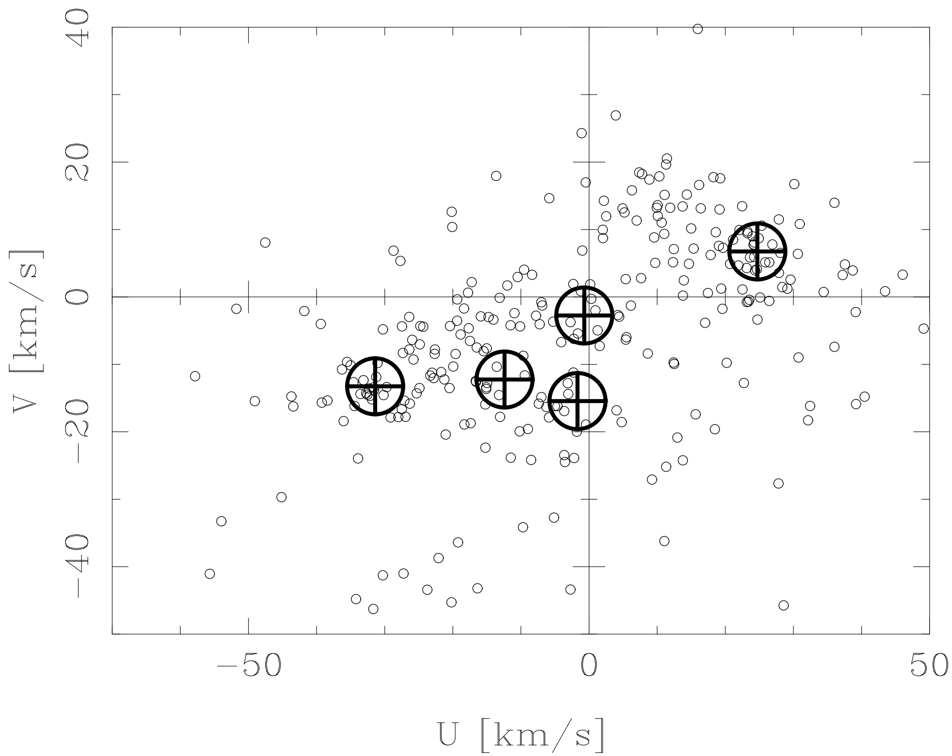


L2R: Hyades MG, IC 2391, Pleiades MG, Castor MG, Ursa Mayor MG

Kinematics - Pleiades-like stars



Kinematics - Low W_{Li} stars



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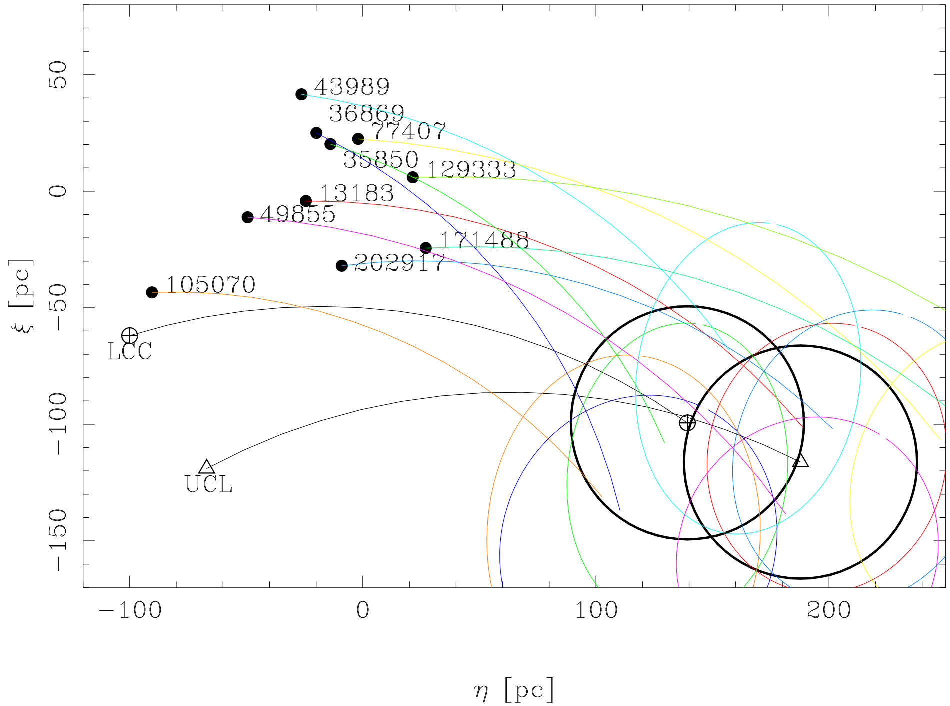

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