

# Validation of LAMOST Stellar Parameters with the PASTEL Catalog

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# Outlines

- Introduction
- Cross identification and sample
- Comparison of stellar parameters
- Conclusions

# Introduction

- LAMOST DR1:
  - 2,204,860 spectra of stars, quasars, galaxies, ...
  - 1,944,406 stellar spectra
  - LAMOST stellar parameter pipeline (LASP)
    - UlySS software (Wu et al.)
  - 1,085,404 full set stellar atmospheric parameters and radial velocities

# SDSS SSPP validation

- Compare the parameters with:
  - Previously published spectral libraries
  - Well-studied open and globular clusters
  - High-resolution observations of field stars

# PASTEL catalog

Soubiran et al. 2010

- A bibliographical compilation of stellar atmospheric parameters providing ( $T_{\text{eff}}$ ,  $\log g$ ,  $[\text{Fe}/\text{H}]$ ) determinations obtained from the analysis of high resolution, high signal-to-noise spectra.
- Regularly updated. The version that we use is 17-May-2013, consists of 52,045 entries of 26,657 individual stars.
- ~1000 stars are selected and provided to LAMOST observation (Huang et al.).

# Cross identification and sample

- Cross identification
  - Due to position offsets of bright stars search radius expand to **10 arcsec**.
  - Check results one by one according photometric data and images

–422 stars sample

# The sample

- **DR1:**
  - more than 300 stars have full set of stellar atmospheric parameters
  - rest have only radial velocities
- **PASTEL:**
  - 420 stars:  $T_{\text{eff}}$
  - 150 stars:  $\log g$ ,  $[\text{Fe}/\text{H}]$
  - 323 stars: radial velocity from SIMBAD

# Stellar parameters of PASTEL

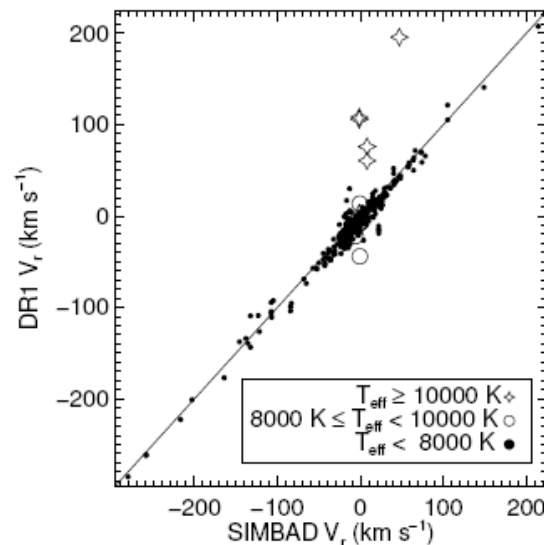
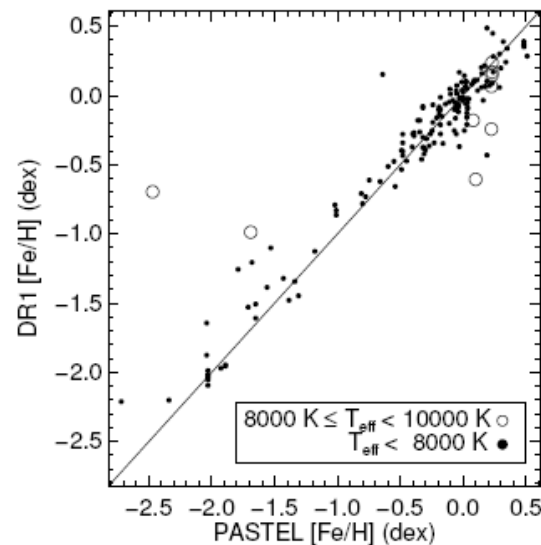
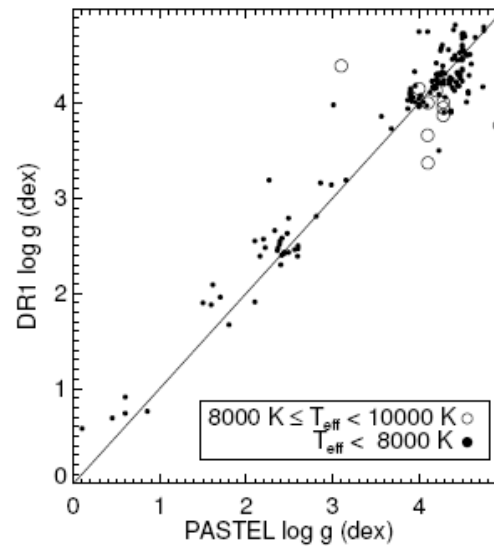
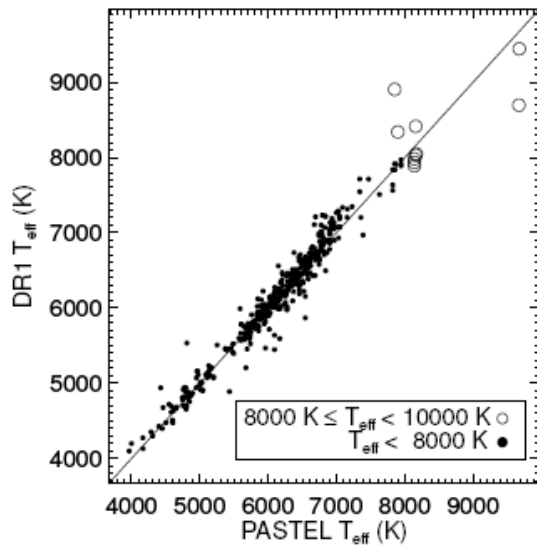
- PASTEL stars that contain multiple measurements remove:
  - very early results: published before 1990
  - do not consist well with the other ones for the same star
- average the remaining measurements as adopted values.



# Exclude outliers

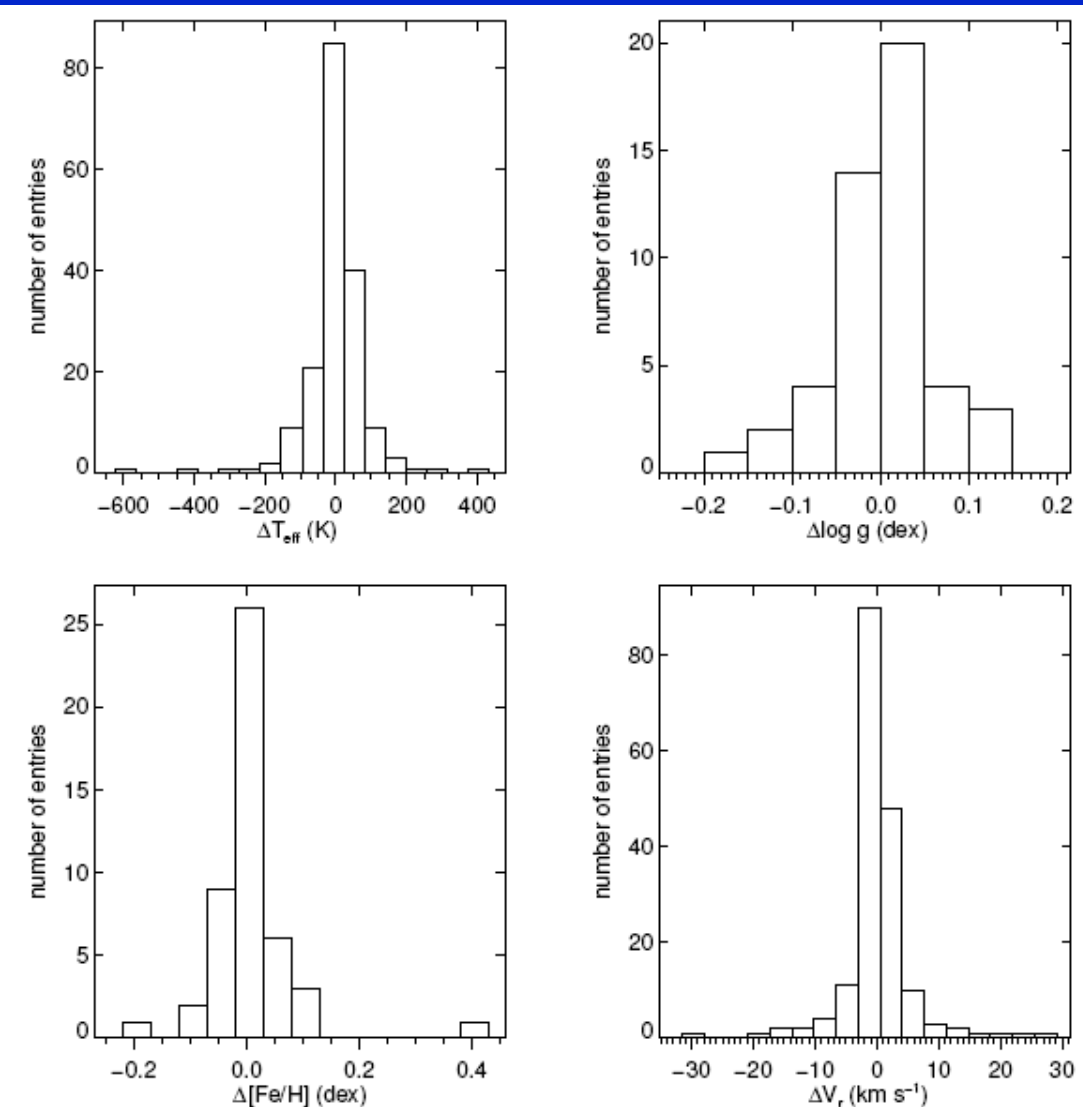
- 'Bad' Spectra
  - $S/N < 7$
  - Bad pixel masks
- Stars residing in binaries or clusters
- Mistakes in the PASTEL catalogs:
  - KIC 5524720 for TYC3125-2594-1
  - TYC 2667-624-1 for TYC 2267-624-1
  - SAO201781 for HD201781

# Temperature bins



- $< 8000 \text{ K}$
- $8000 \text{ K} - 10000 \text{ K}$
- $> 10000 \text{ K}$
  
- Stellar atmospheric parameters:
  - $< 8000 \text{ K}$
  
- Radial velocity:
  - $< 10000 \text{ K}$

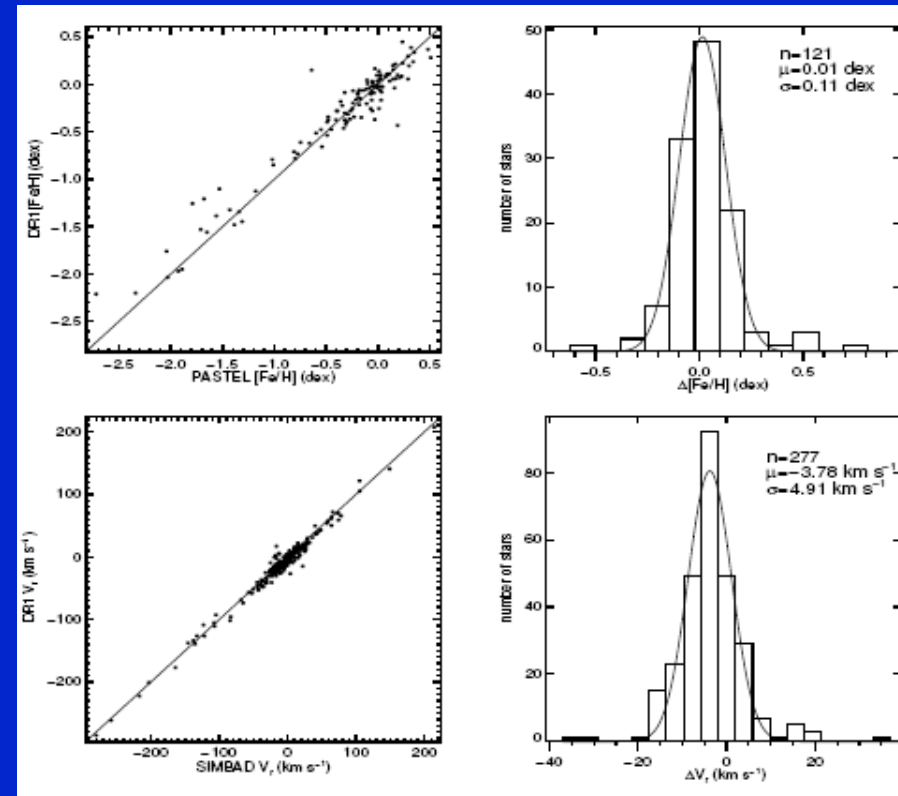
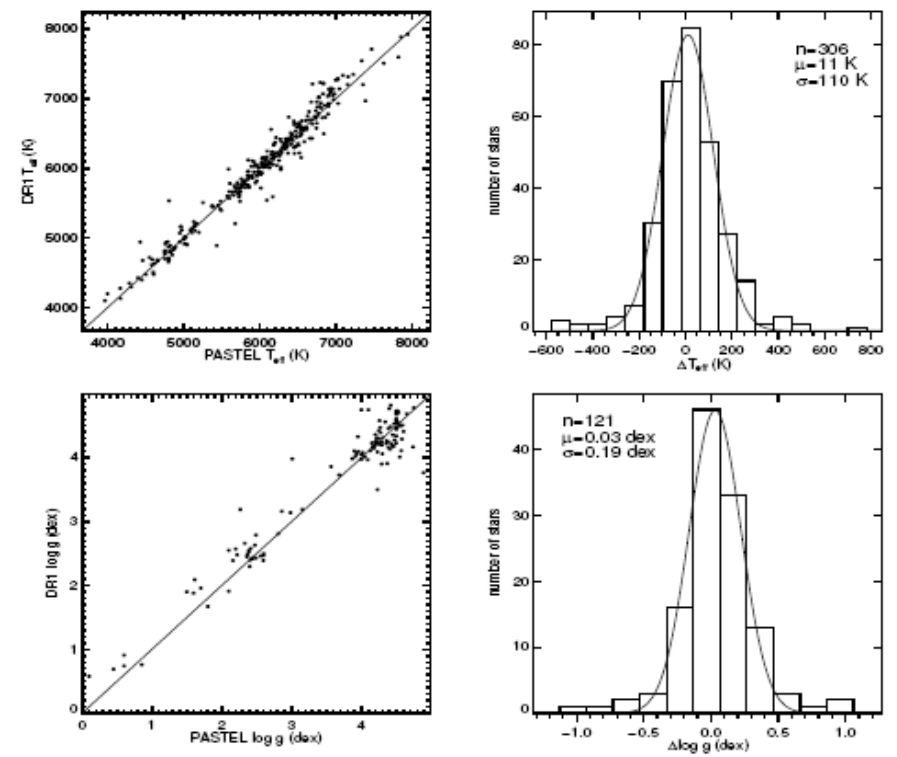
# Internal Scatter of DR1 Stellar Parameters



- Multiple measurements in DR1

- 154 of 176  $T_{\text{eff}}$  for 73 stars are within 100K.
- 42 of 48  $\log g$  for 19 stars are within 0.1 dex.
- 44 of 48  $[\text{Fe}/\text{H}]$  for 19 stars are within 0.1 dex.
- 151 of 178  $V_r$  for 73 stars are within 5km/s.

# Comparison of stellar parameters



# Results

**Table 1** Statistics in Comparison Results of individual stars

	$T_{\text{eff}}$	$\log g$	[Fe/H]	$V_r$
number of stars	306	121	121	277
systematic error	11 K	0.03 dex	0.01 dex	-3.78 km s <sup>-1</sup>
dispersion	110 K	0.19 dex	0.11 dex	4.91 km s <sup>-1</sup>

- **Accuracies** of LAMOST DR1 stellar parameters are **comparable** with SDSS SSPP results.

- Obviously systematic errors of stellar parameters are negligible except for that of  $V_r$ .
  - Since radial velocities in the SIMBAD database are collections from different literatures, biases of different measurements should have canceled out;
  - systematic error of  $-3.78\text{km/s}$  should be taken into account.
- DR1  $[\text{Fe}/\text{H}]$  of metal-poor stars with  $[\text{Fe}/\text{H}] < -1.5$  are systematically higher than metallicities obtained by high resolution spectra analysis.

