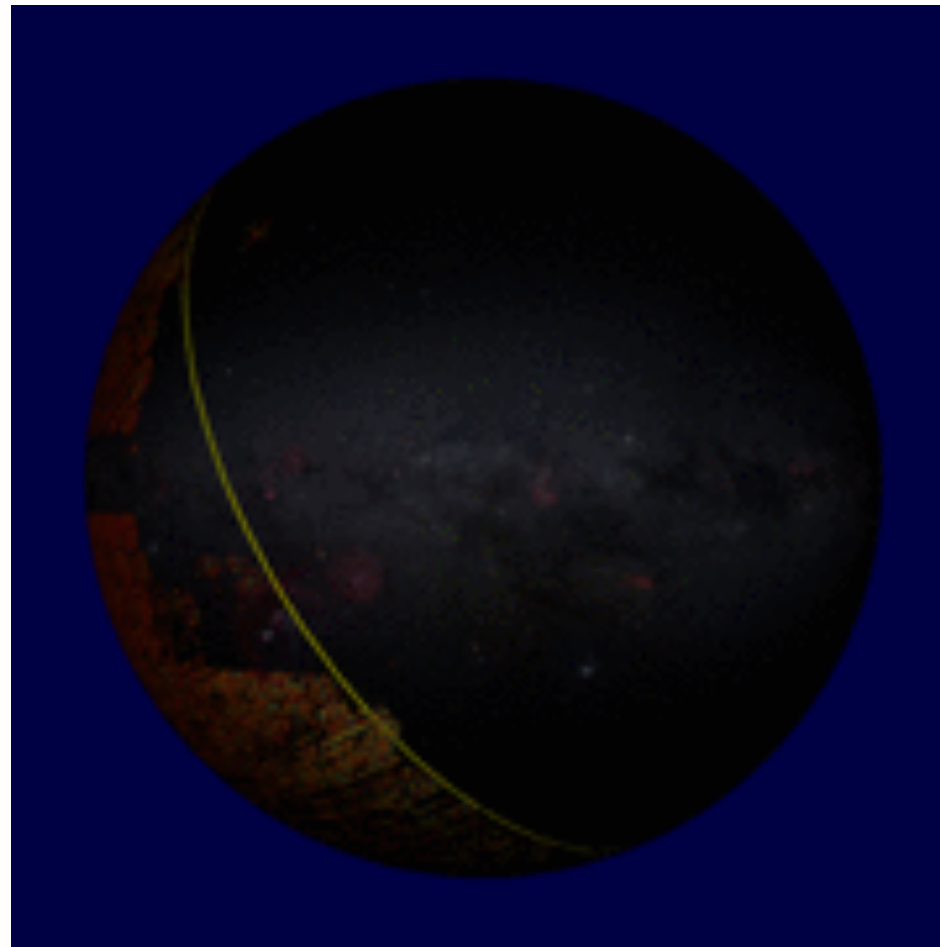




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Astrophysik Potsdam

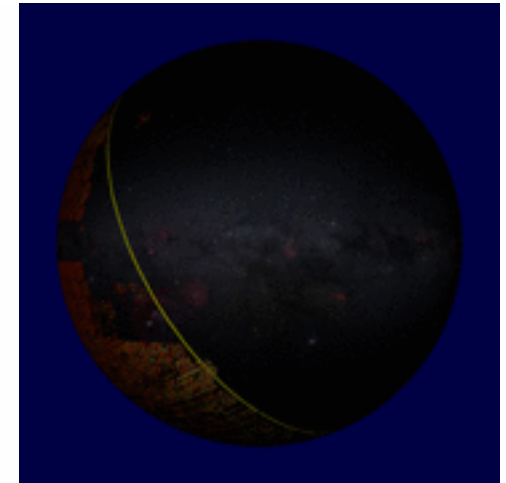


Matthias Steinmetz

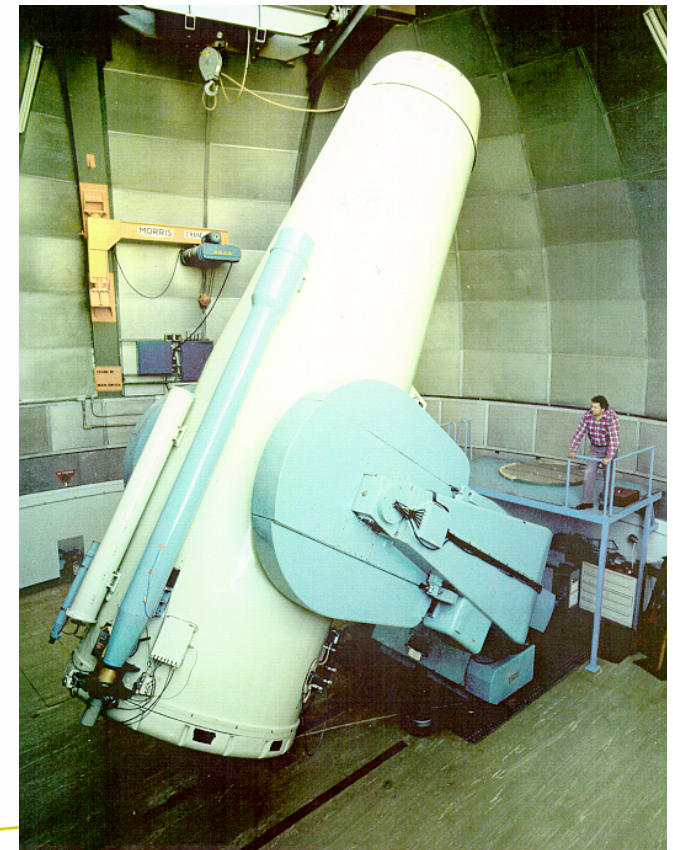


The **RAVE** Survey

RADIAL VELOCITY EXPERIMENT

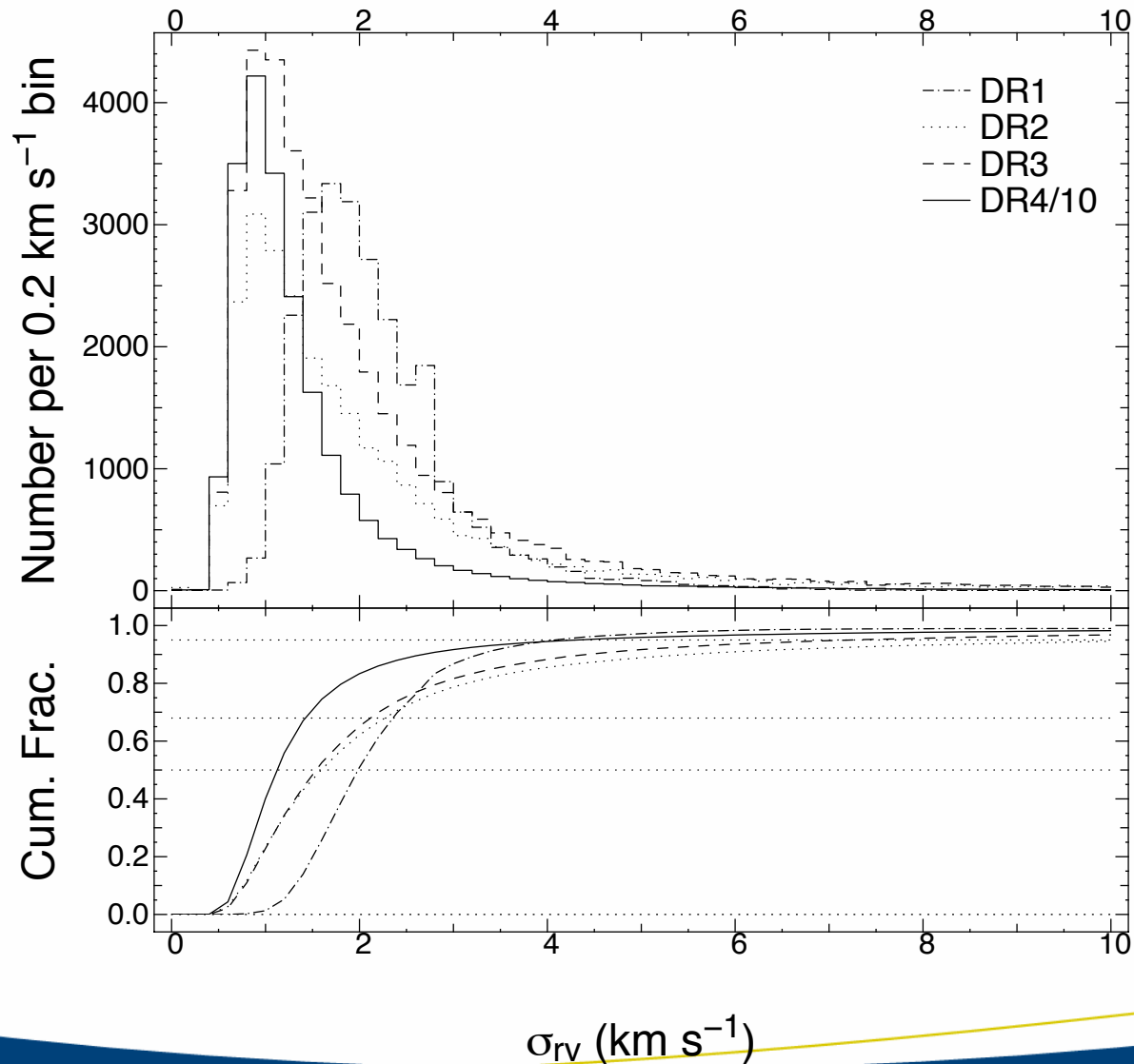


- Spectroscopic high latitude survey of the MW
 - $9 < l < 13$
- GAIA spectral range and resolution
 - Ca triplet region (8400-8800Å), $R_{\text{eff}}=7500$
- 6dF at the 1.2m UKST in Australia
 - 100-120 fibres
 - 38 sqdeg FoV
- Scheduled operation: 2003 – 2012
 - 7 nights per lunation up to 8/2005
 - 25 nights per lunation since 8/2005
- 560000 spectra (Aug 2012)

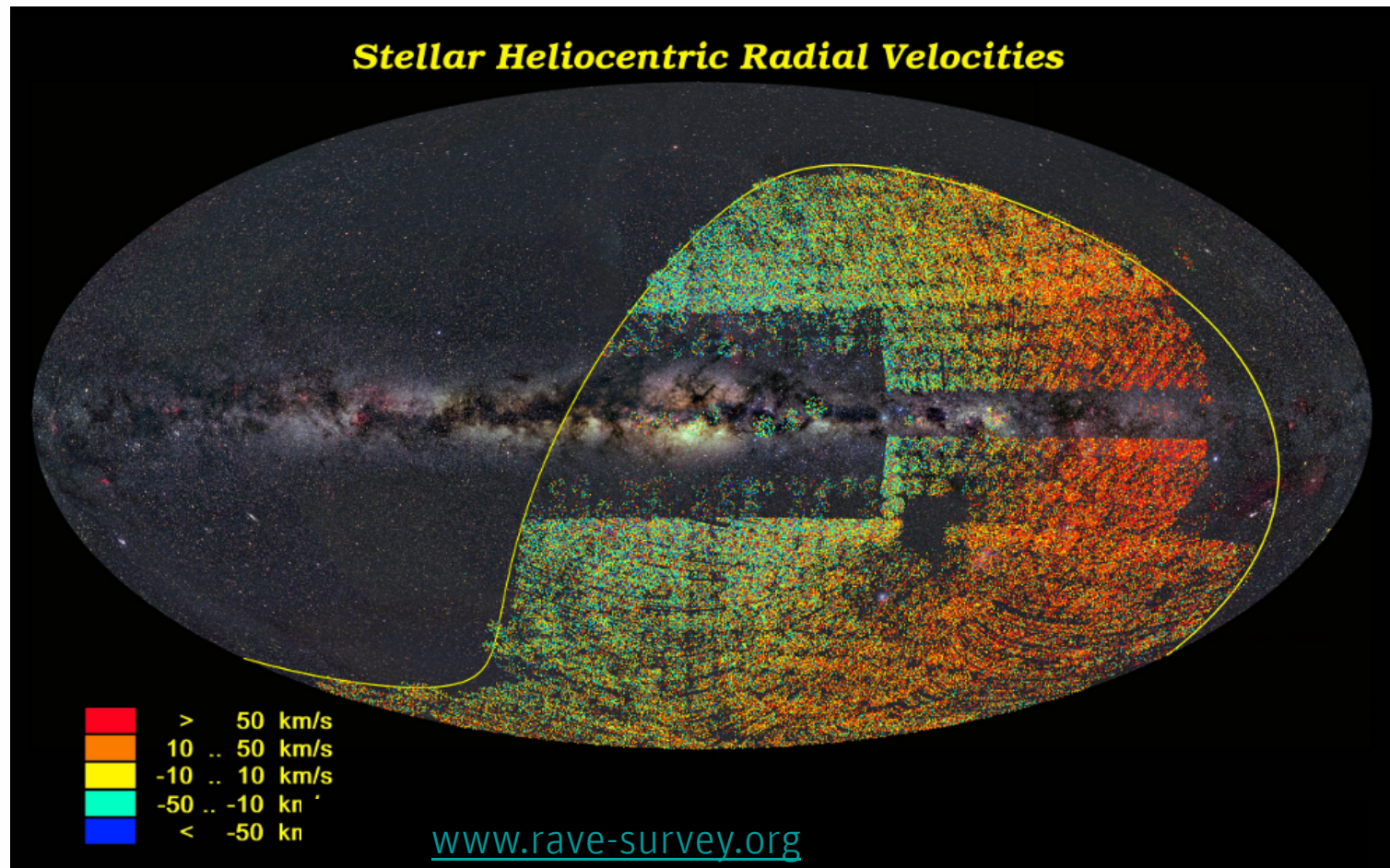




Radial Velocities: DR4 Internal errors

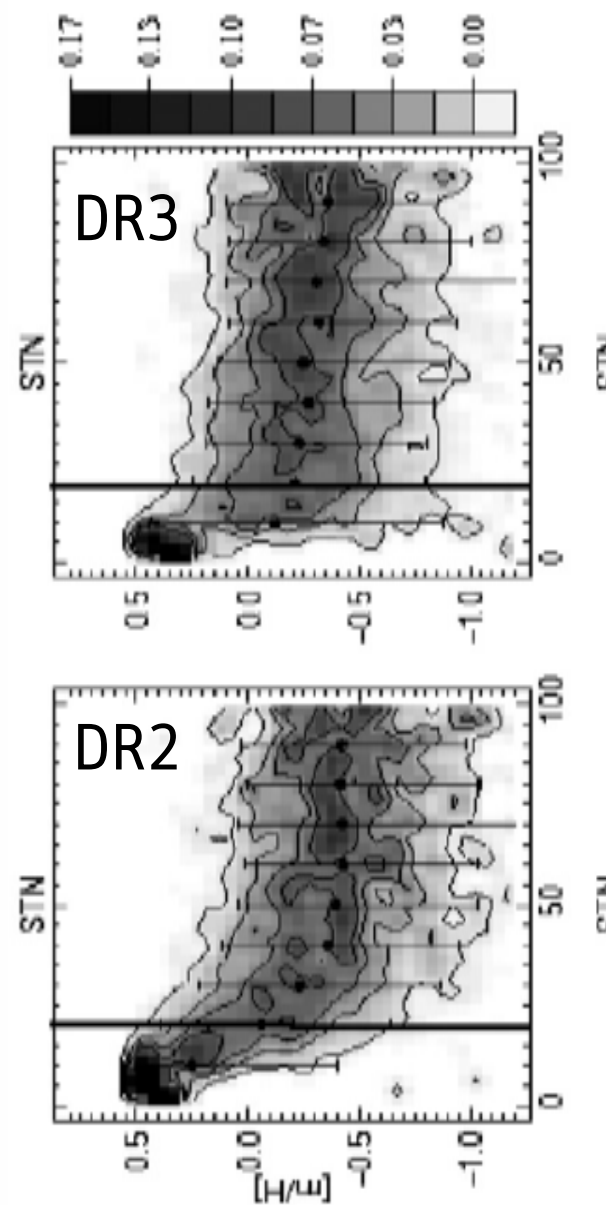
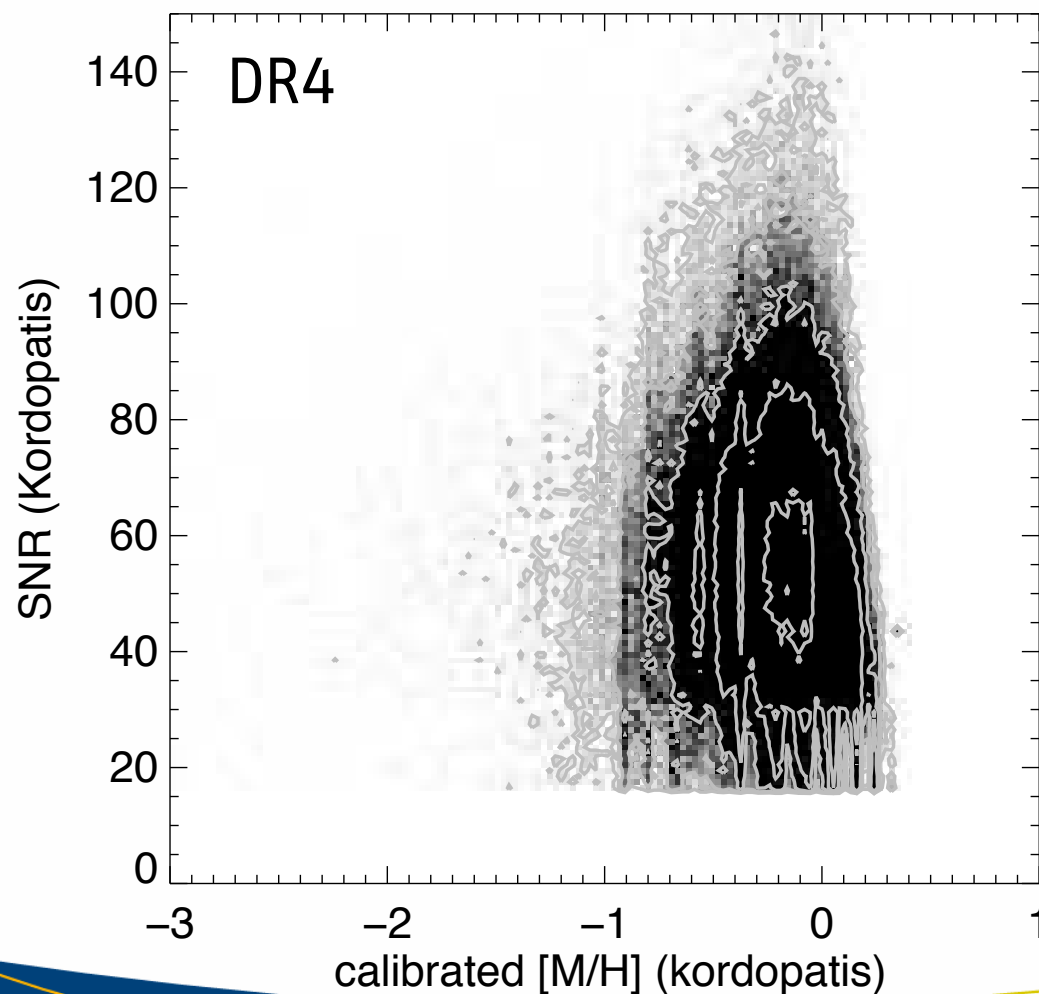


RAVE: current status

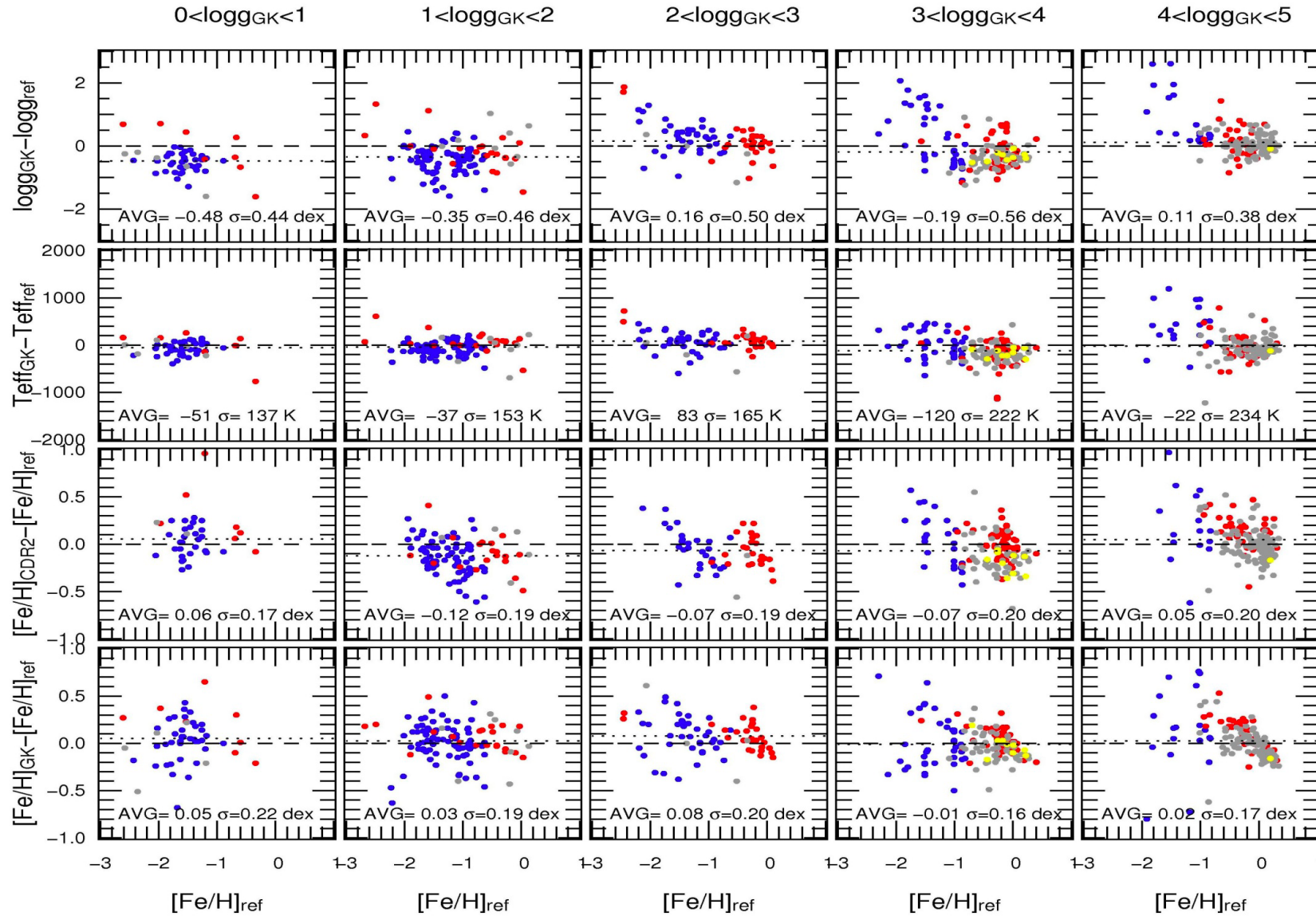


Aug 2012: 560,000 Spectra

Trends with S/N

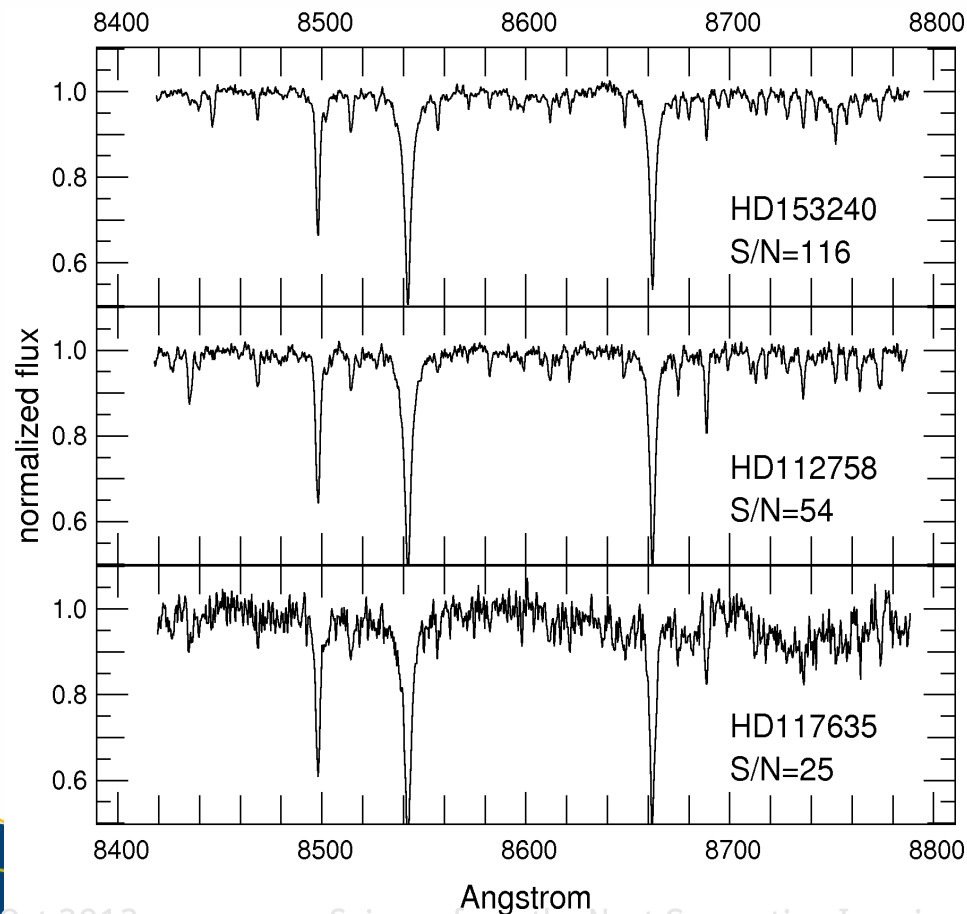


RAVE DR4 stellar parameters



Chemical abundances with

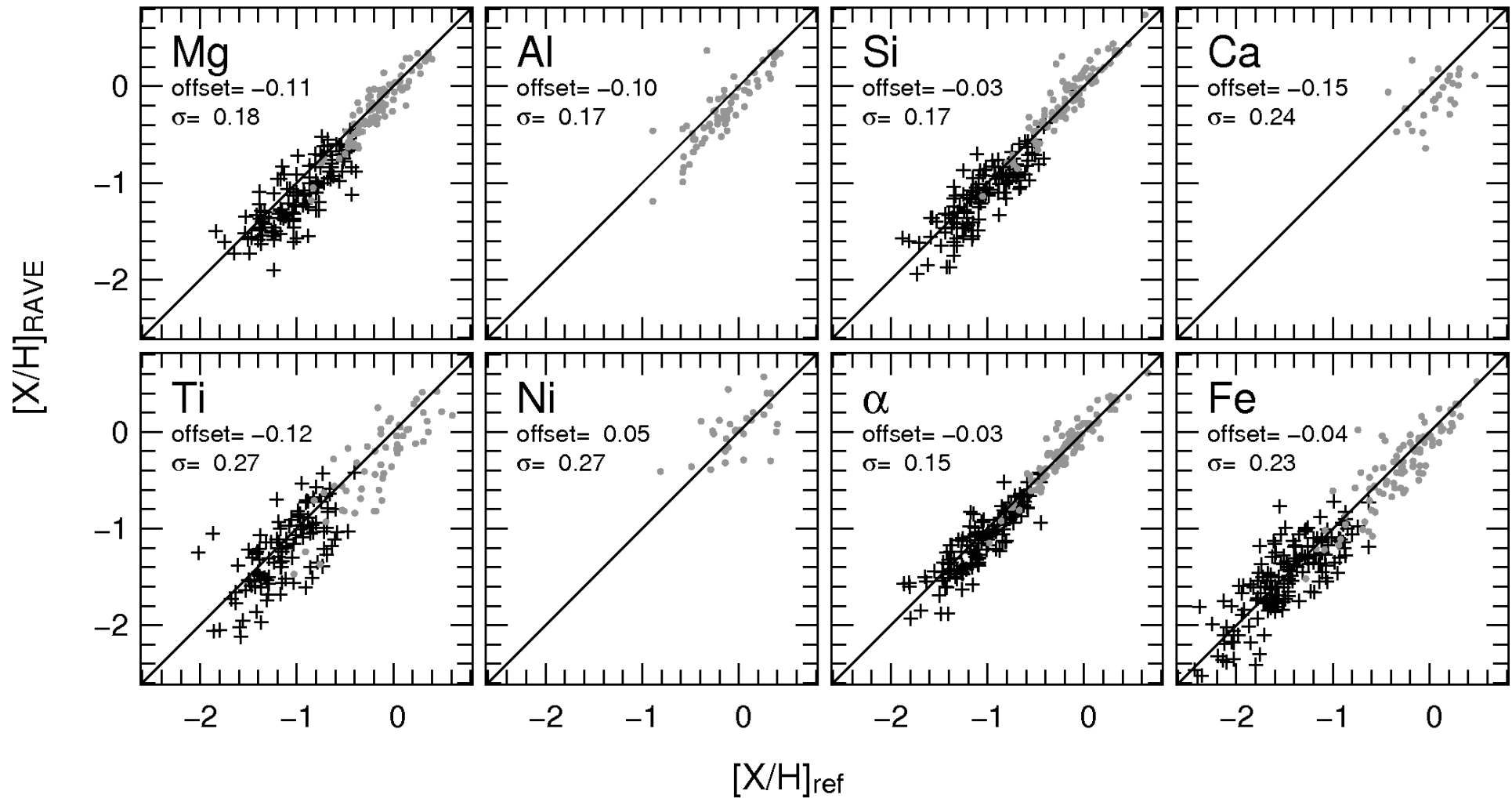
λ range: 8410-8795Å (Gaia wavelength range)
Resolution $R=7500$ at 8600Å; Dispersion = 0.4Å/pix



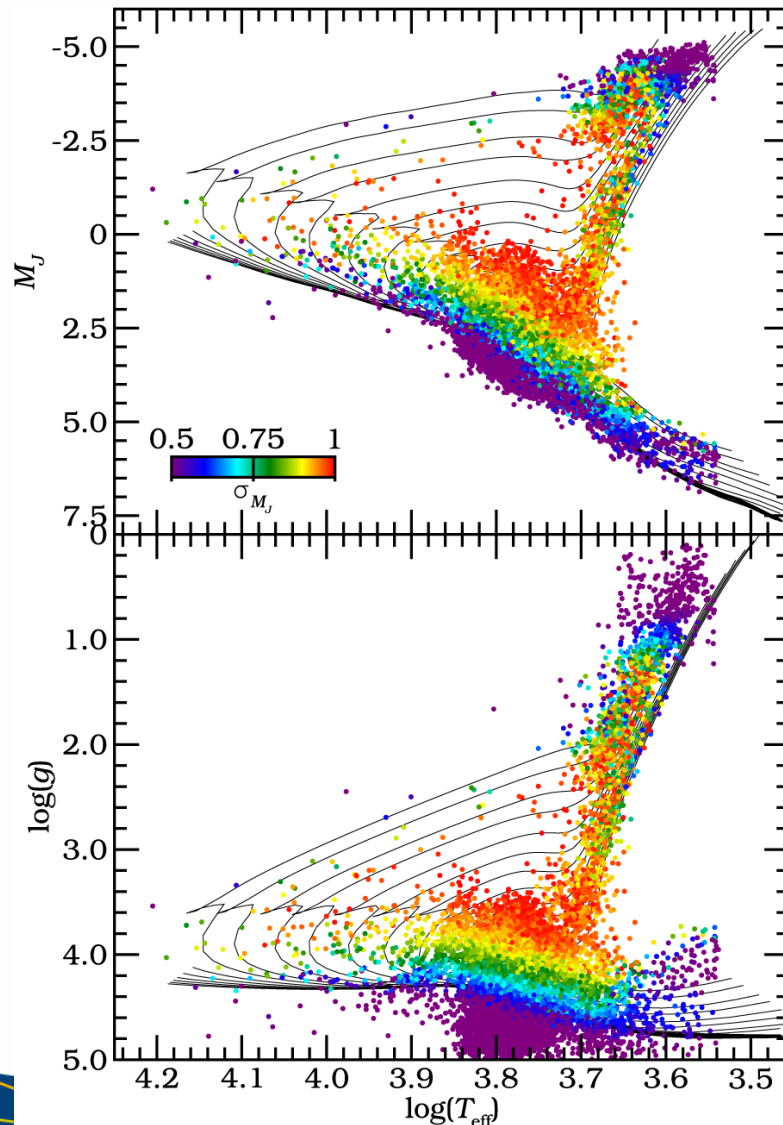
From the RAVE spectra we obtain:

- radial velocities
- stellar parameters (effective temperature, gravity and metallicity)
- chemical abundances

DR4 stellar parameters



Going 6D: Distances of RAVE stars

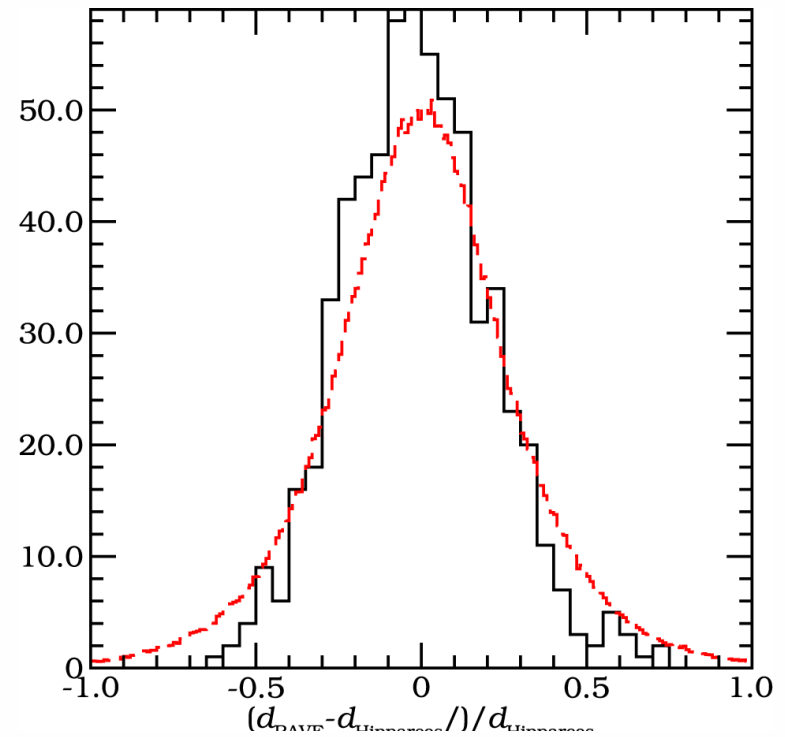
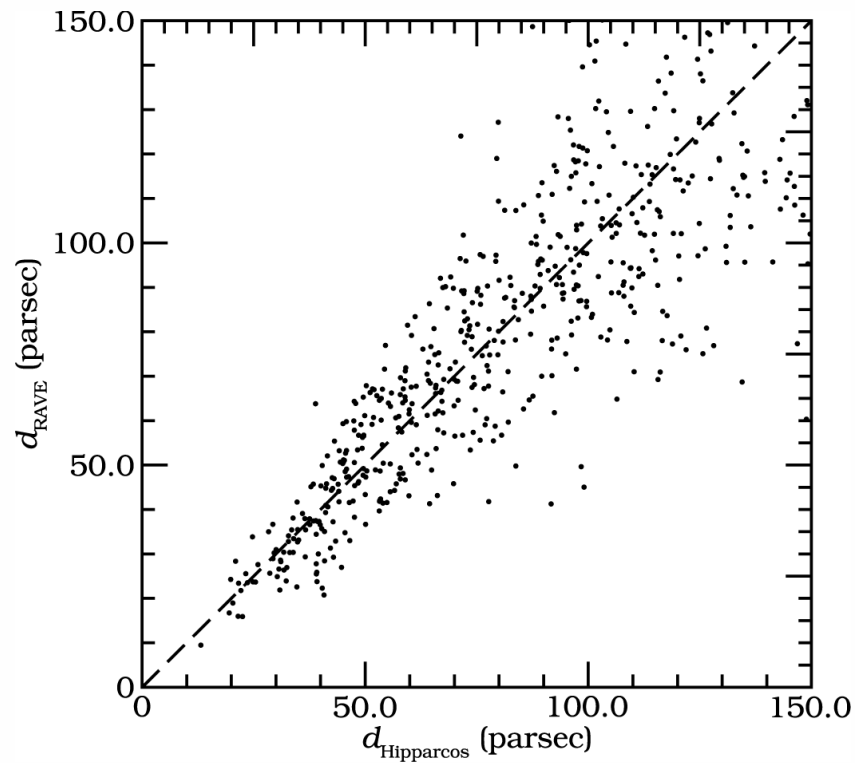


- Fit Y^2 -isochrones to RAVE data/
deduced stellar parameters + J-
K colors
 - J-Magnitude
 - Error in J-Magnitude
- Check by Monte-Carlo sampling
- Result:
 - 1/7 better 25%
 - 1/3 better 37.5%
 - 2/3 better 50%

Breddels et al, 2009
Zwitter et al, 2010
Burnett et al, 2010



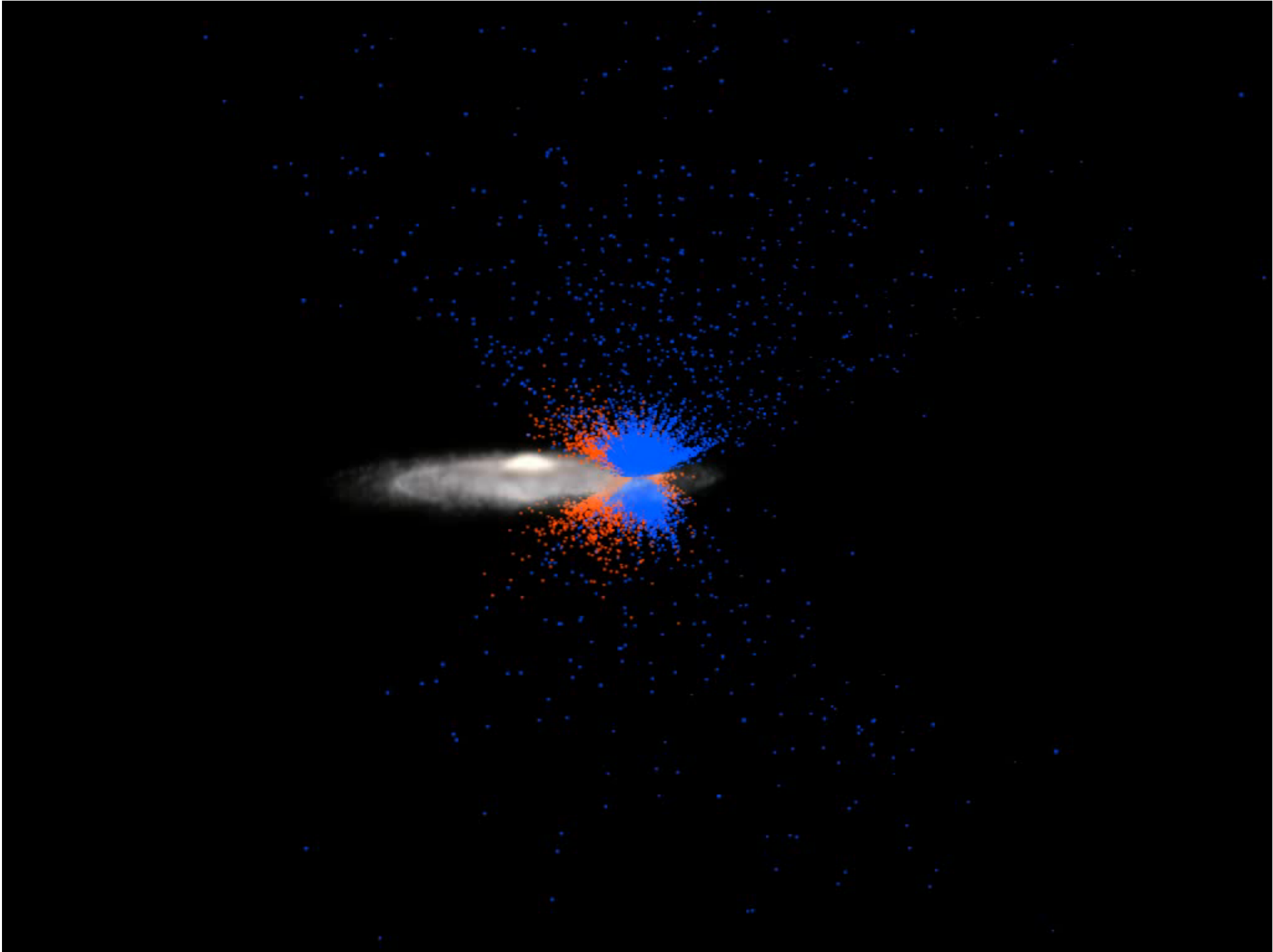
Verification for stars with Hipparcos distances



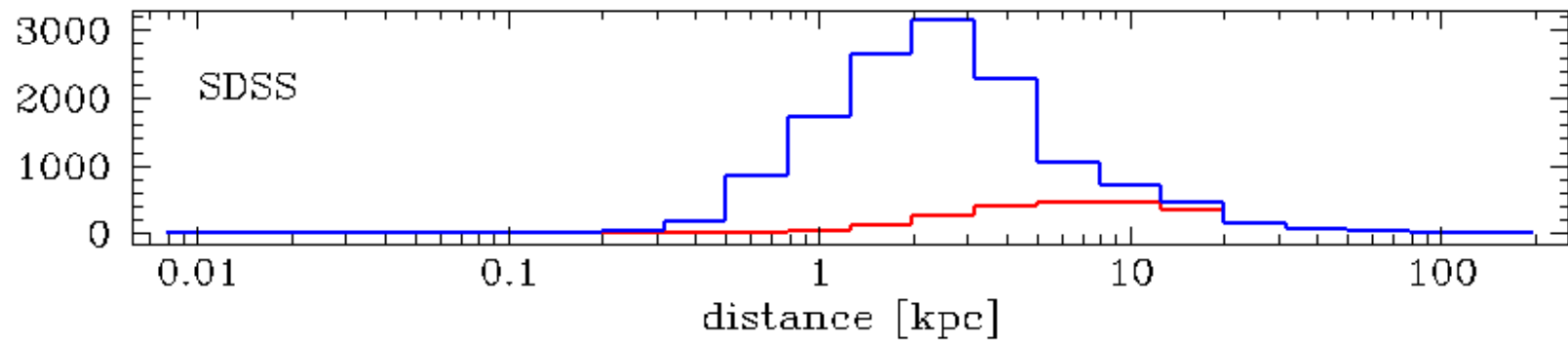
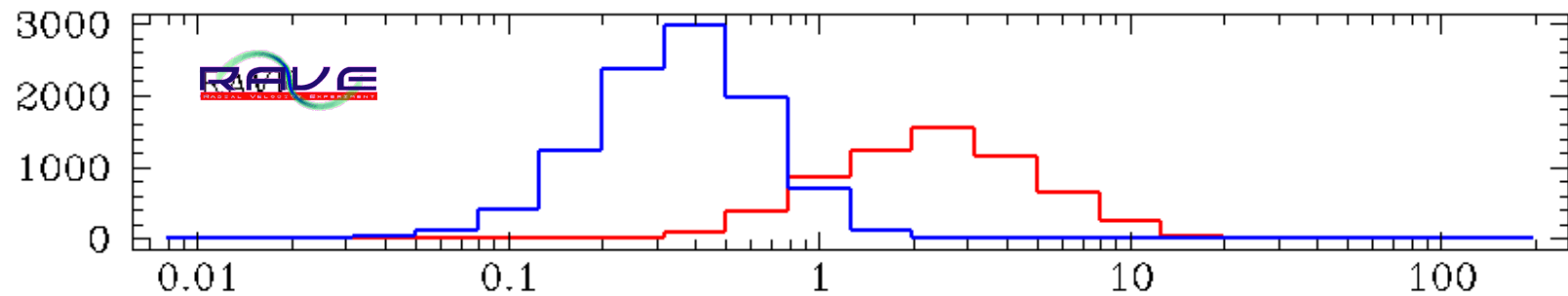
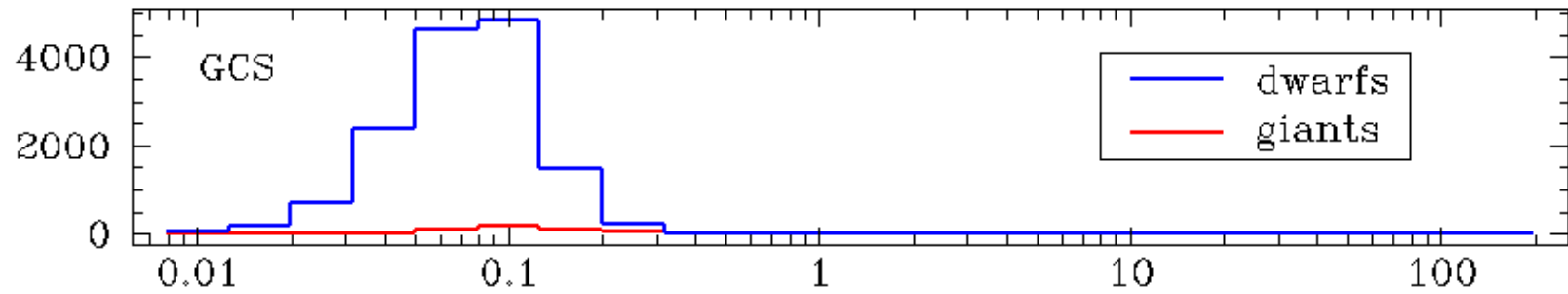
Breddels et al, 2009

Geneva-Copenhagen

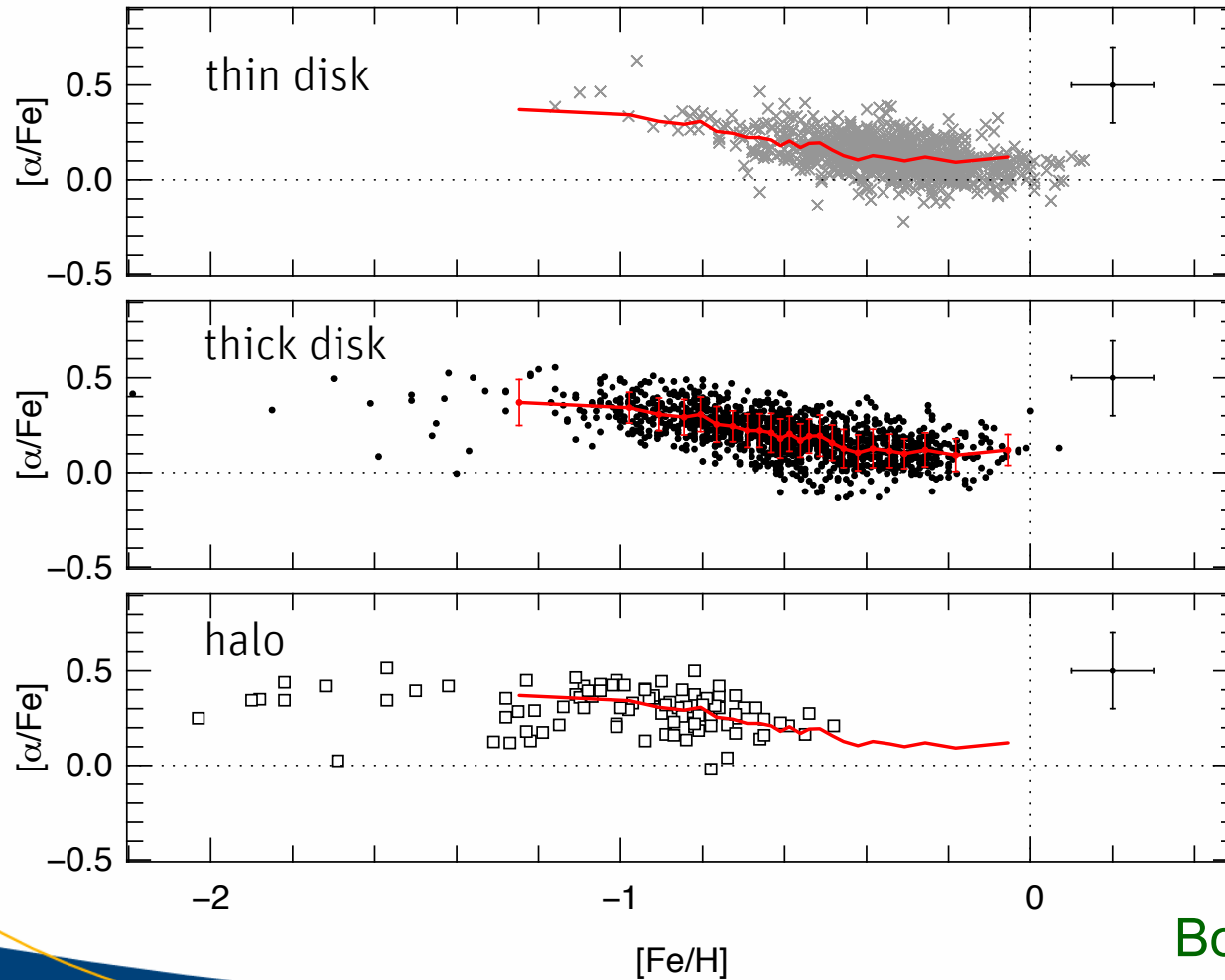




Comparison of RV-surveys



Kinematics vs Chemistry of thin disk, thick disk and halo

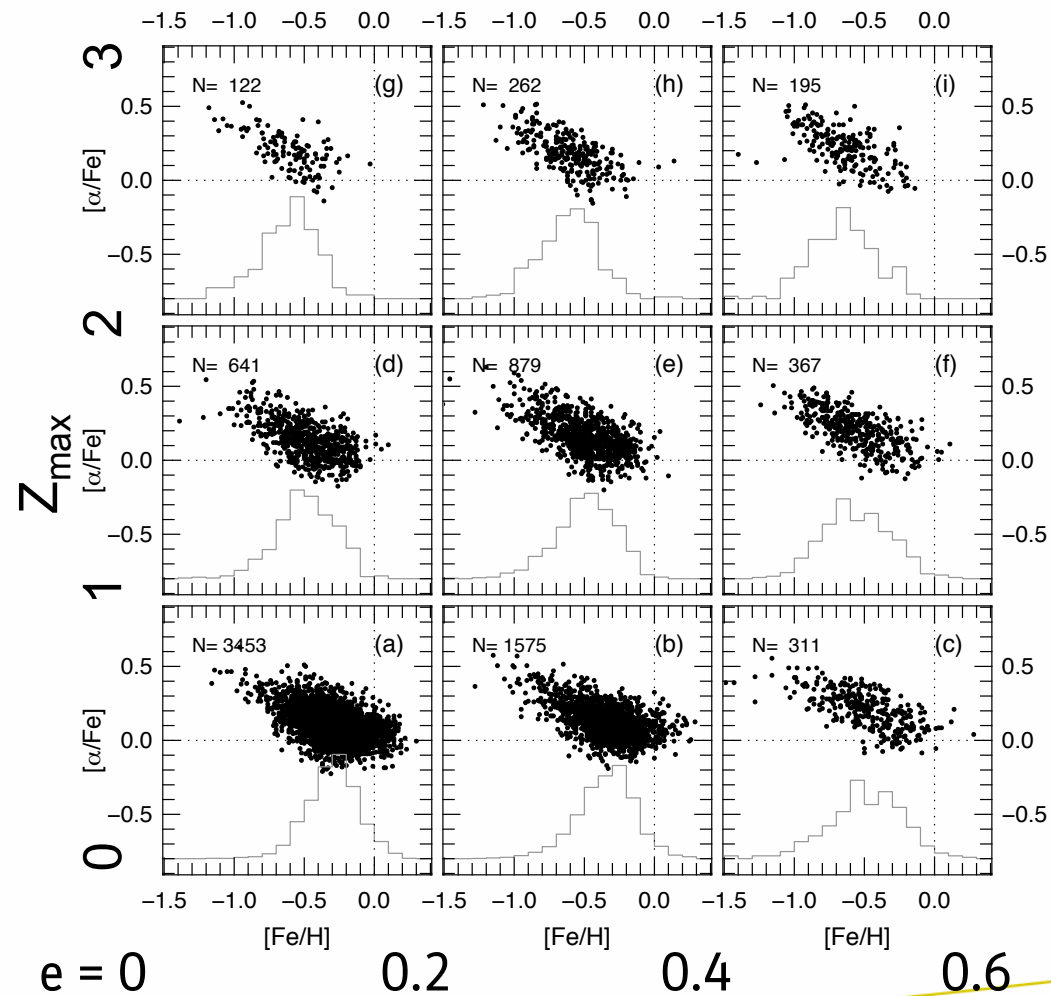


- highest quality Rave Spectra (S/N >80)
- giants ($1.0 < \log g < 3.5$); $4000 < T_{\text{eff}} \text{ (K)} < 5500$)
- best chemical elements Fe, Mg
- other 5 elements available

Boeche et al., 2012



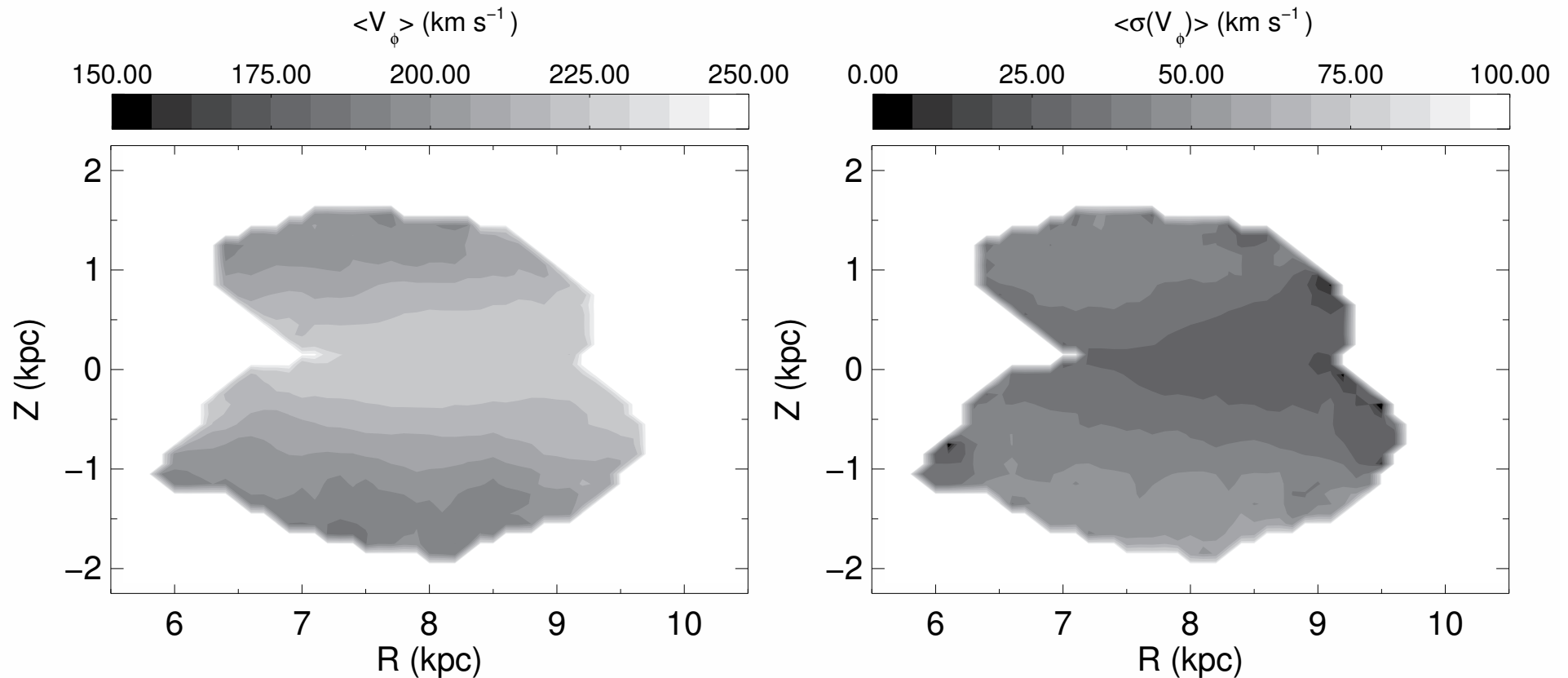
Kinematics vs Chemistry of thin disk, thick disk and halo



Boeche
et al., 2012



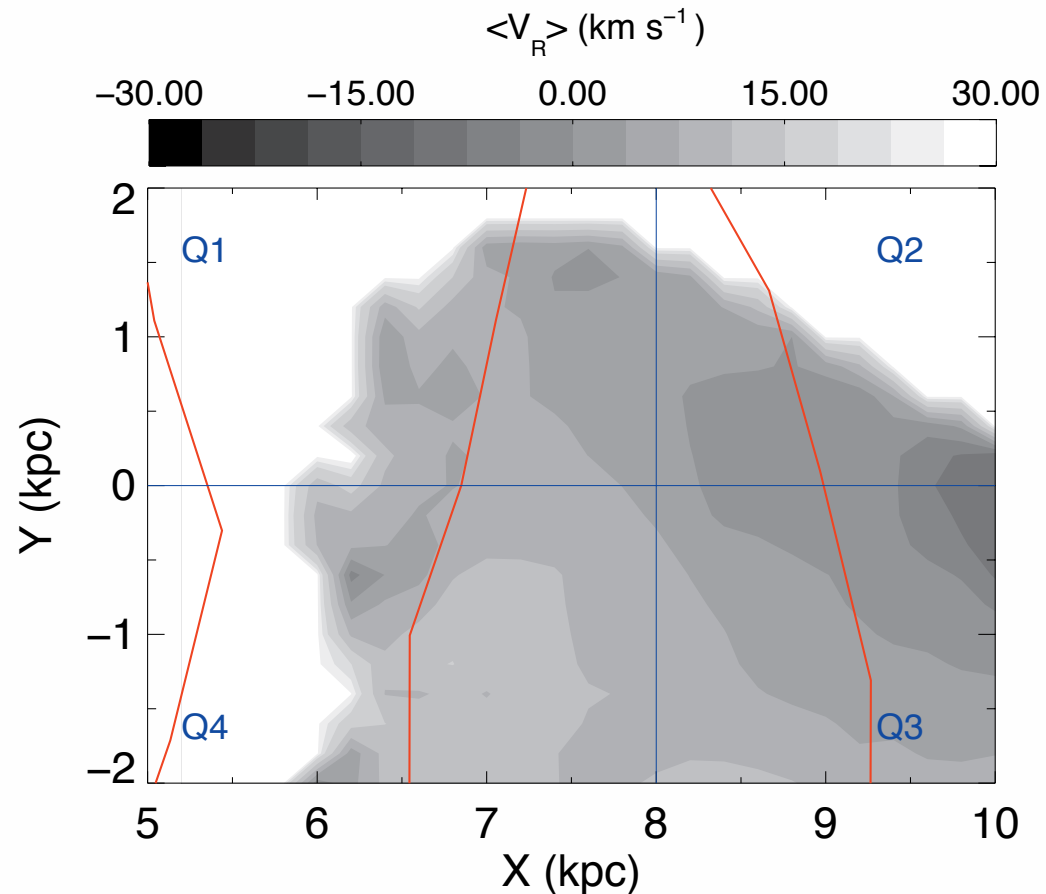
Dissecting the Milky Way



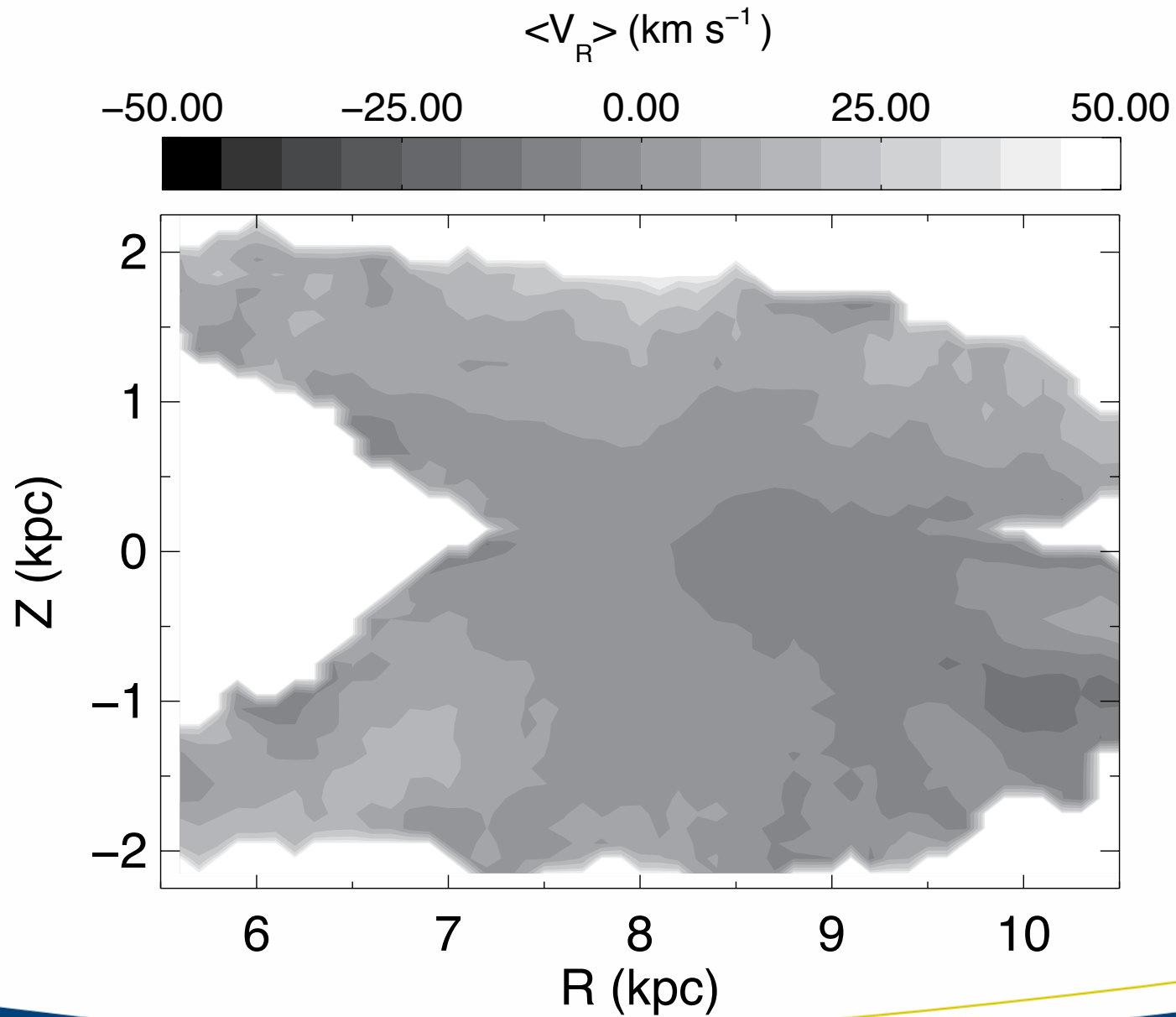
Williams et al., 2012



Radial velocity gradient in the extended SN (Siebert et al 2011)



Assum \odot $R_0 = 7.8$ kpc, $v_{c0} = V_{\text{LSR}} = 247$ km/s, $U_{\text{LSR}} = 0$ km/s
(U,V,W) = (11,12,7) km/s

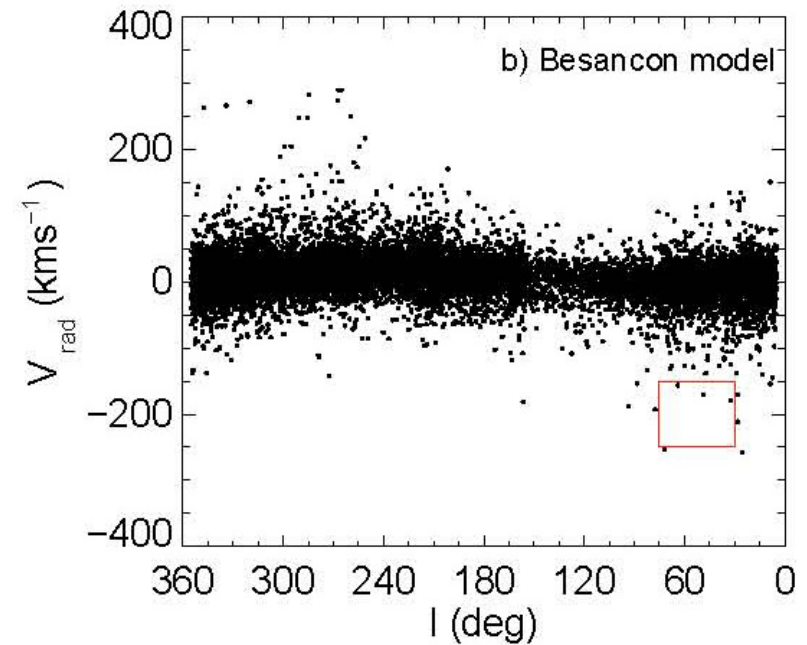
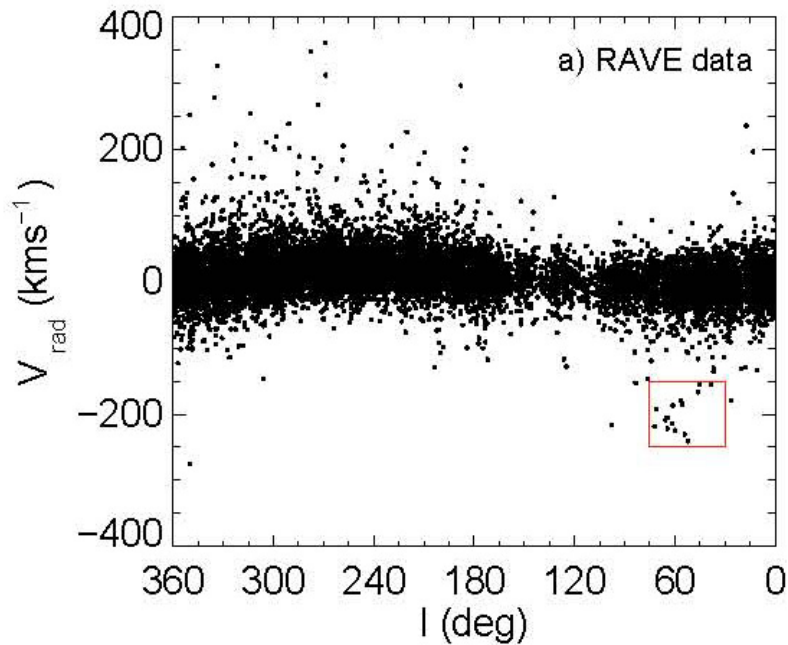




Velocity Substructure in RAVE



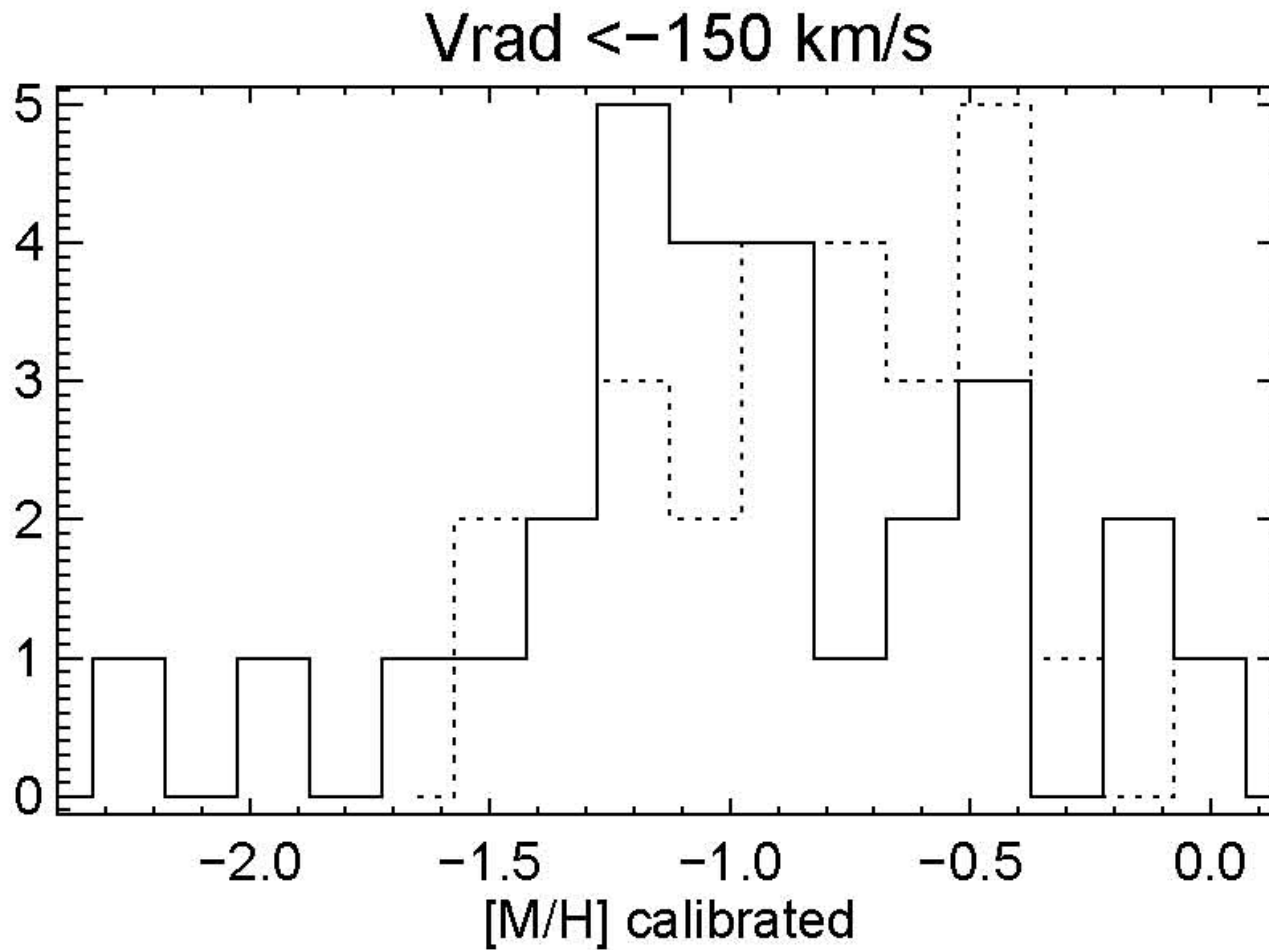
$-70^\circ < b < -50^\circ$



Williams et al, 2011



Wylie-deBoer et al 2012:
6 Aquarius stars: $-1.28 < [Fe/H] < 0.98$

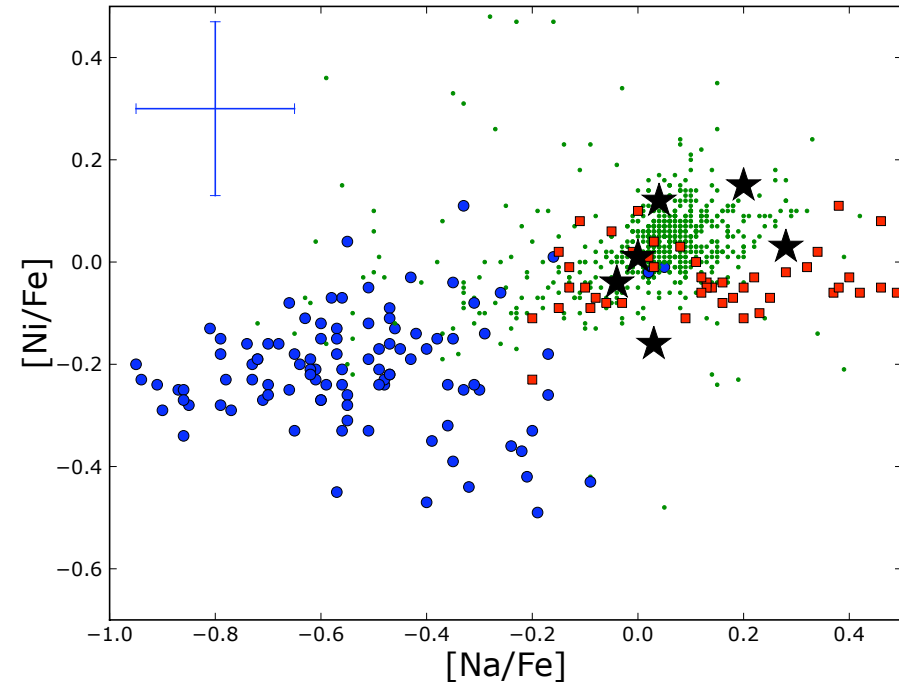
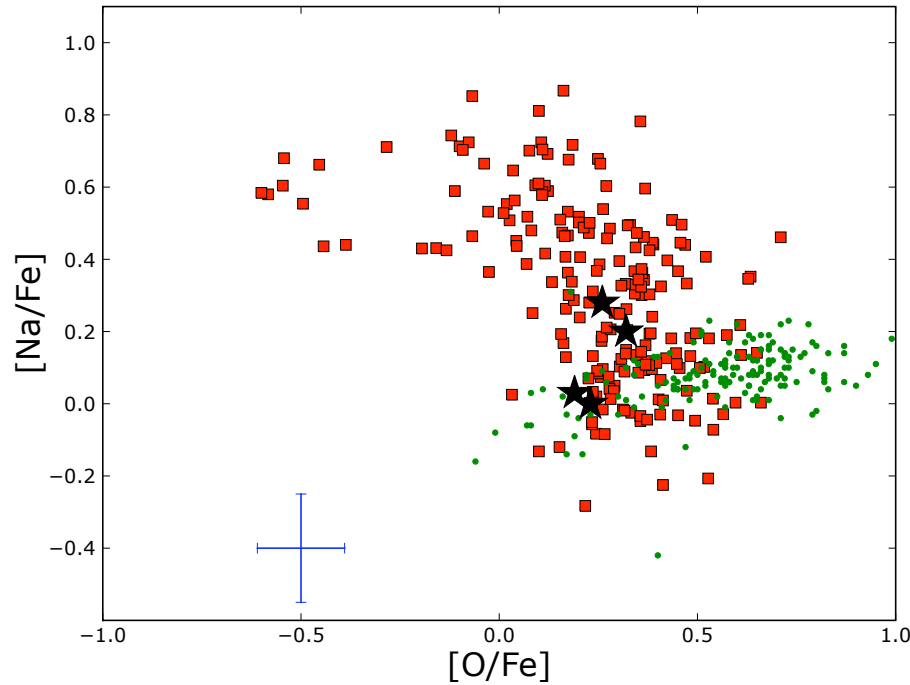


deBoer
et al., 2012



Follow-up Spectroscopy

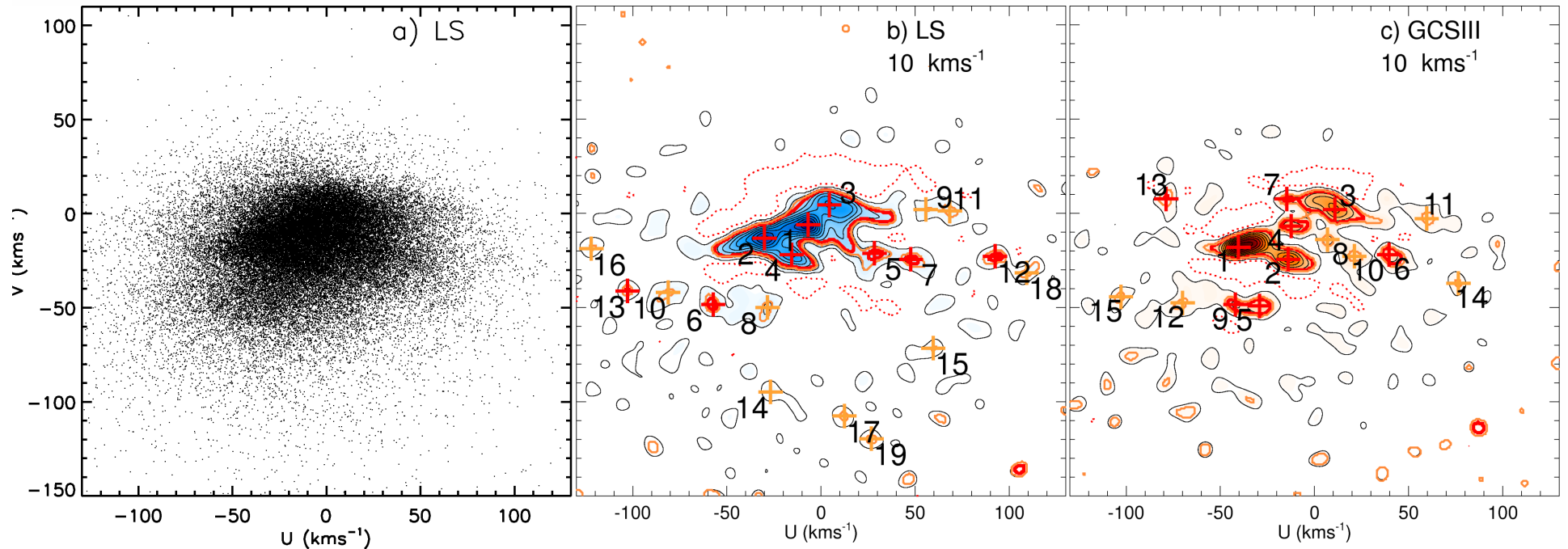
(Wylie-deBoer et al, 2012)



Aquarius stream stars
globular clusters

field stars
dSph stars

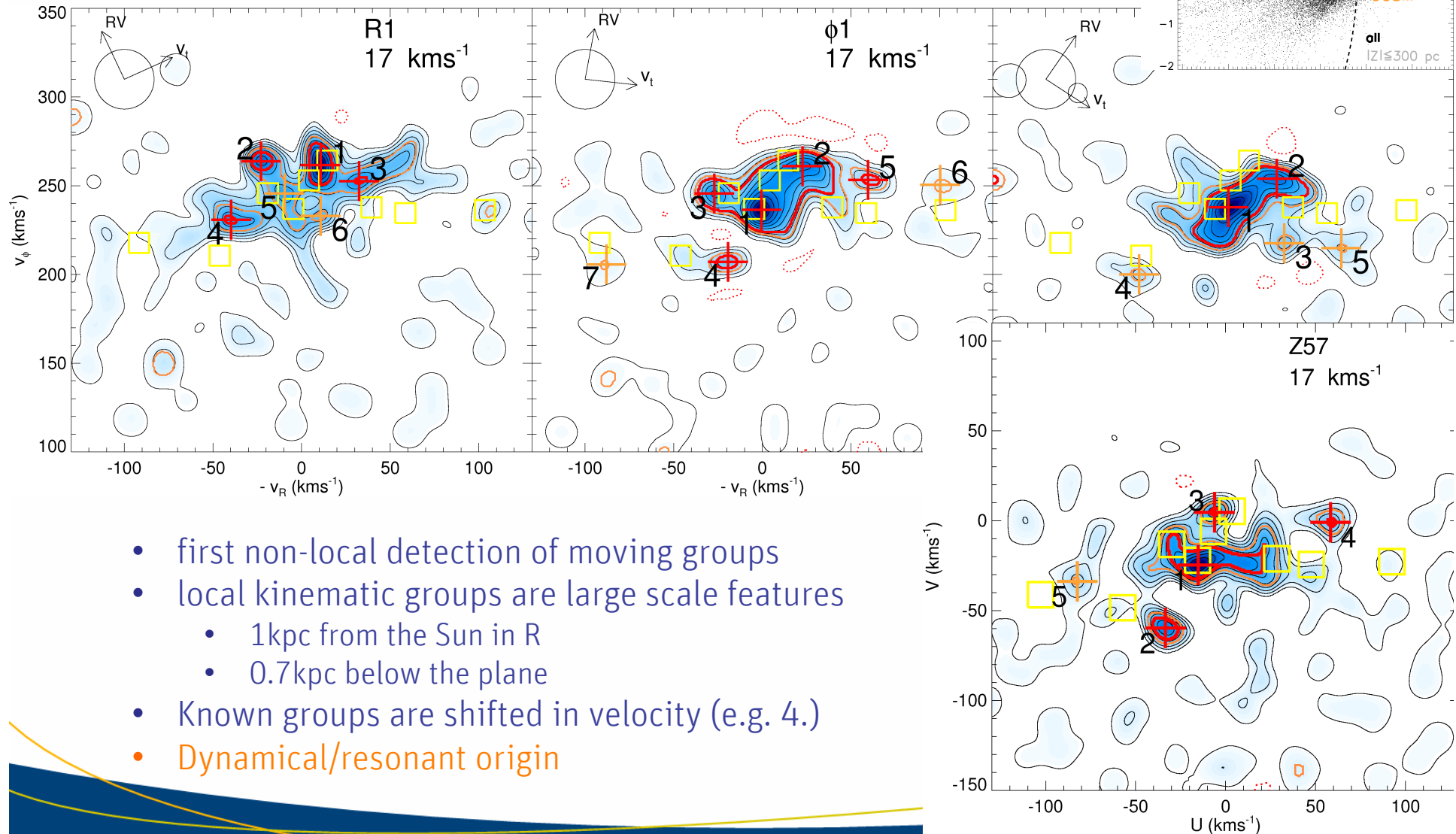
Local sample, RAVE vs GCS



Wavelet analysis via a trous algorithm (Starck & Murthag, 2002)
 1: Coma Berenice; 2: Hyades; 3: Sirius; 4: Pleiades; 6: Hercules

Antoja
 et al., 2012

Non-local samples



- first non-local detection of moving groups
- local kinematic groups are large scale features
 - 1kpc from the Sun in R
 - 0.7kpc below the plane
- Known groups are shifted in velocity (e.g. 4.)
- Dynamical/resonant origin



Summary

- RAVE survey: more than 500,000 spectra taken
 - Radial velocities (1km/s)
 - Stellar parameters
 - Distances
 - Abundances
- Kinematical Tomography of the galactic disks
- Substructure and tidal debris can be found in the galactic disks (Aquarius)
- Detection of large-scale non-axisymmetry of the velocity field in the solar neighborhood
 - Apparent asymmetry above vs below the plane