

# Galactic stellar populations and exoplanet frequencies therein

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## 1 Galactic stellar populations

- Dissecting and characterizing the Galactic stellar populations
- $V_\phi$  and *eccentricity* vs.  $[\text{Fe}/\text{H}]$
- High- $\alpha$  metal-rich ( $h\alpha_{\text{mr}}$ ) stars

## 2 Planet frequencies

- Chemical peculiarities of planet hosts
- Planet frequencies in different stellar families

# Stellar populations in the solar neighborhood

## The stellar population in the solar neighborhood

- The thin disk
- The thick disk
- The halo
- Many stellar streams...

## Different scenarios for their formation

New observational results are very important and provide new constraints on the formation models.

# Dissecting and characterizing the stellar populations

846 FGK stars with  $-1.4 < [Fe/H] < 0.55$ ,  $\log g \geq 4$  dex  
 $5000 \leq T_{eff} \leq 6500$  K.

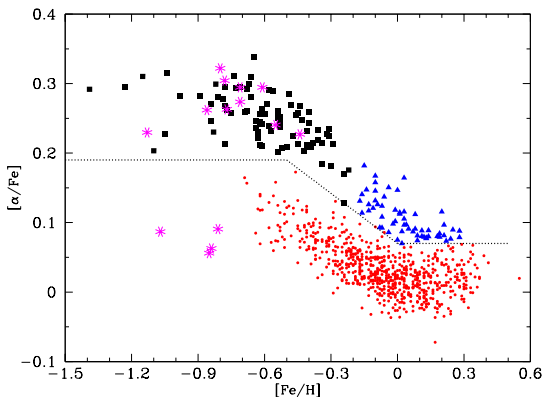


Figure:  $[\alpha/Fe]$  against  $[Fe/H]$  for the HARPS sample (Adibekyan et al, 2013).

## Dissecting and characterizing the stellar populations

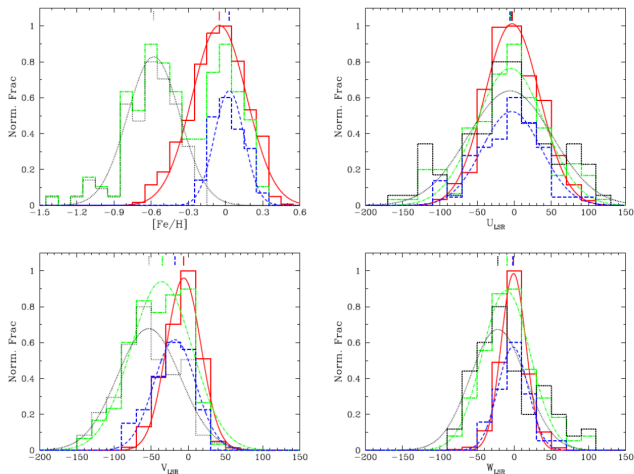
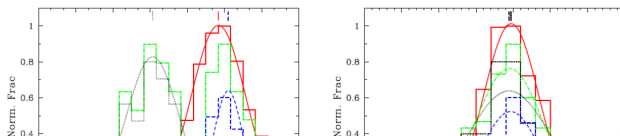


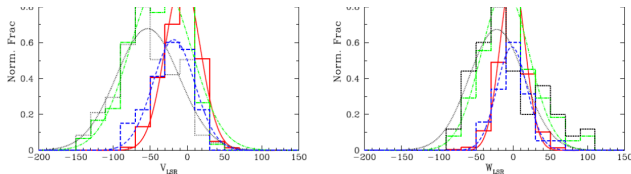
Figure: Distributions of the Galactic space velocities and metallicity (Adibekyan et al, 2013).

## Dissecting and characterizing the stellar populations



**Table** The average values of the  $U_{LSR}$ ,  $V_{LSR}$ , and  $W_{LSR}$  velocity components and their standard deviations for the stellar groups, along with the number of stars and their percentage. The values obtained from the Gaussian fitting of the data presented in brackets.

Stellar groups	$U_{LSR}$	$\sigma_U$	$V_{LSR}$	$\sigma_V$	$W_{LSR}$	$\sigma_W$	$[Fe/H]$	$N$	Percentage
Thick	-5(-5)	66(56)	-52(-53)	39(42)	-8(-2)	44(36)	$-0.60 \pm 0.23$ (-0.58)	84	$9.94 \pm 1.03$
$h\alpha mr$	-7(-3)	42(39)	-23(-18)	26(28)	0(-2)	21(20)	$0.03 \pm 0.12$ (0.03)	58	$6.85 \pm 0.86$
Thick+ $h\alpha mr$	-6(-5)	58(45)	-40(-35)	37(41)	-4(-10)	36(32)	$-0.34 \pm 0.37$	142	$16.78 \pm 1.28$
Thin	0(-3)	37(37)	-9(-6)	22(23)	0(-1)	18(16)	$-0.06 \pm 0.22$ (-0.05)	692	$81.79 \pm 1.32$
Halo	-39	154	-198	60	-27	73	$-0.82 \pm 0.23$	12	$1.42 \pm 0.40$



**Figure:** Distributions of the Galactic space velocities and metallicity (Adibekyan et al, 2013).

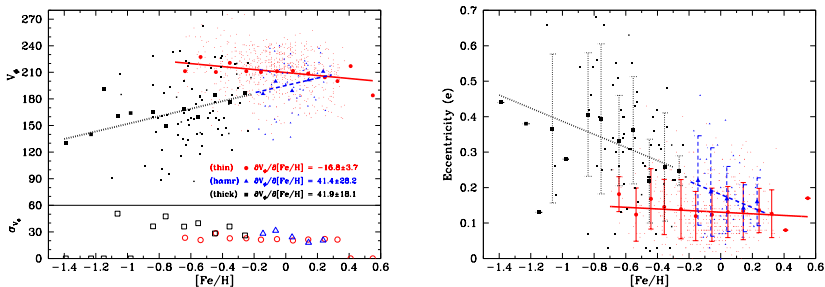
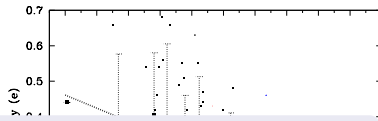
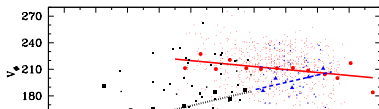
$V_\phi$  and eccentricity vs.  $[\text{Fe}/\text{H}]$ 

Figure:  $V_\phi$  and eccentricity as a function of  $[\text{Fe}/\text{H}]$  (Adibekyan et al, 2013).

$V_\phi$  and eccentricity vs.  $[Fe/H]$ 

The  $h\alpha mr$  stars behave like an extension of the thick disk stars on the  $V_\phi$ - $[Fe/H]$  and  $e$ - $[Fe/H]$  planes.

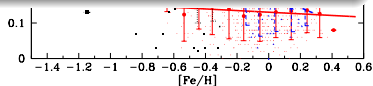
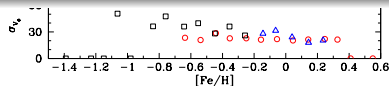


Figure:  $V_\phi$  and eccentricity as a function of  $[Fe/H]$  (Adibekyan et al, 2013).



## High- $\alpha$ metal-rich ( $h\alpha\text{mr}$ ) stars

$h\alpha\text{mr}$  stars share properties of both the thin and thick disks

- Low dispersion of velocities (similar to the **thin** disk)
- Low  $Z_{\text{max}}$  of about 0.3 kpc (similar to the **thin** disk)
- $V_\phi$ - $[\text{Fe}/\text{H}]$  and  $e$ - $[\text{Fe}/\text{H}]$  trends similar to the **thick** disk
- Intermediate/old ages similar to the **thick** disk
- metal-rich and  $\alpha$ -enhanced similar to the **bulge** stars  
(Fulbright et al. 2007; Bensby et al. 2013; Ness et al. 2013)

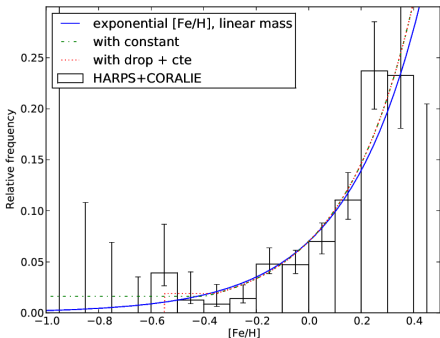
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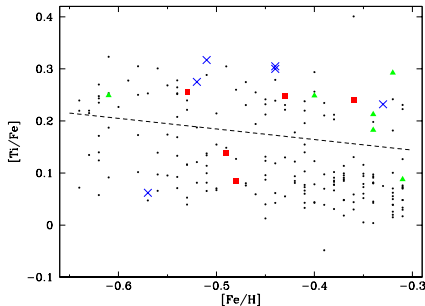
A comparison with a sub-population identified in the simulations by Roškar et al 2012 and Loebman et al 2011 suggests that  $h\alpha mr$  stars may be extreme-migrators ( $R_{form} < 1-2$  kpc).

## Chemical peculiarities of planet hosts



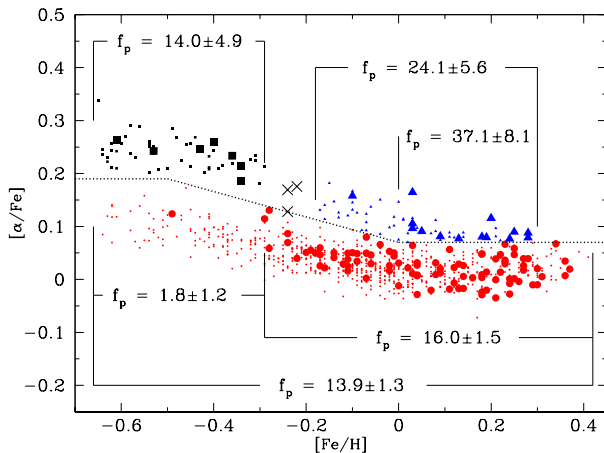
**Figure:** Relative frequency of giant-planet hosts as a function of  $[Fe/H]$  (Mortier et al. 2013).

The binomial statistics gives a probability of about 99.97% that Ti-enhancement of planet hosts is not accidental.



**Figure:**  $[Ti/Fe]$  against  $[Fe/H]$  (Adibekyan et al, 2012).

## Planet frequencies in different stellar families

Figure:  $[\alpha/\text{Fe}]$  against  $[\text{Fe}/\text{H}]$  for the HARPS sample.

## The main results/conclusions

### New stellar family (*hmr*)

- Metal-rich and  $\alpha$ -rich
- Shares properties of both the thin and thick disks
- Extreme-migrators from the inner Galaxy (Bulge)

### Planet frequencies

Planet frequency is different in different stellar populations

(even at the same metallicity ( $[Fe/H]$ ) region)

Thank YOU