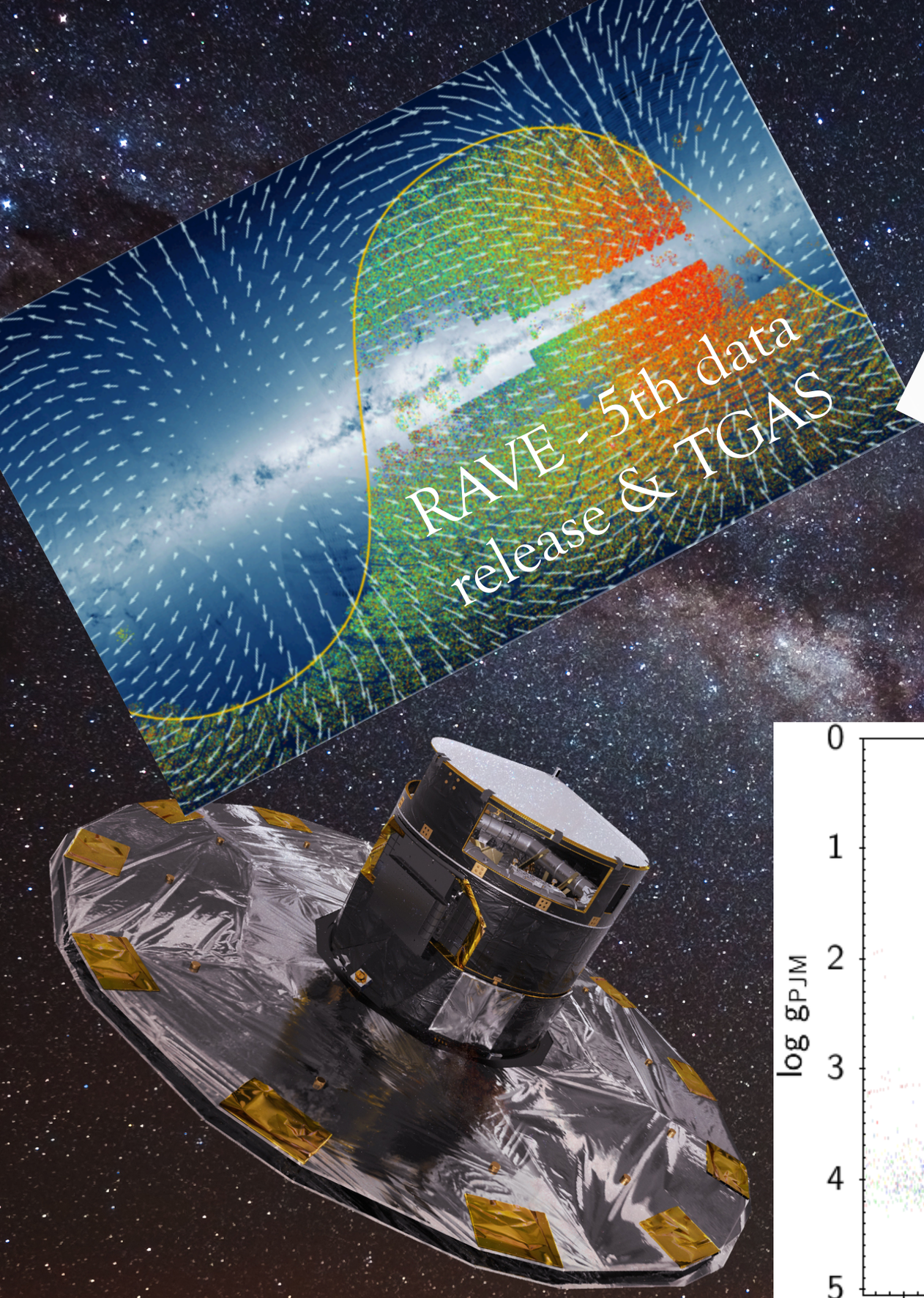
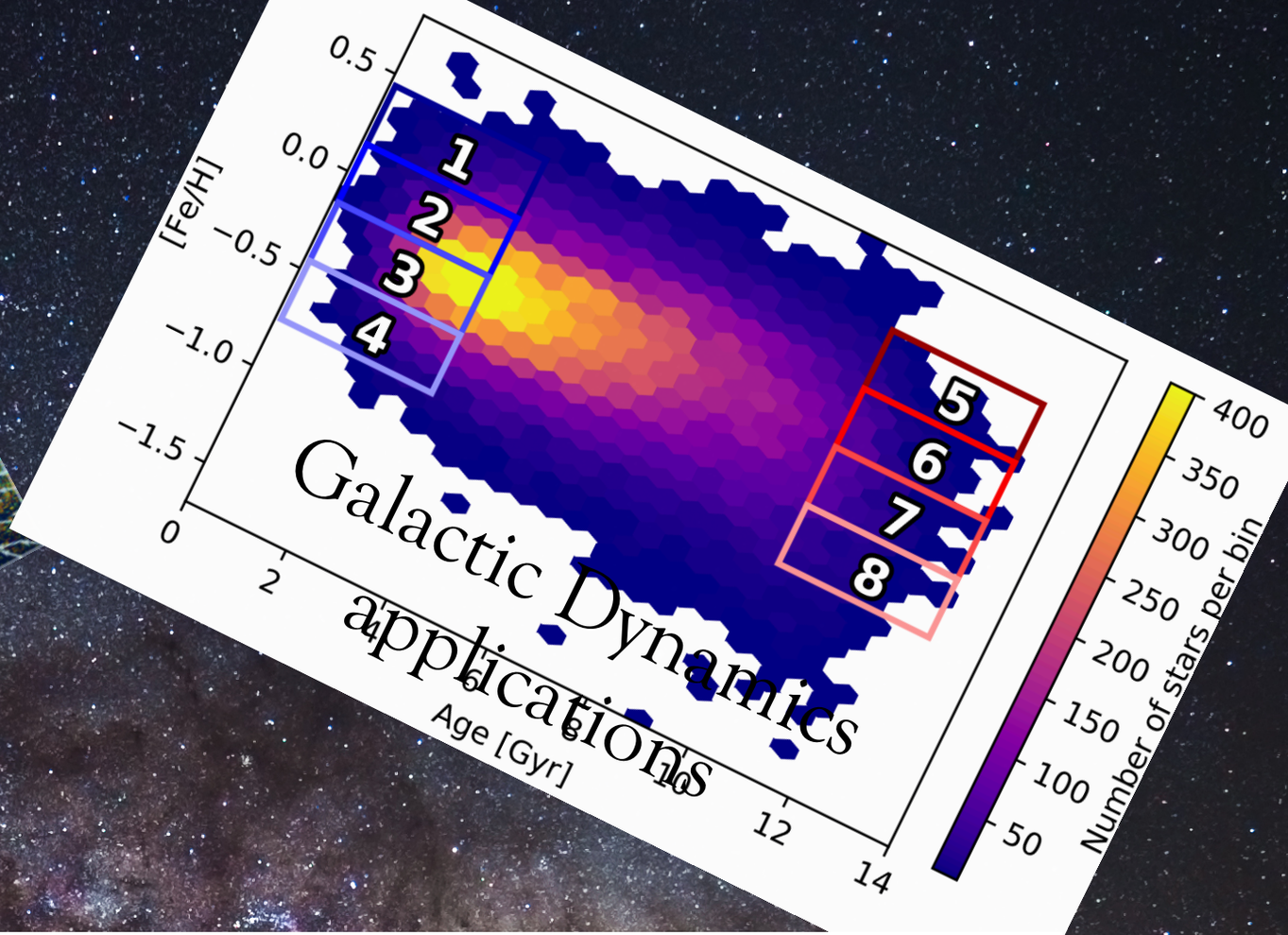
AIP

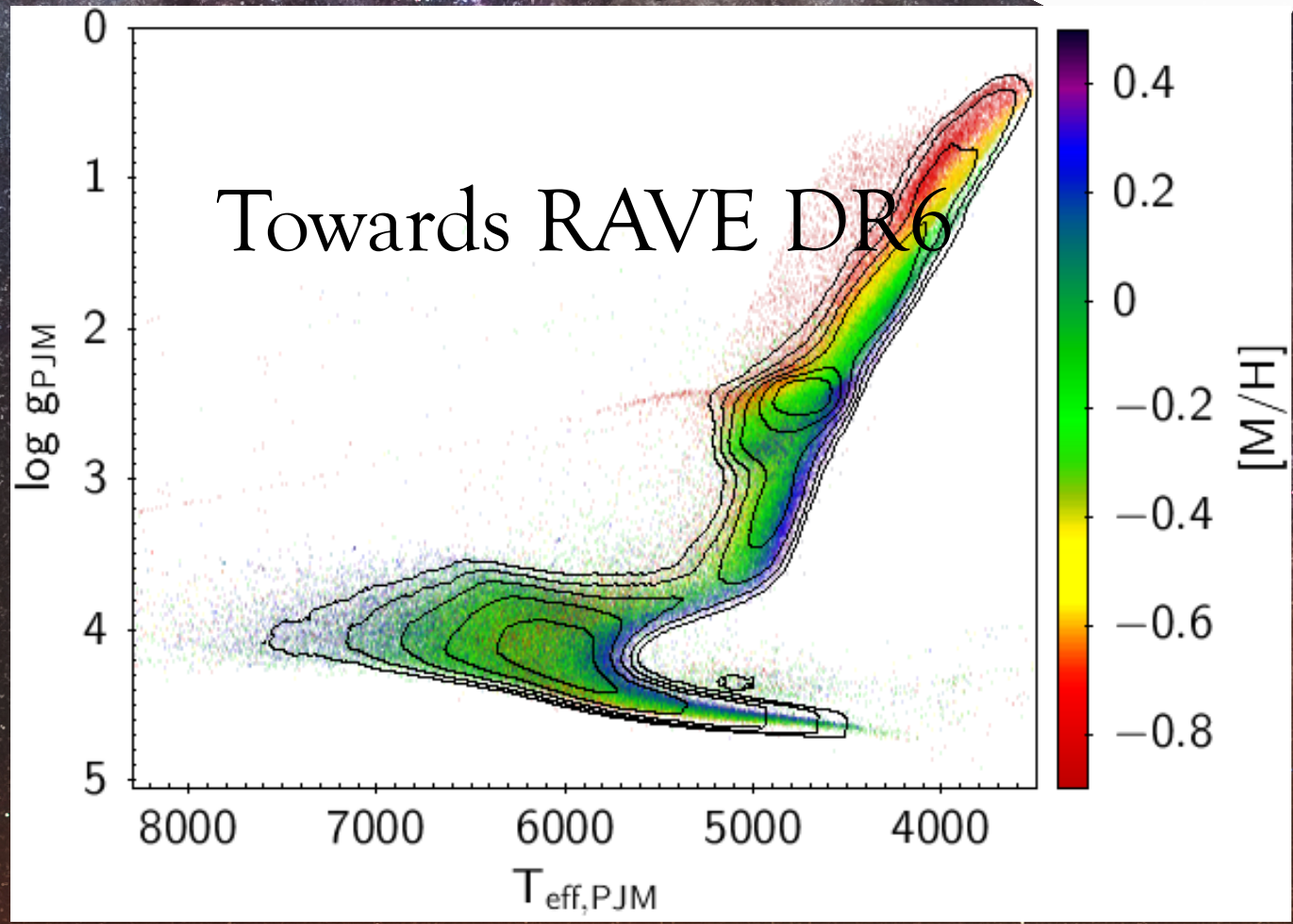
Combining Gaia DR1, DR2 and RAVE
a preview on the full Gaia dataset

Matthias Steinmetz (AIP)





Galactic Dynamics applications



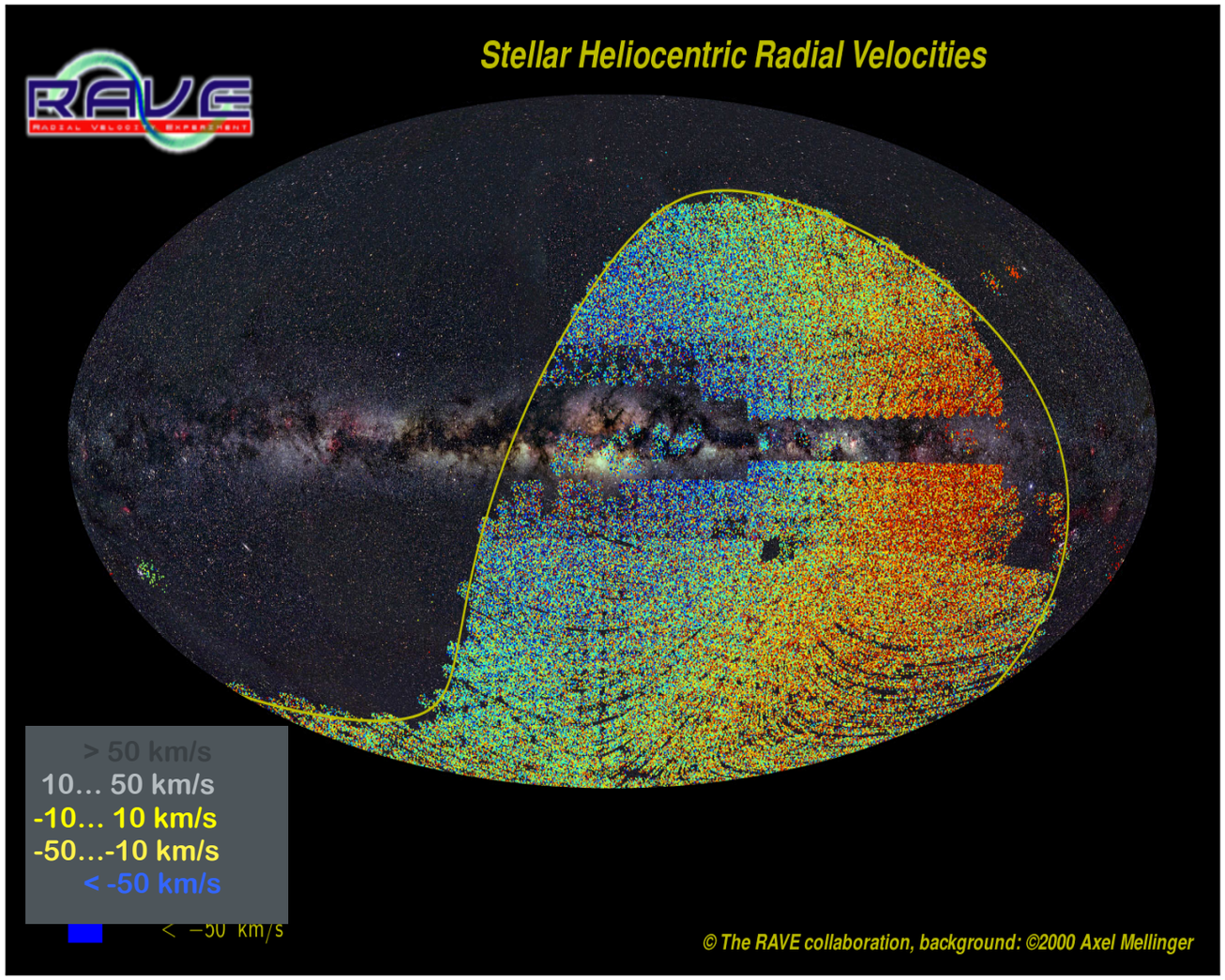
RAVE: 5th public data release

Kunder, et al. 2017

- Intermediate resolution (R~7500)
- 457 588 stars,
- 520 781 spectra (DR4: 482 430 stars)
- 9 <I< 12 mag

Database:

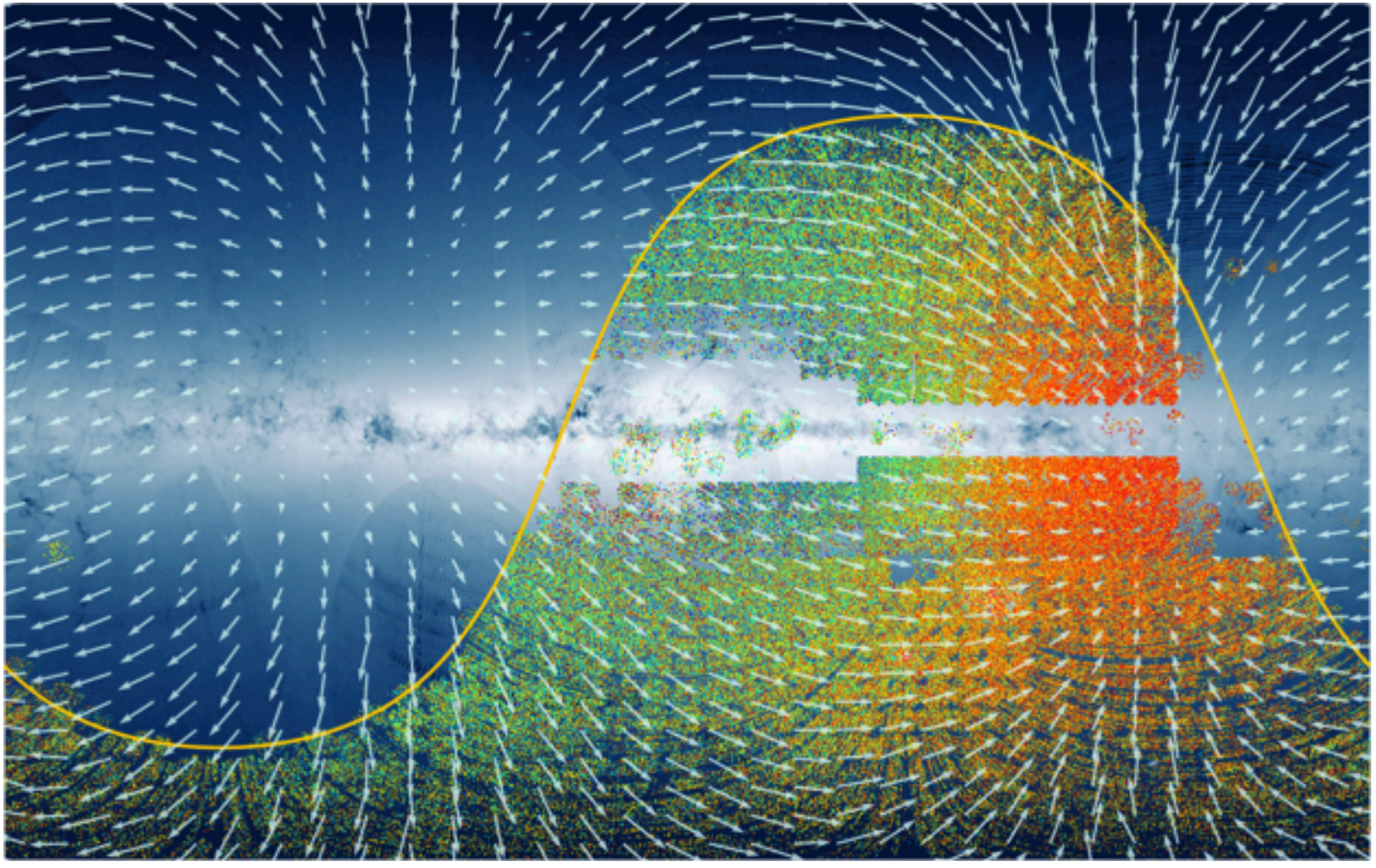
- Radial velocities
- Spectral morphological flags
- Teff, logg, [M/H]
- Mg, Al, Si, Ti, Ni, Fe
- Line-of-sight Distances
- Photometry:
  - 2MASS, APASS
- Proper motions:
  - UCAC5, PPMX, PPMXL, Tycho-2, TGAS
- Selection function (Wojno et al 2017)
- Distances with TGAS priors (McMillan et al 2017)



RAVE - some new developments

- major clean-up of the data base, recovered almost 50% of poor fields
- revised distances for low metallicity
- revised metallicity for supersolar abundances
- more calibration targets
- calibration based on astroseismology from K2 (red giants)
- IR flux method $T_{\rm eff}$
- distances with TGAS priors, twin distances

DR5 and TGAS

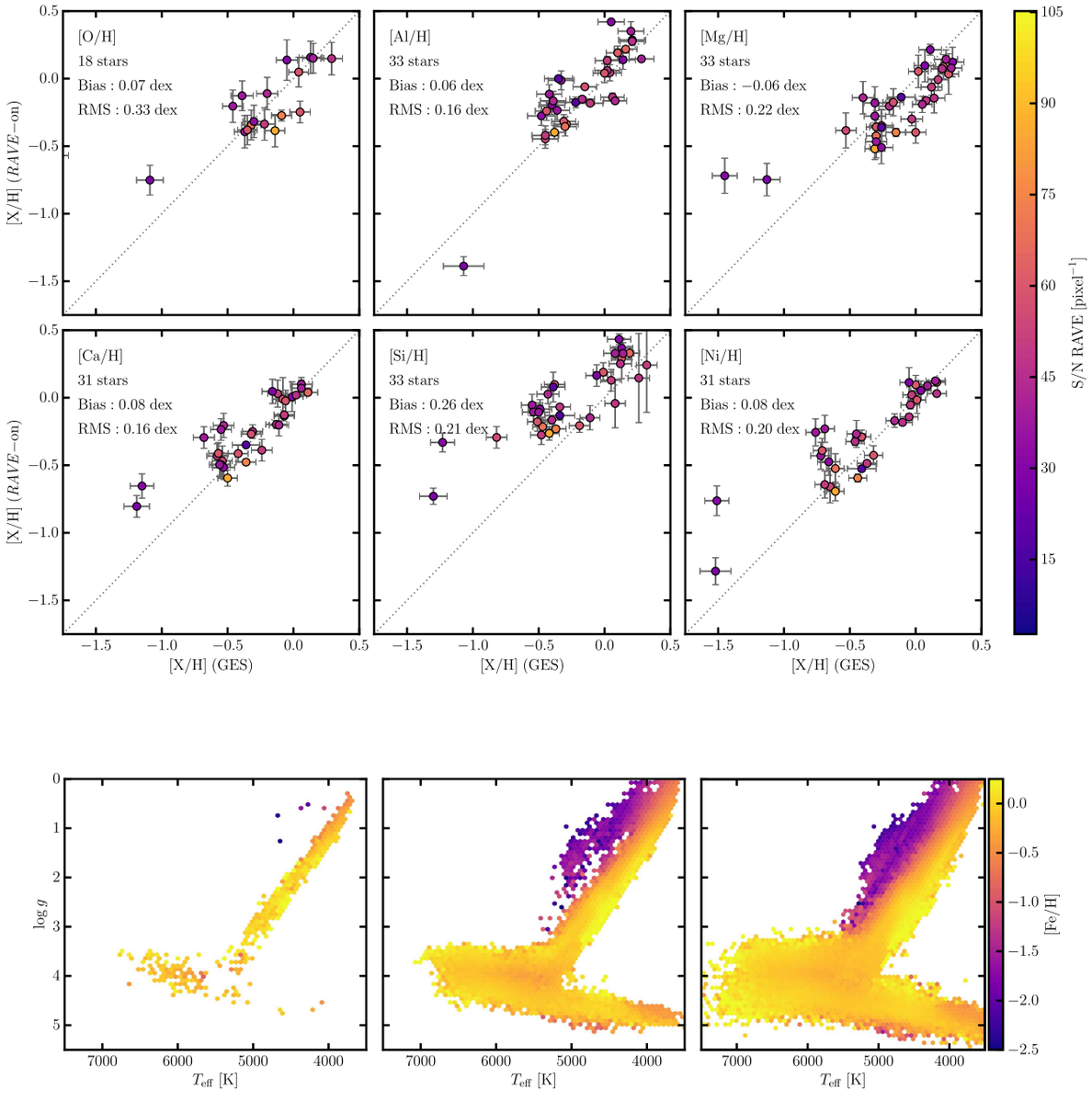


Credits: Maarten Breddels, Kristin Riebe, RAVE team
Visualisation tool: vaex
Data: Gaia GDR1, TGAS, full catalogue and RAVE DR5

Cross matches with TGAS

- RAVE DR5: 215,600
- LAMOST DR3: 124,300
- GALAH DR1: 8,500
- APOGEE DR13: 21,700

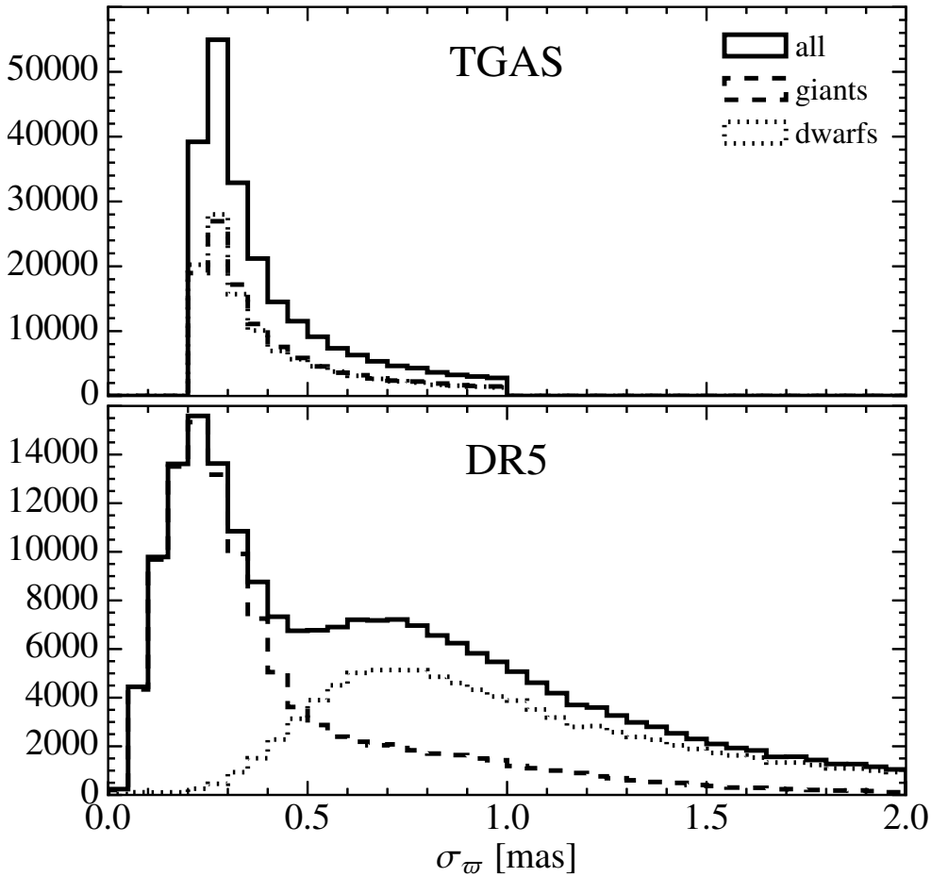
DR5 - complimentary catalogue: RAVE-on



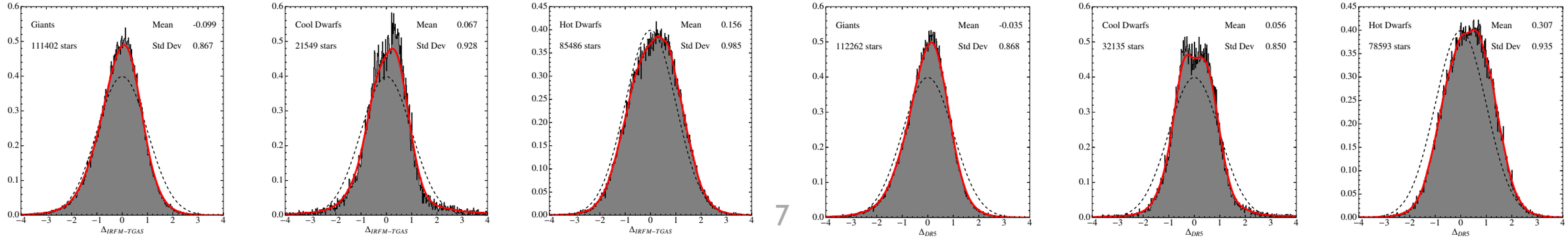
- *The Cannon* based data driven model (Casey, RAVE et al, 2017)
- Red giants matched to APOGEE stellar parameters
- subgiants & main sequence matched to K2/EPIC
- $T_{\rm eff}$, log g, O, Mg, Al, Si, Ca, Fe and Ni
- Ansatz can be applied to full Gaia RVS spectral data set

DR5 distances & parallaxes with TGAS priors

- complement Binney-Burnett (2010) distance pipeline with TGAS priors (McMillan & RAVE, 2017)

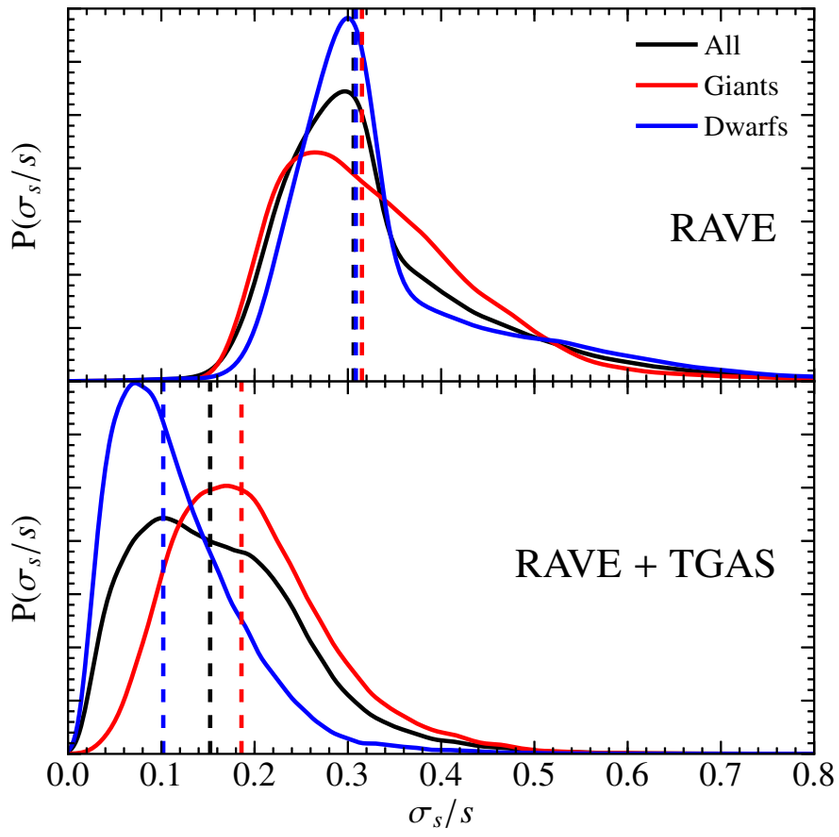


- DR5 parallaxes are
  - overestimated for hot dwarfs ($T_{\rm eff}$ > 5,500 K)
  - underestimated for giants with log g < 2
- hot dwarfs can be improved by using temperatures derived using IR flux method

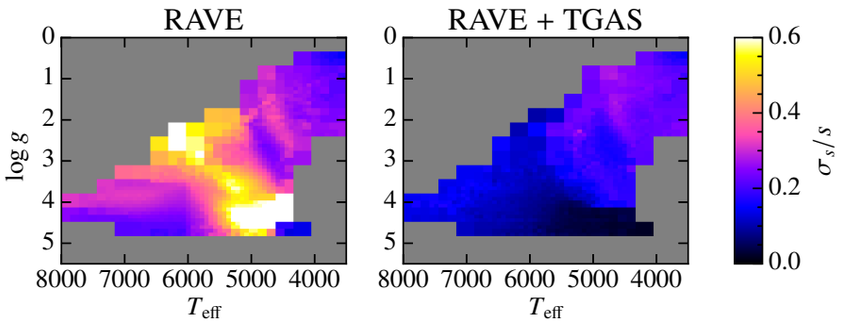


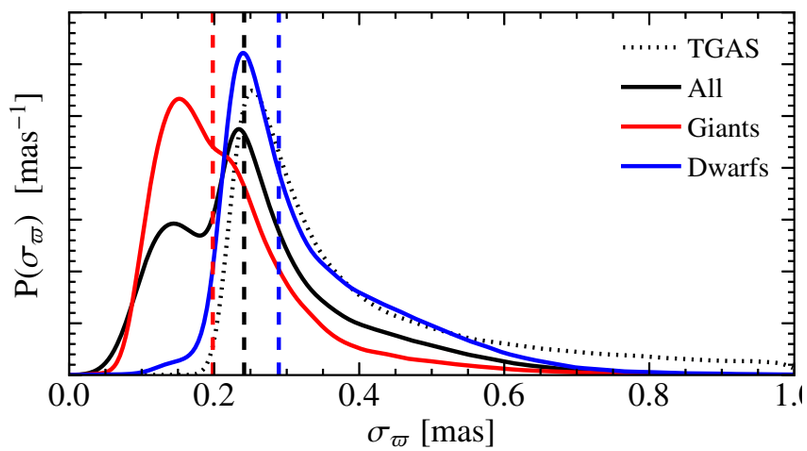
DR5 distances & parallaxes with TGAS priors

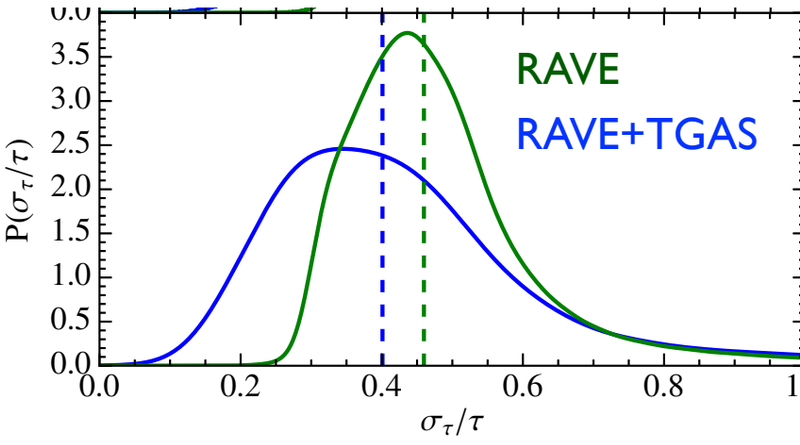
- combined DR5+TGAS distances more accurate than either determination in isolation



- improve DR5 distance uncertainty by factor 2, TGAS by 1.4 (2 for giants)
- derive ages for RAVE stars, many with relative uncertainties of 20% or less

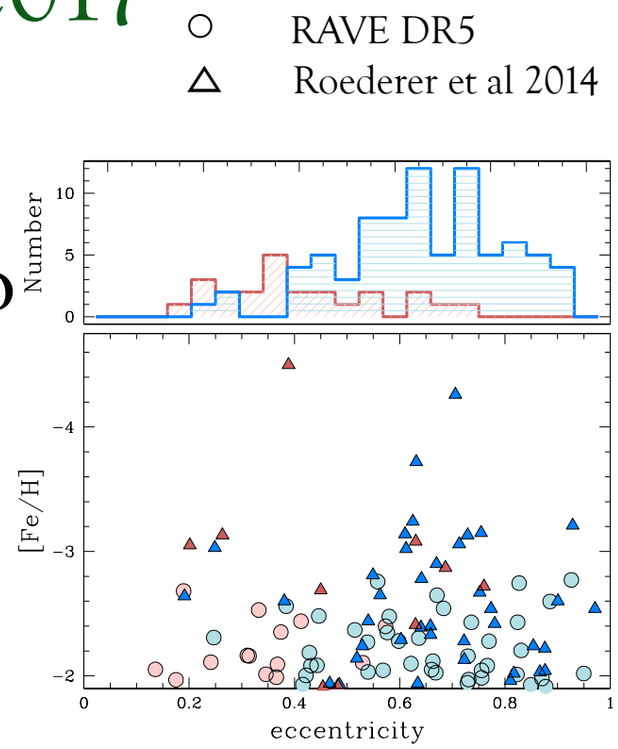






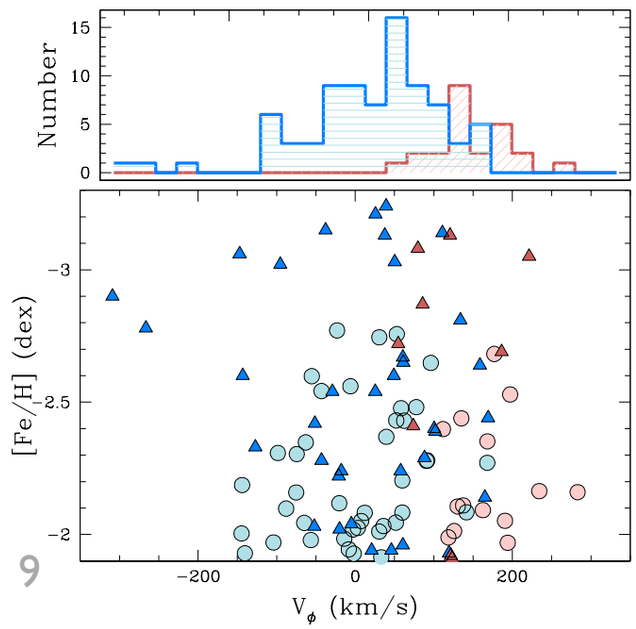
Kinematics of low Z stars in RAVE

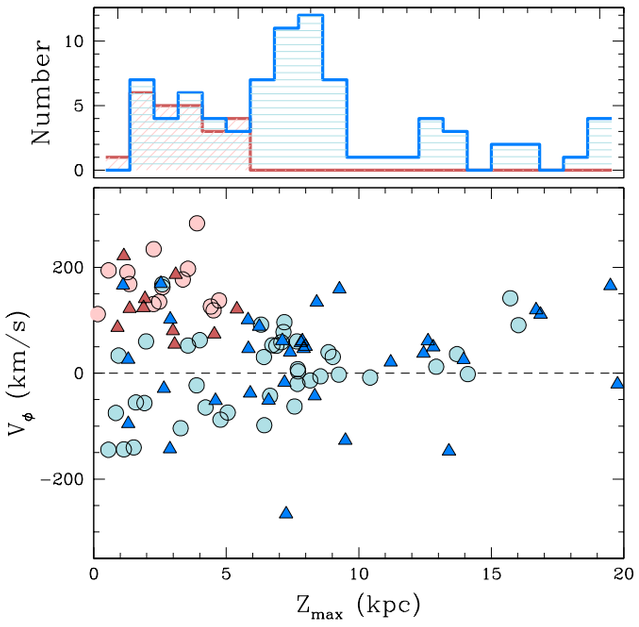
- t-SNE projection to identify very metal-poor stars ([Fe/H]< –2dex) from Matijevic et al 2017
- select those 55 stars with TGAS parallax uncertainties better than 20%
- continuation of Ruchti & RAVE (2011) to lower Z



About 25% of the RAVE- identified very low metallicity stars in the solar neighborhood have disk-like kinematics

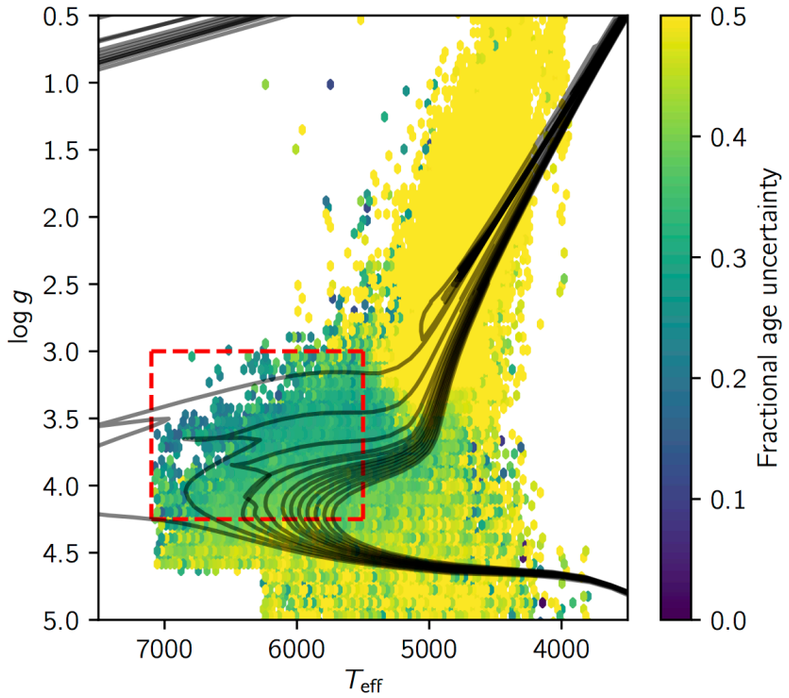
Kunder & RAVE, in prep

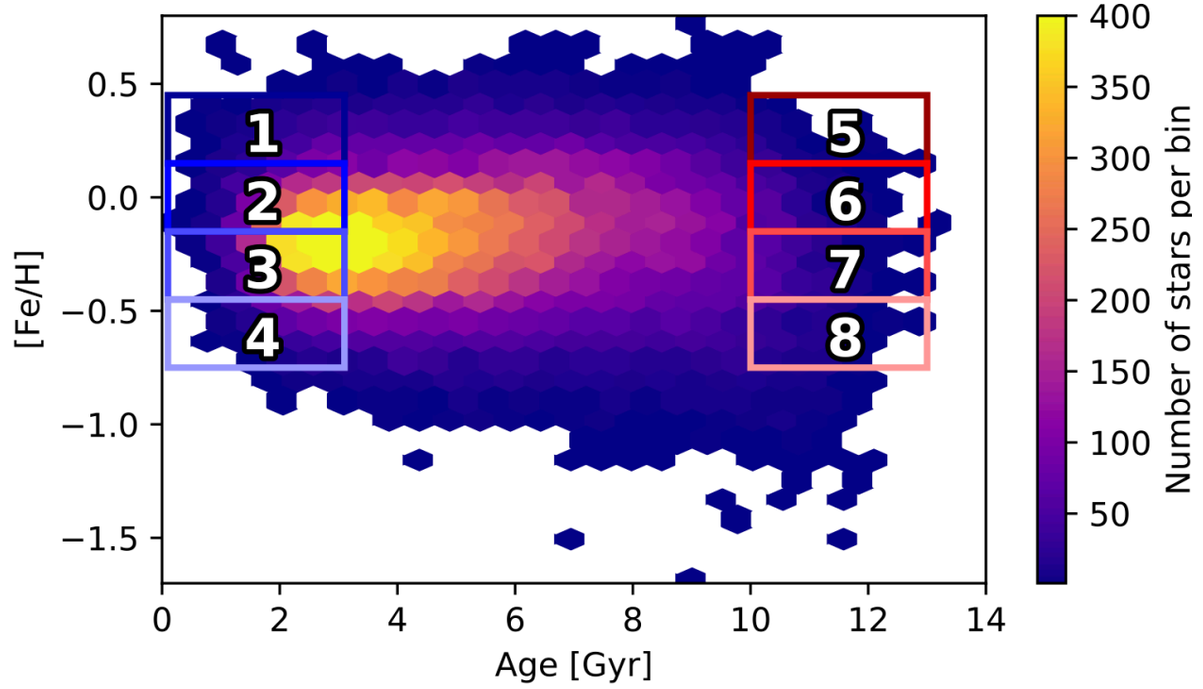


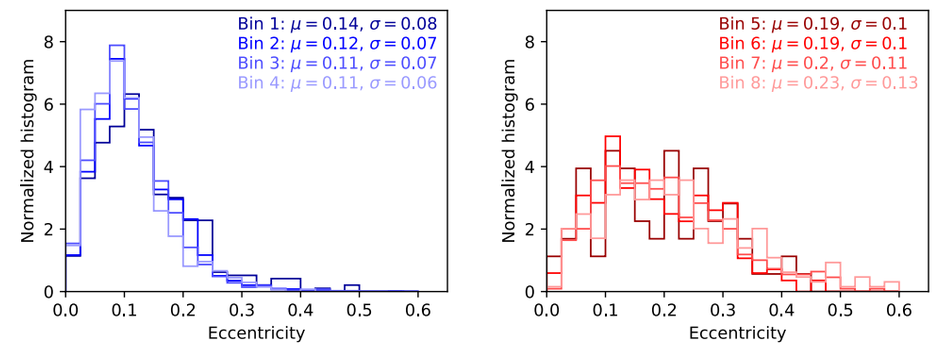


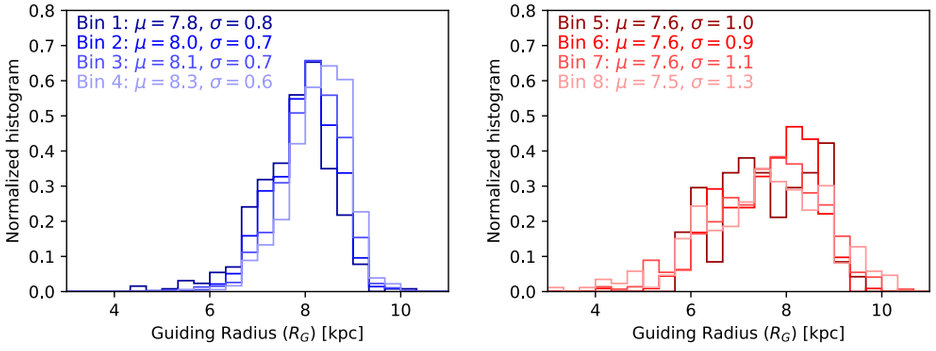
Age, kinematics, and chemical correlations in RAVE

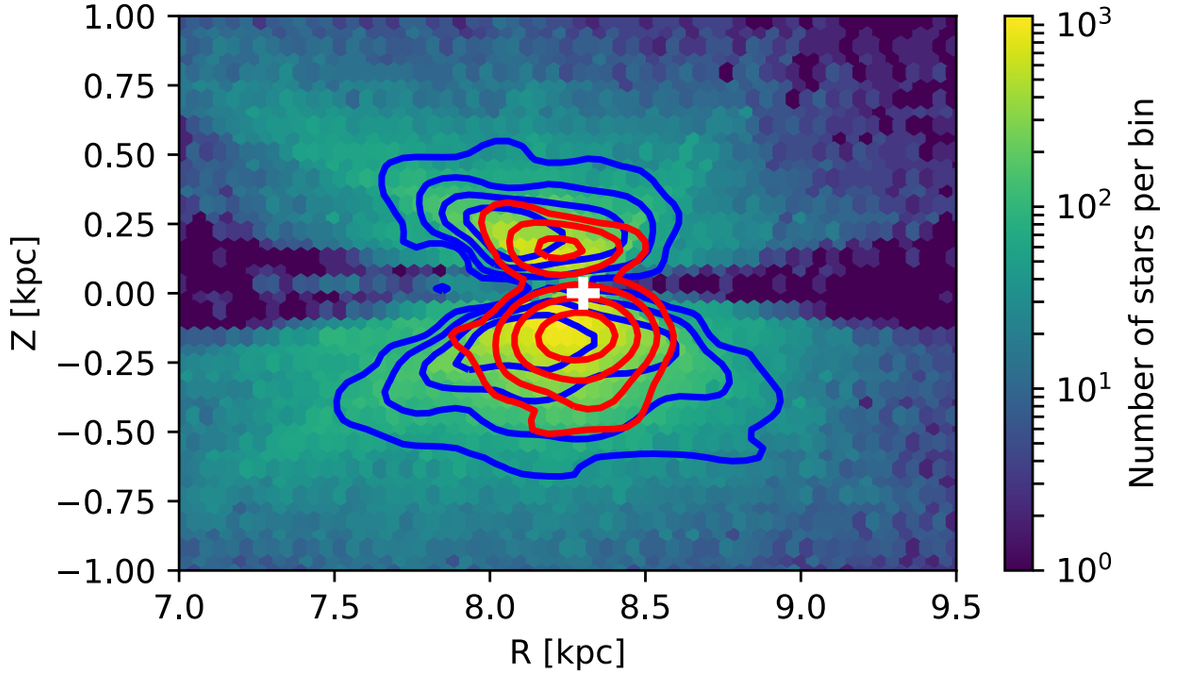
Sample selection: ~ 30 000 turnoff stars from RAVE DR5





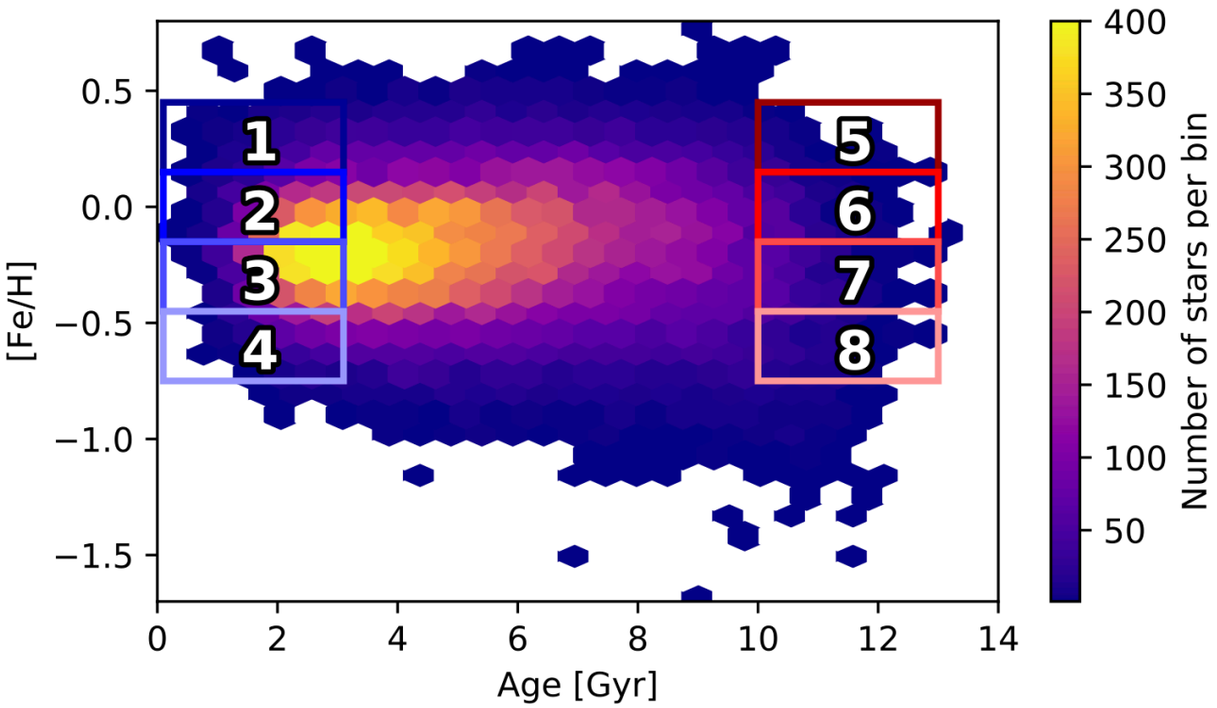


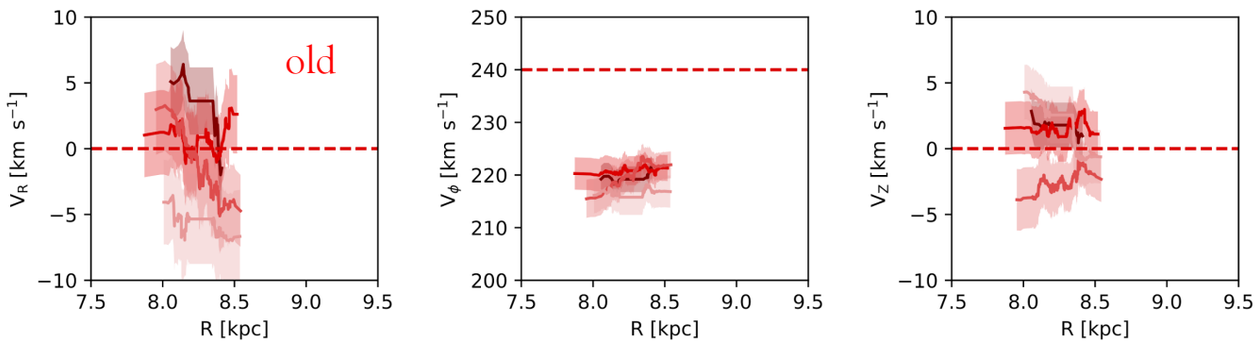


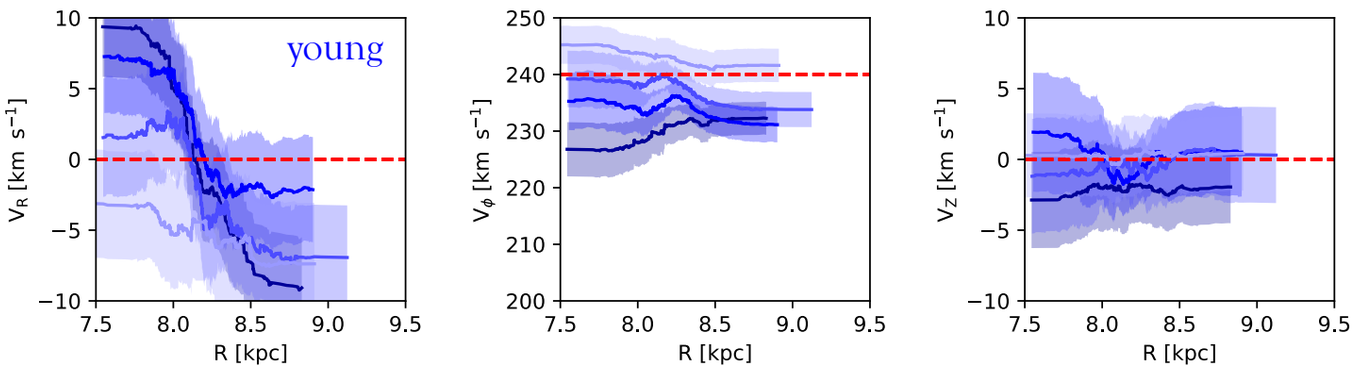


Jennifer Wojno & RAVE, in prep

Age, kinematics, and chemical correlations in RAVE



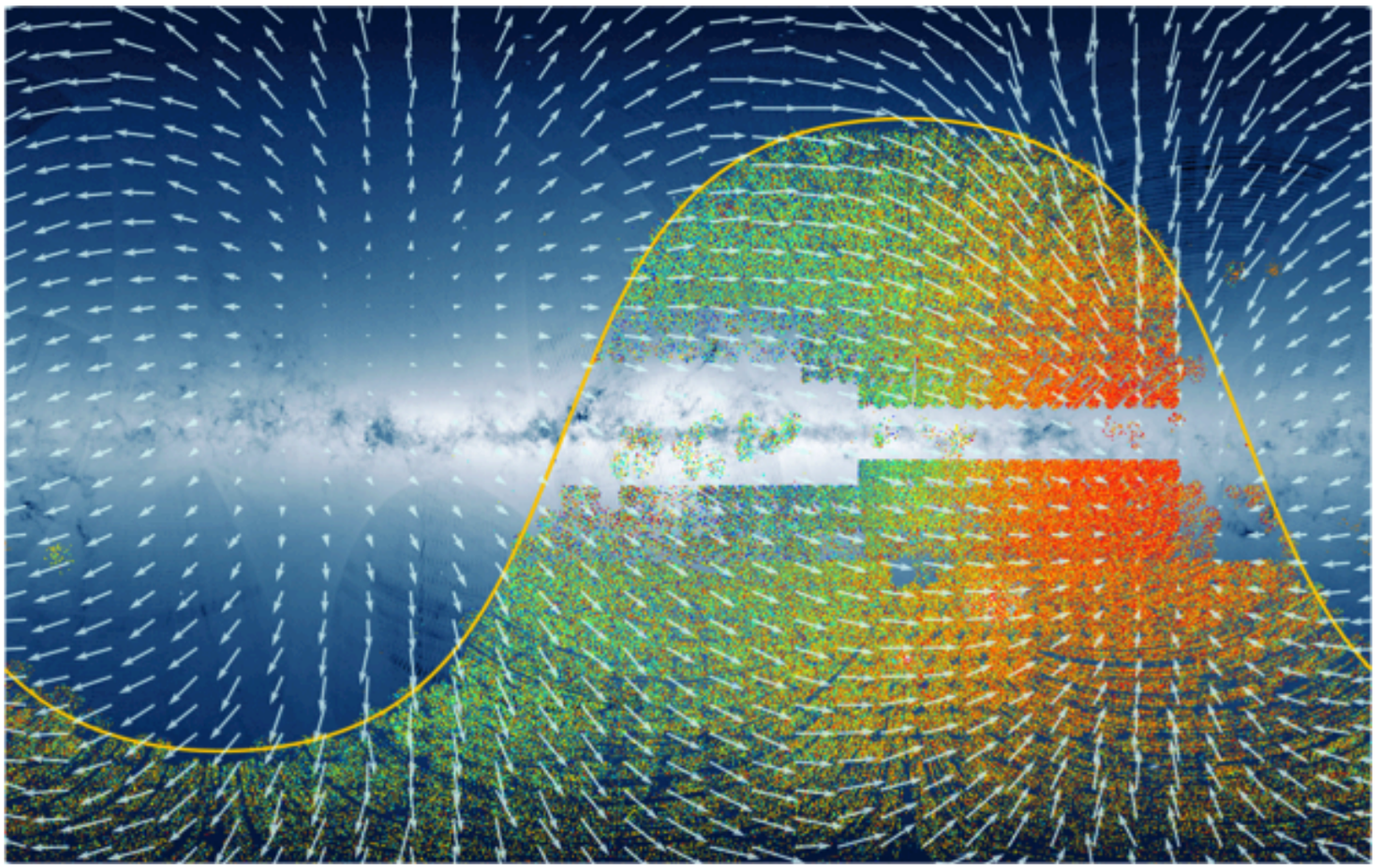




- Negative $\langle \partial V_R \rangle / \partial R$, steeper than measured previously for RAVE (cf. Siebert et al. 2011, Williams et al. 2013), see also talk by Ismael Carrillo on Friday
- Indicates presence of bar (Monari et al. 2014) and/or spiral arms (Faure et al. 2014)
- Young, metal-rich stars lag LSR, brought to solar neighborhood by radial migration (blurring)

Jennifer Wojno & RAVE, in prep

towards RAVE DR6 (scheduled for summer/fall 2018)



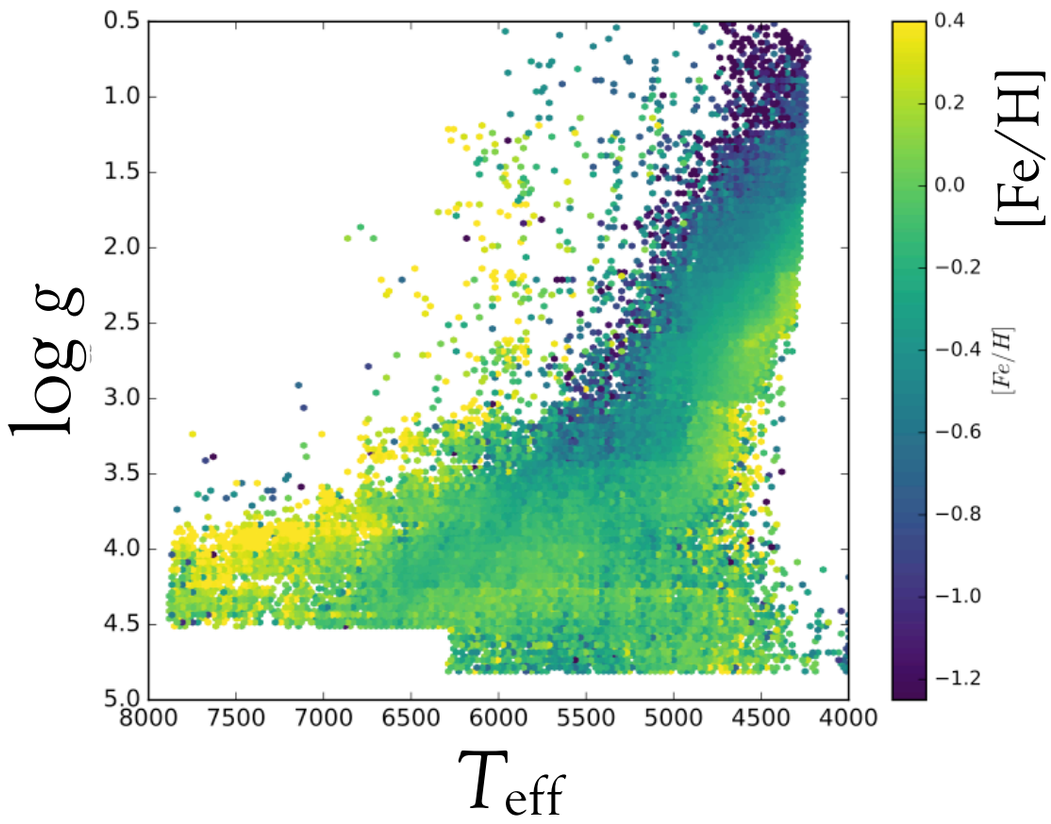
Credits: Maarten Breddels, Kristin Riebe, RAVE team
Visualisation tool: vaex
Data: Gaia GDR1, TGAS, full catalogue and RAVE DR5

- Some house keeping
- publication of spectra
- improved chemical elements
- Stellar parameters using Gaia DR2 priors
- enhanced calibrations

towards RAVE DR6: stellar parameters with Gaia priors

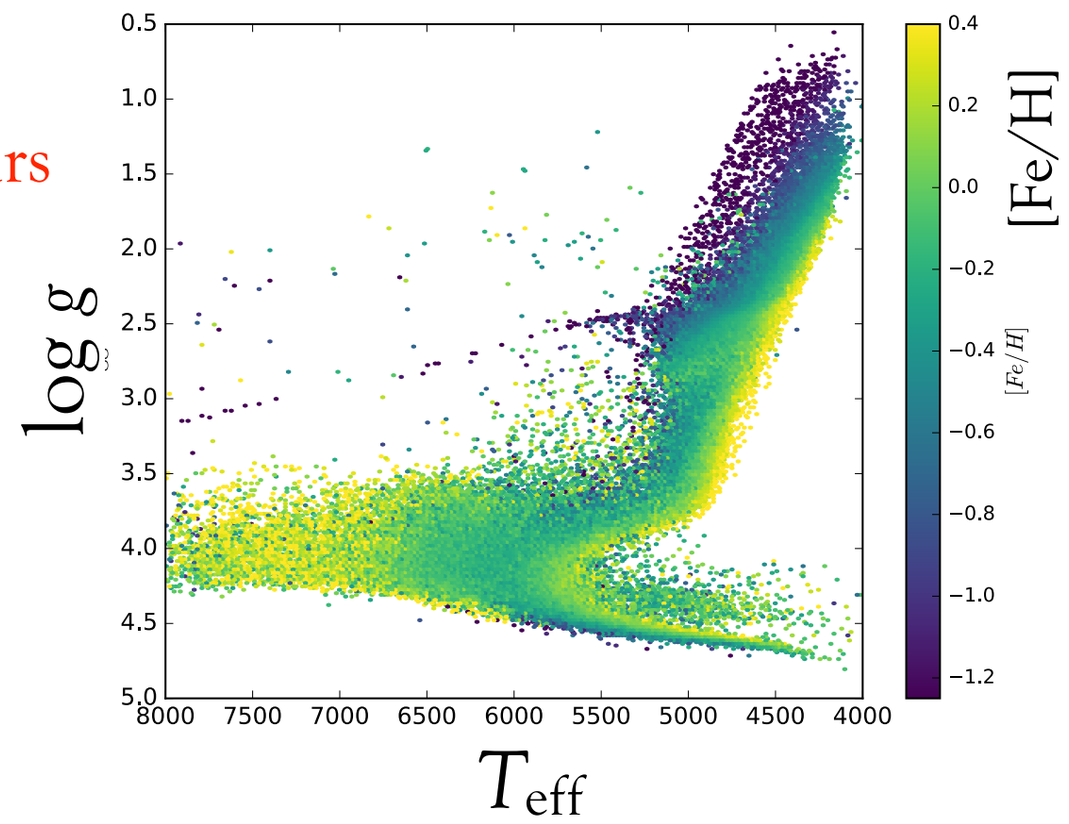
- stellar parameters from the reverse distance pipeline (McMillan & RAVE 2017)
- to be extended to Gaia DR2 distances as soon as they are available

DR5



SNR > 20
158,703 stars

TGAS priors



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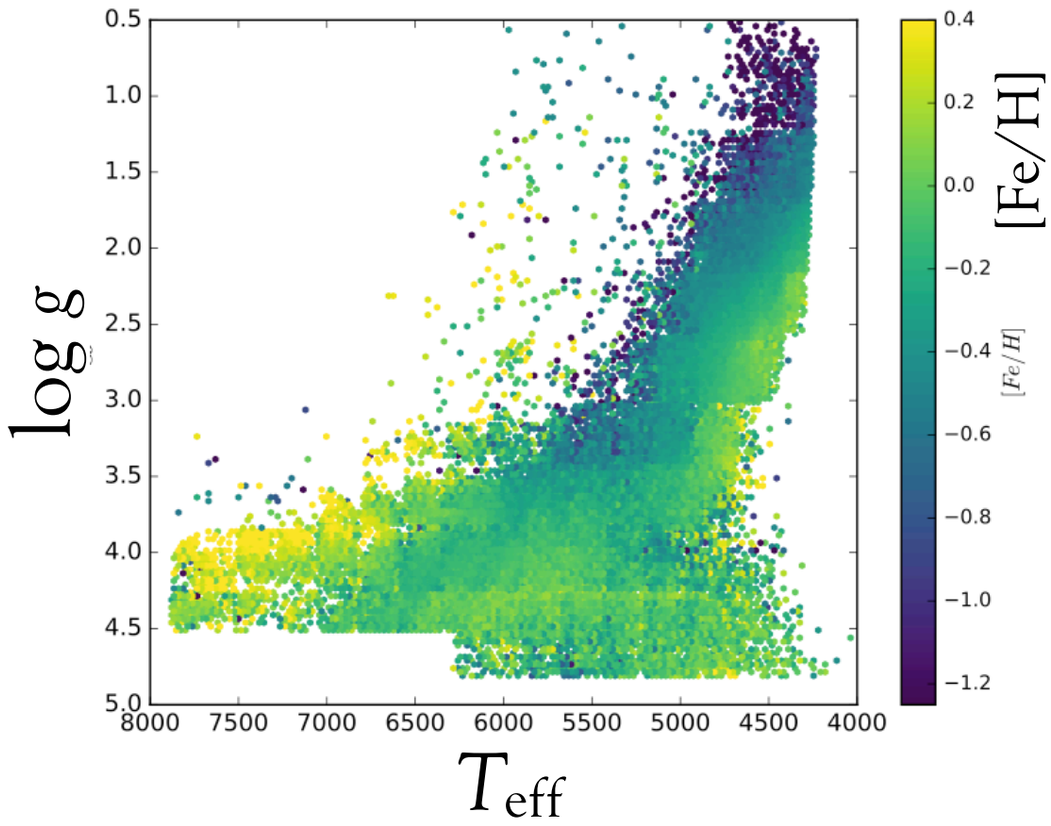
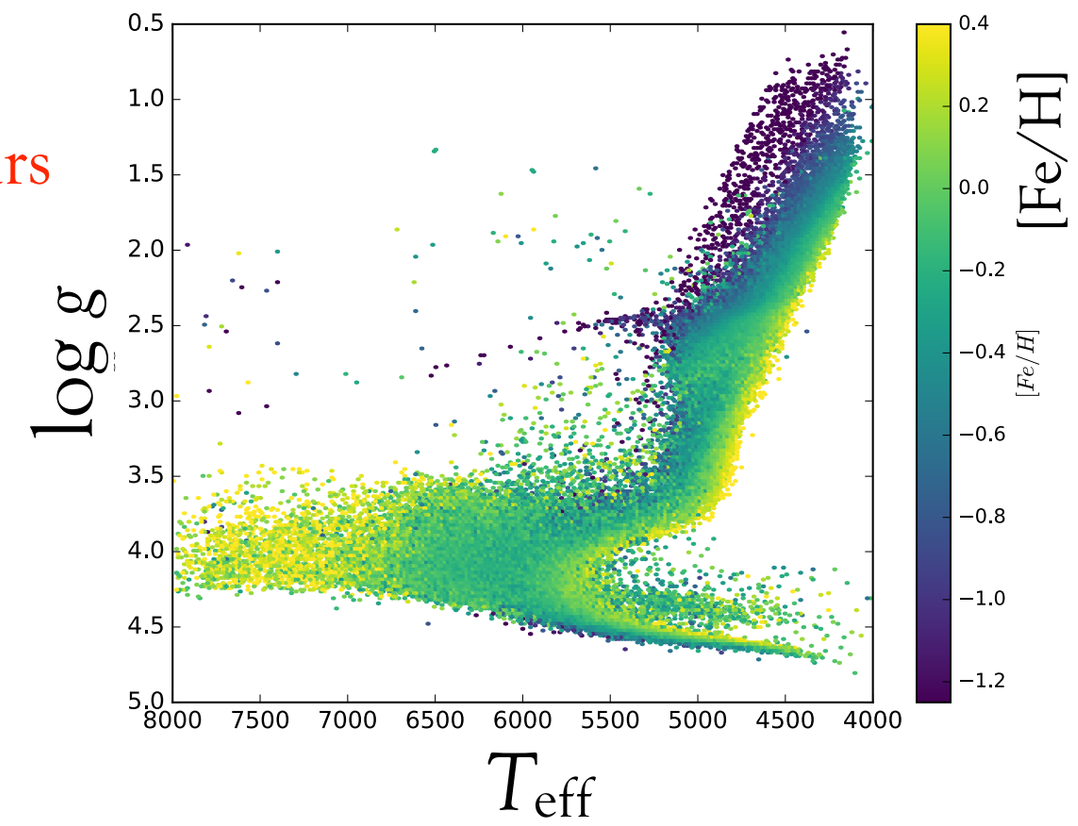
DR5



SNR > 40
131,258 stars

TGAS priors



towards RAVE DR6: stellar parameters with Gaia priors

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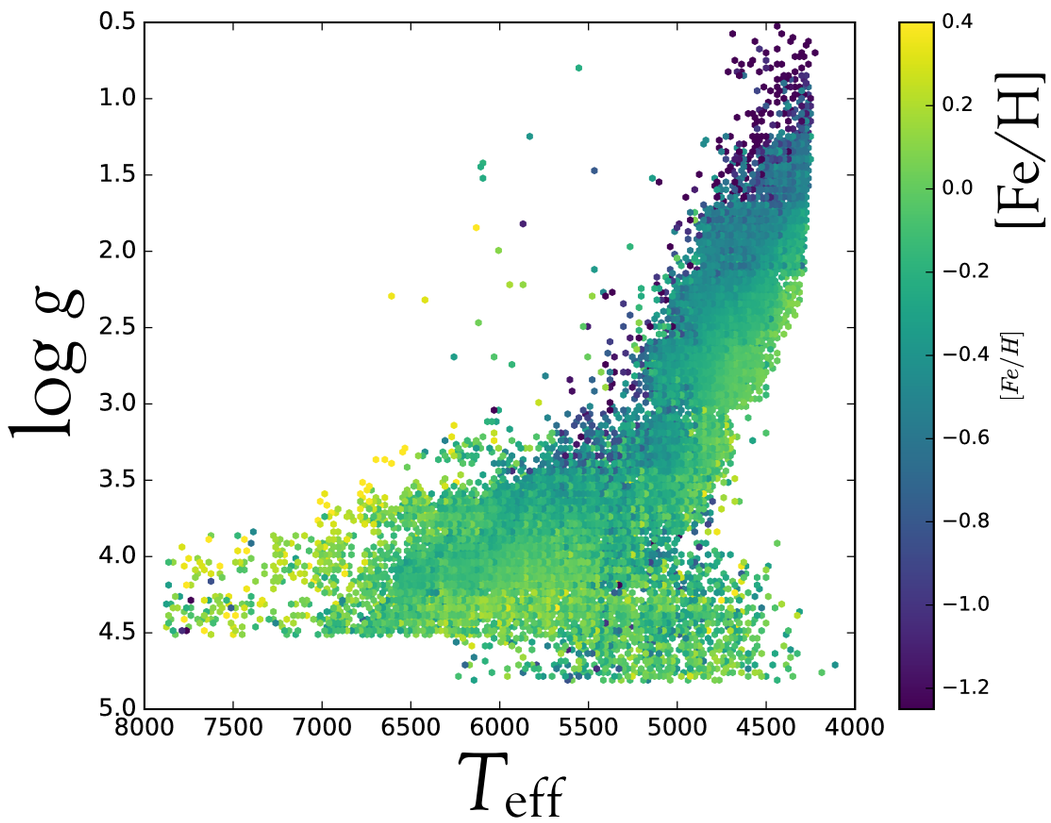
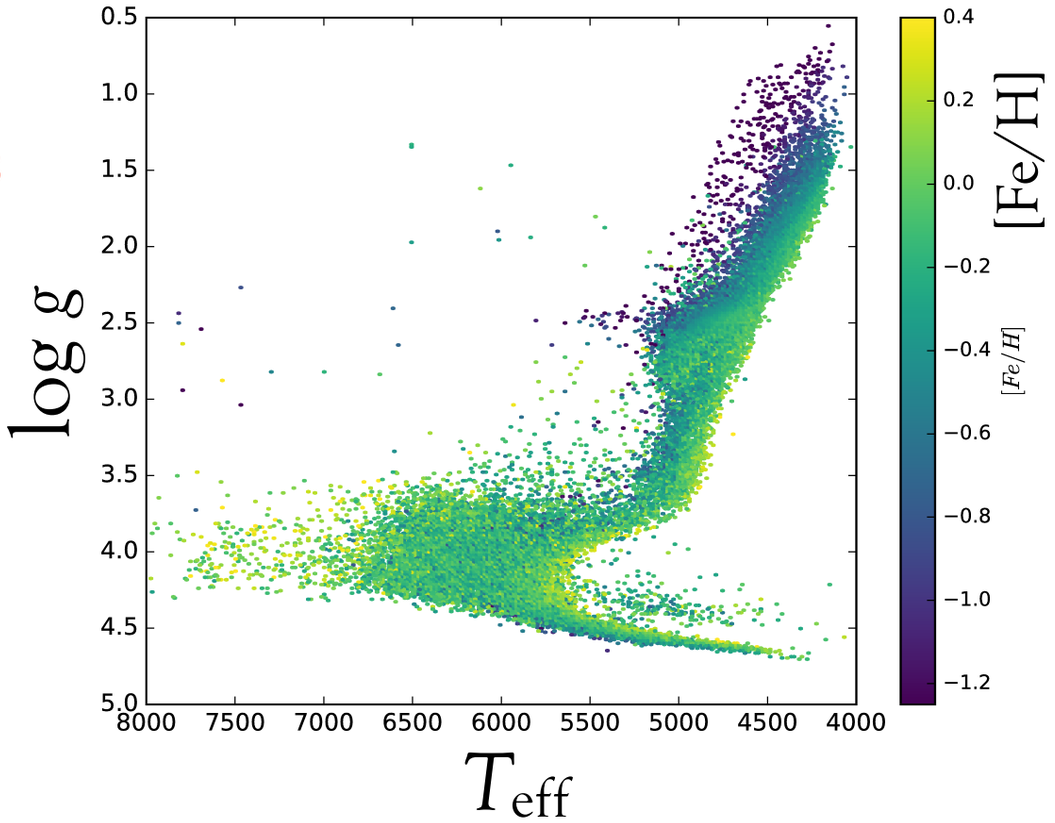
DR5



SNR > 70
42,545 stars

TGAS priors



towards RAVE DR6: stellar parameters with Gaia priors

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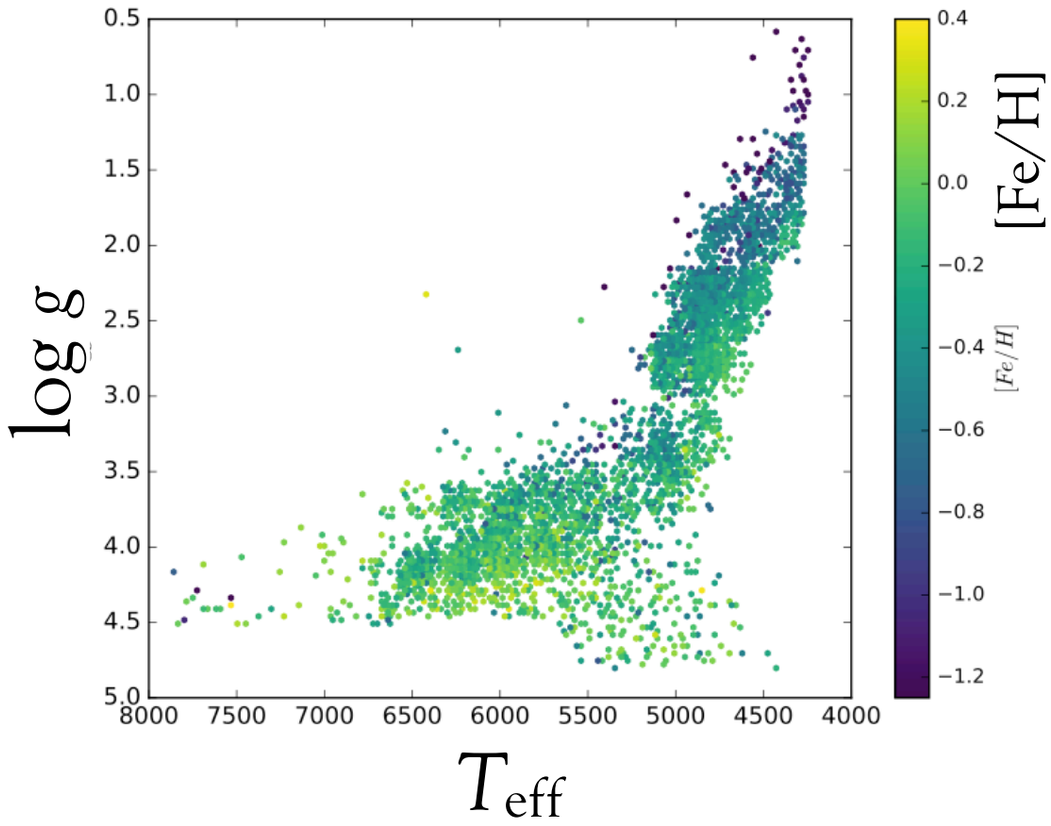
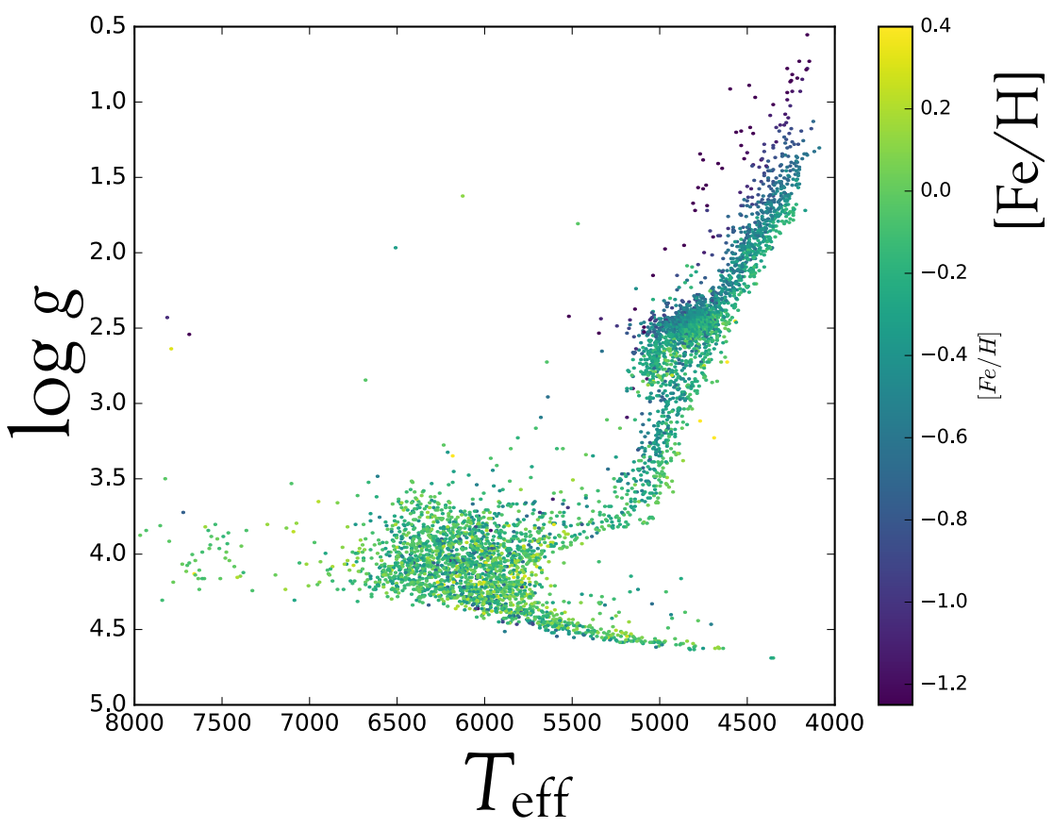
DR5



SNR > 100
5,111 stars

TGAS priors



Summary

- RAVE DR5: currently the largest overlap with TGAS
- revised DR5+TGAS distances
- low metallicity stars with disk-like kinematics
- deeper insight on origin of velocity structure in the local disk
  - better understanding of systematic effects in various catalogues
  - young population stronger affected than old ones
  - many techniques developed for RAVE can be applied to low S/N Gaia data
- DR6 in the making ...