Compilation of stellar fundamental parameters

from literature : high quality observations + primary methods

Calibration stars for astrophysical parametrization

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Most of the key problems in astrophysics rely on the determination of stellar fundamental parameters

è stellar physics : validation of models of internal structure, atmospheres, stellar evolution

masses, radius, elemental abundances, rotation, luminosities

è galactic structure : validation of models of chemical and dynamical evolution of the Milky Way

distances, positions, proper motions, radial velocities, elemental abundances, ages

è cosmology : distance scale, age of the Universe

luminosity of variable stars, ages, abundances of primordial elements

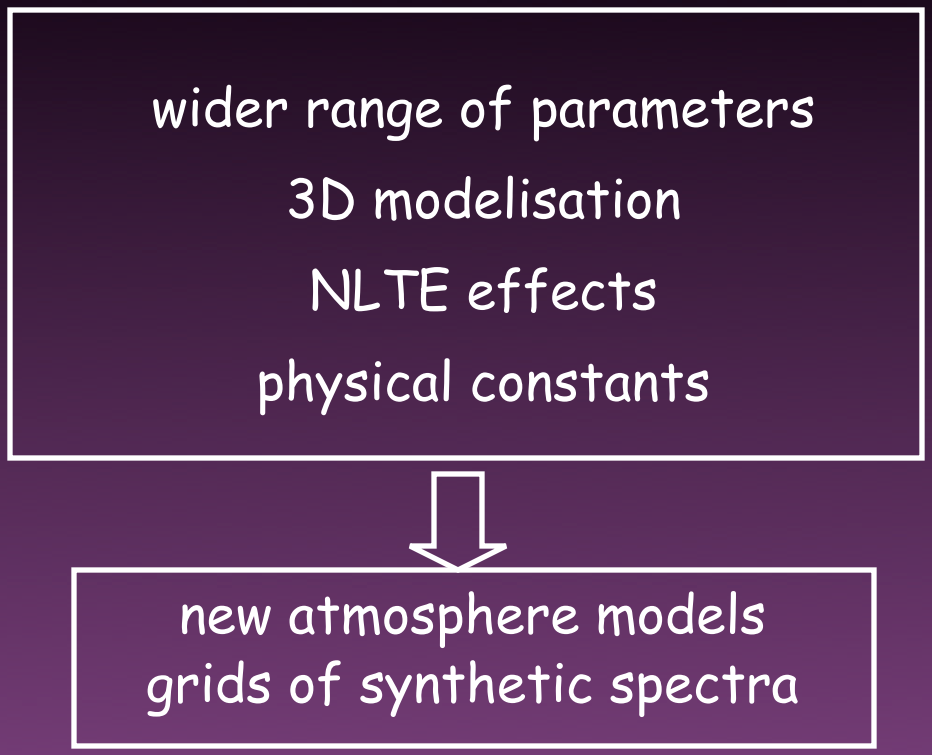
Many new instruments or surveys available for the determination of stellar fundamental parameters

- è echelle spectrographs (FEROS, UVES, HARPS, ESPADONS..)
- è interferometers (VLTI, ...)
- è photometric surveys (DENIS, 2MASS, SDSS...)
- è astrometric surveys (UCAC2, ..)
- è spectroscopic surveys (RAVE, ...)
- è GAIA

Archives
Databases
AVO

Data mining
Clustering
Classification
Parametrization

Theories on stellar atmospheres are improving



Essential for simulations, parametrization methods but need to be tested against real stars !!

The POLLUX database

è developed by the GRAAL team in Montpellier (PI A. Lèbre)

è collects **high resolution, high S/N spectra** from various echelle spectrographs

è processes them in **uniform** manner

è makes them **available** through a Web interface

è provides **tools** (quick-look, EW measurements..)

è provides grids of **validated synthetic spectra**

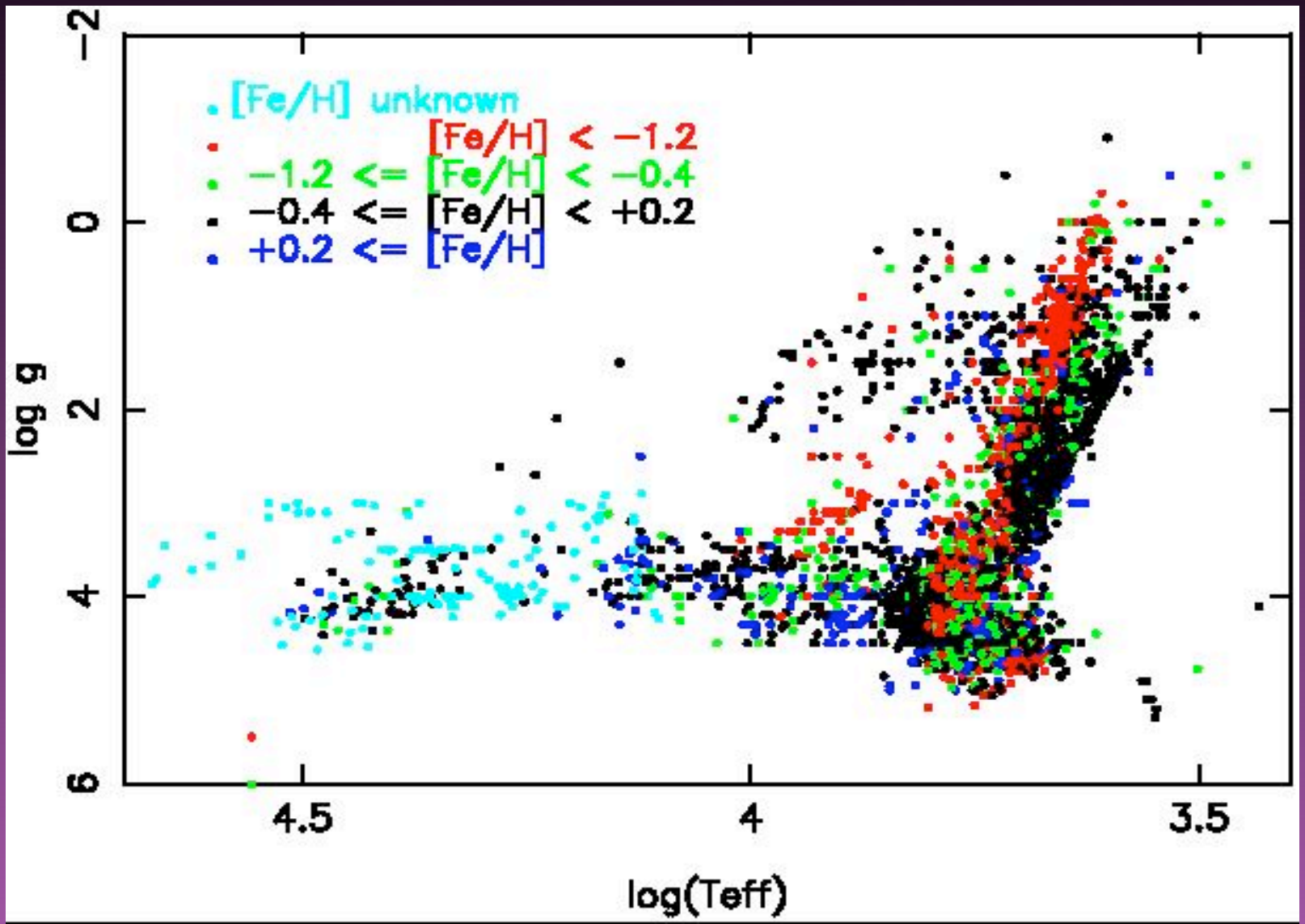
è provides observed libraries of **reference spectra**

è provides **catalogues** of stellar fundamental parameters

è provides on-line **automated methods** (TGMET..) to determine **atmospheric parameters** (Teff,logg,[Fe/H])

The bibliographical [Fe/H] catalogue (Cayrel de Strobel et al, 1997, 2001) constantly updated and completed with Teff, logg determinations

11000 determinations for 5000 stars



a dramatical lack of cool dwarfs with Teff < 5000 K

KM dwarfs are intrinsically faint and their spectra are dominated by broad molecular features : classical detailed analysis cannot be performed

they span the full range of ages : it is crucial to estimate their metallicity

they will be the most represented class of stars in the GAIA survey

an effort has to be done !

atmosphere models of cool dwarfs have been improved in the last years (Allard,..)

Elodie-OHP observations V < 9 : analysis in collaboration with the ukrainian group

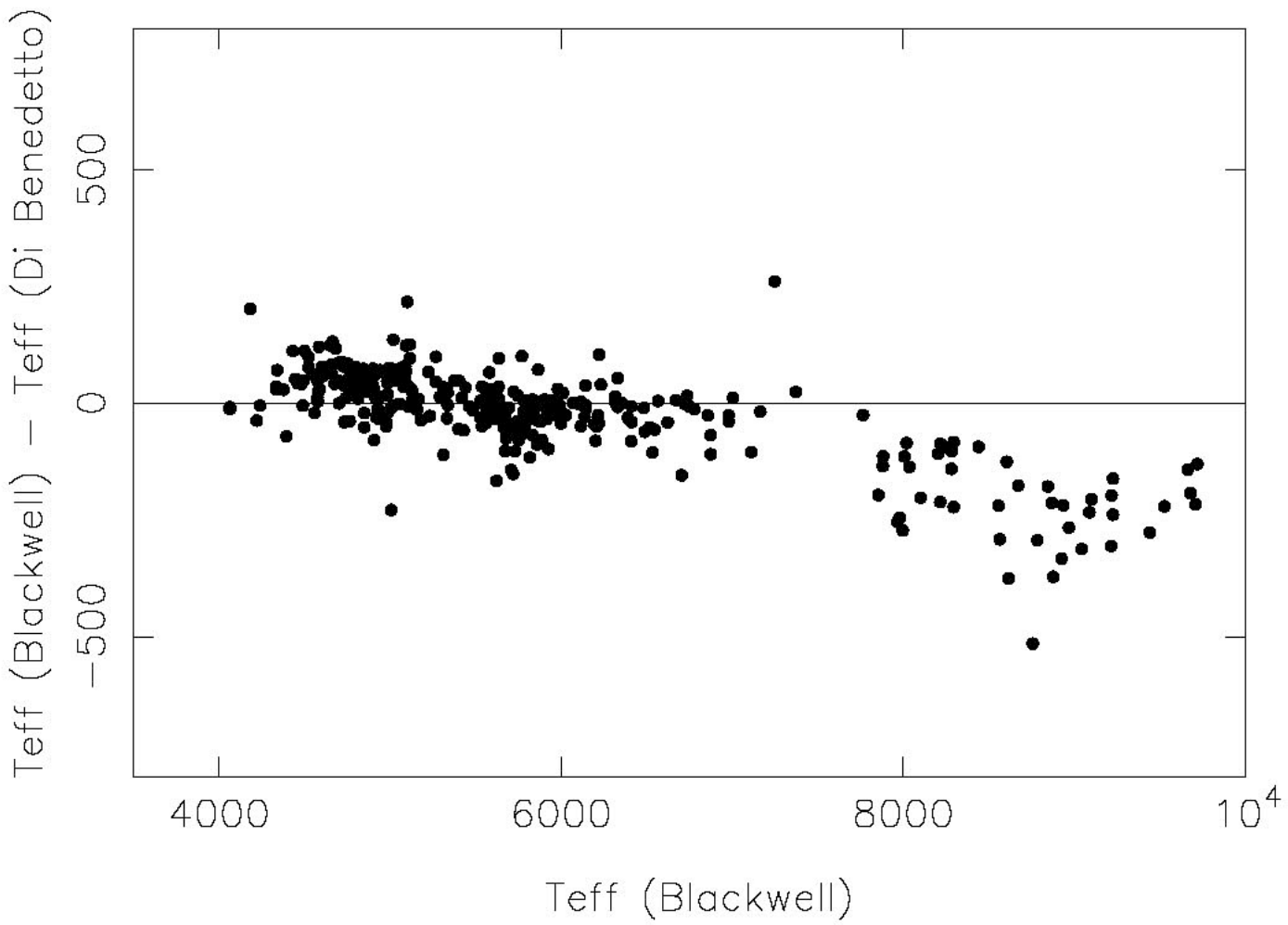
The catalogue of atmospheric parameters

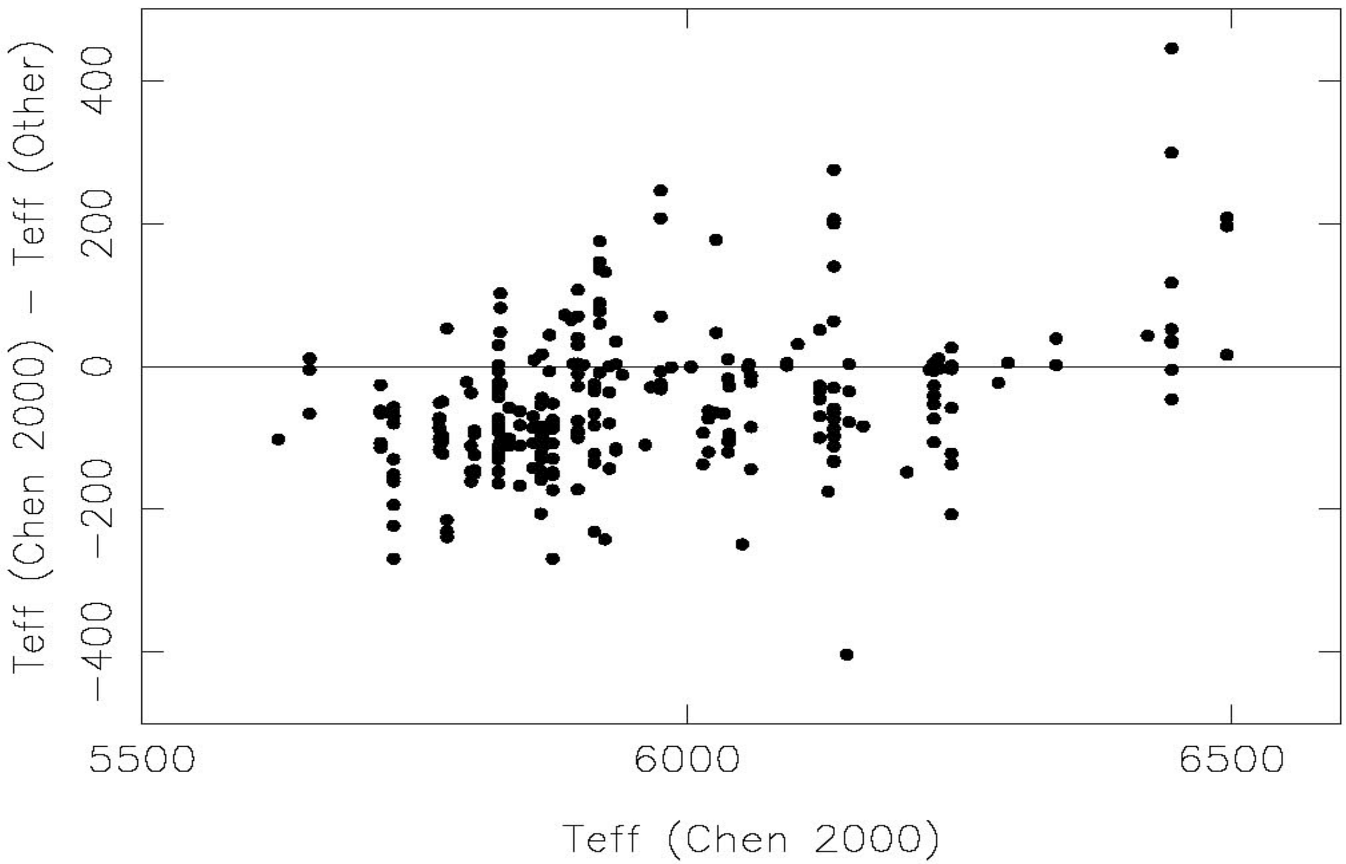
è provide a single set of parameters for each star : average but authors do not use the same temperature scales, the same methods, the same physics --> systematic differences

è Teff : interferometric, IRFM, Hα profile, line depth ratio, photometric calibrations (empirical or theoritical) - Random errors 50-100K, systematics up to 200 K in the FGK regime

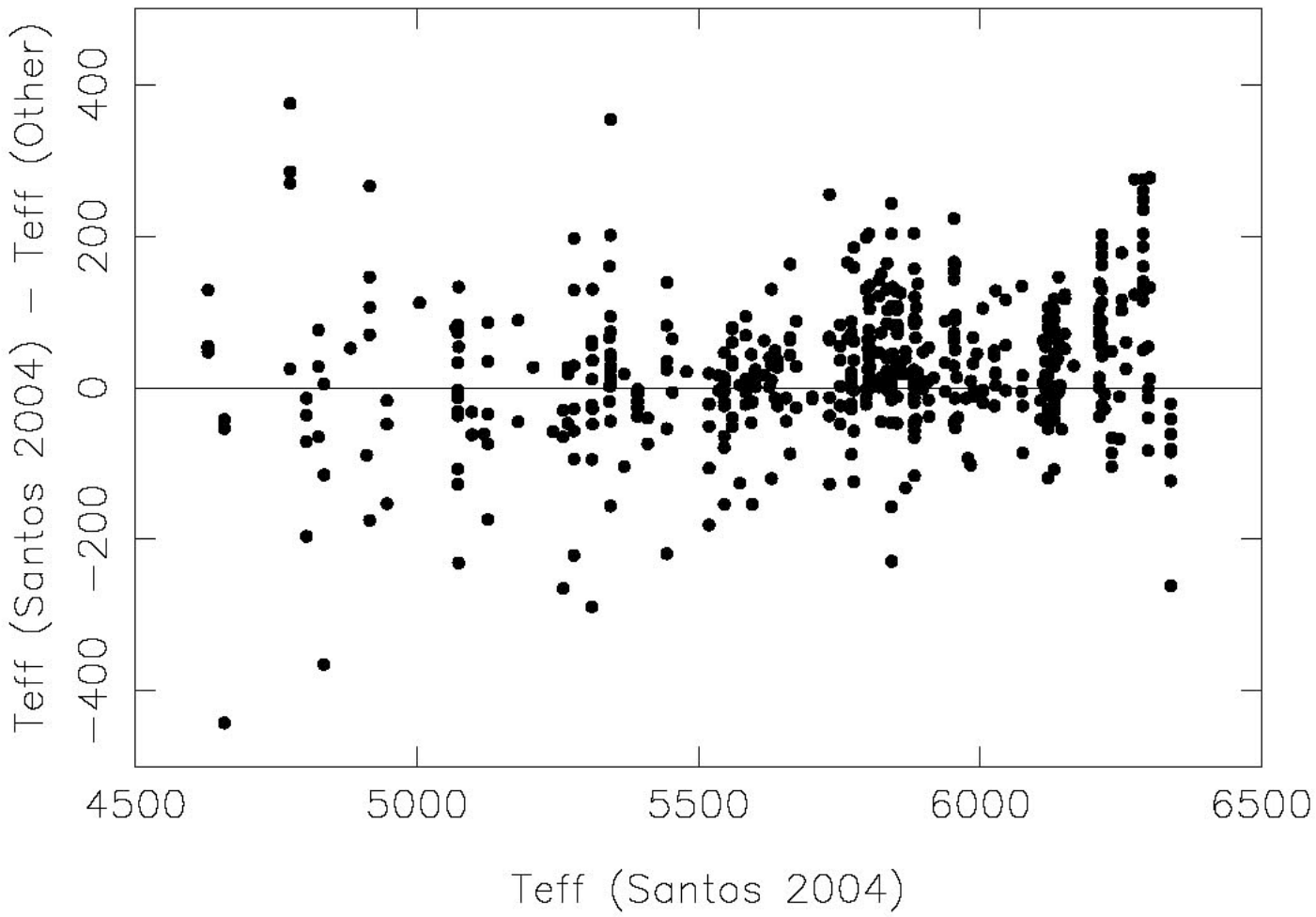
è logg : Hipparcos, ionization balance, random errors 0.20, systematics up to 0.8

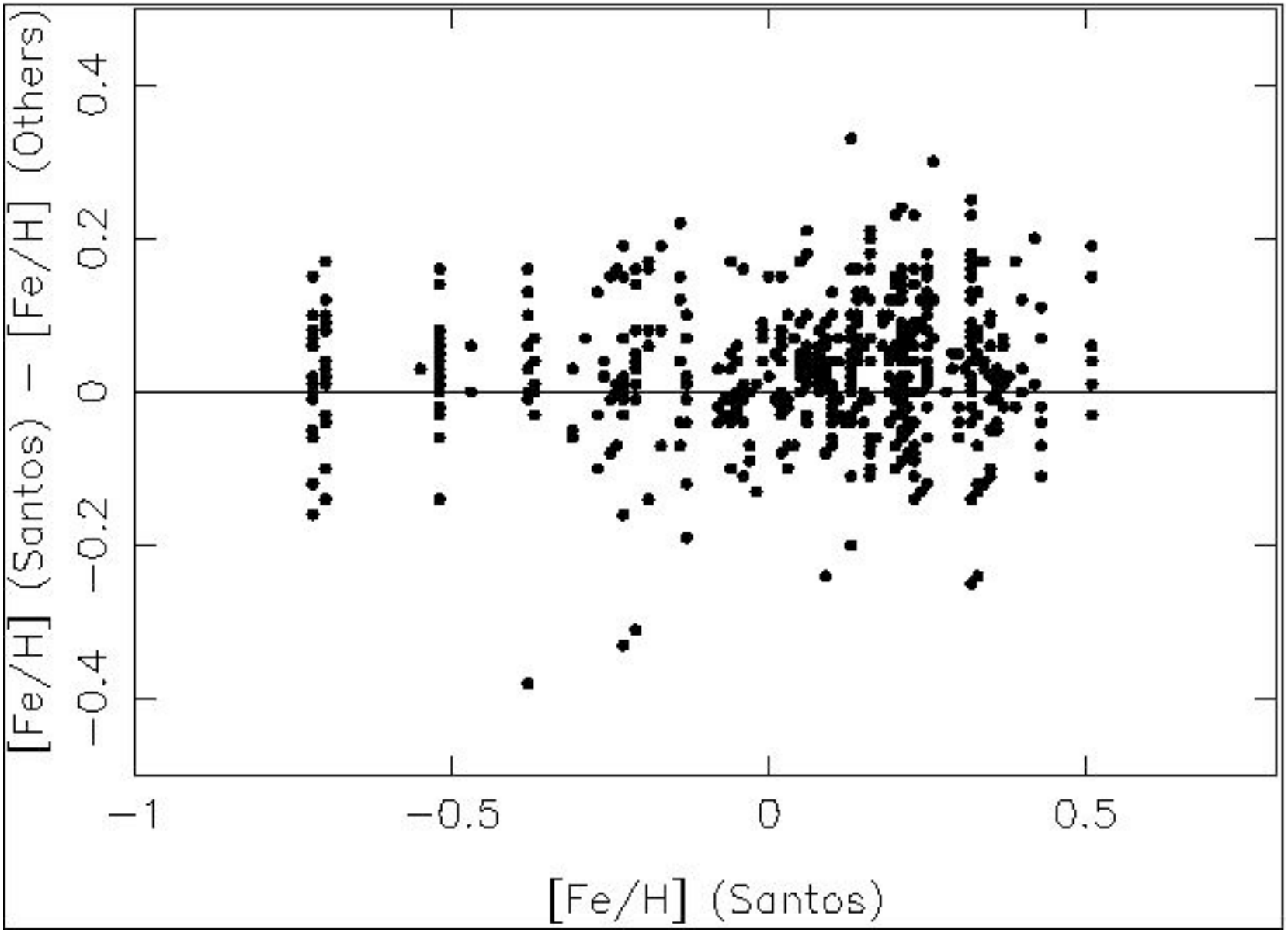
è [Fe/H] : typical accuracy 0.1 - 0.2

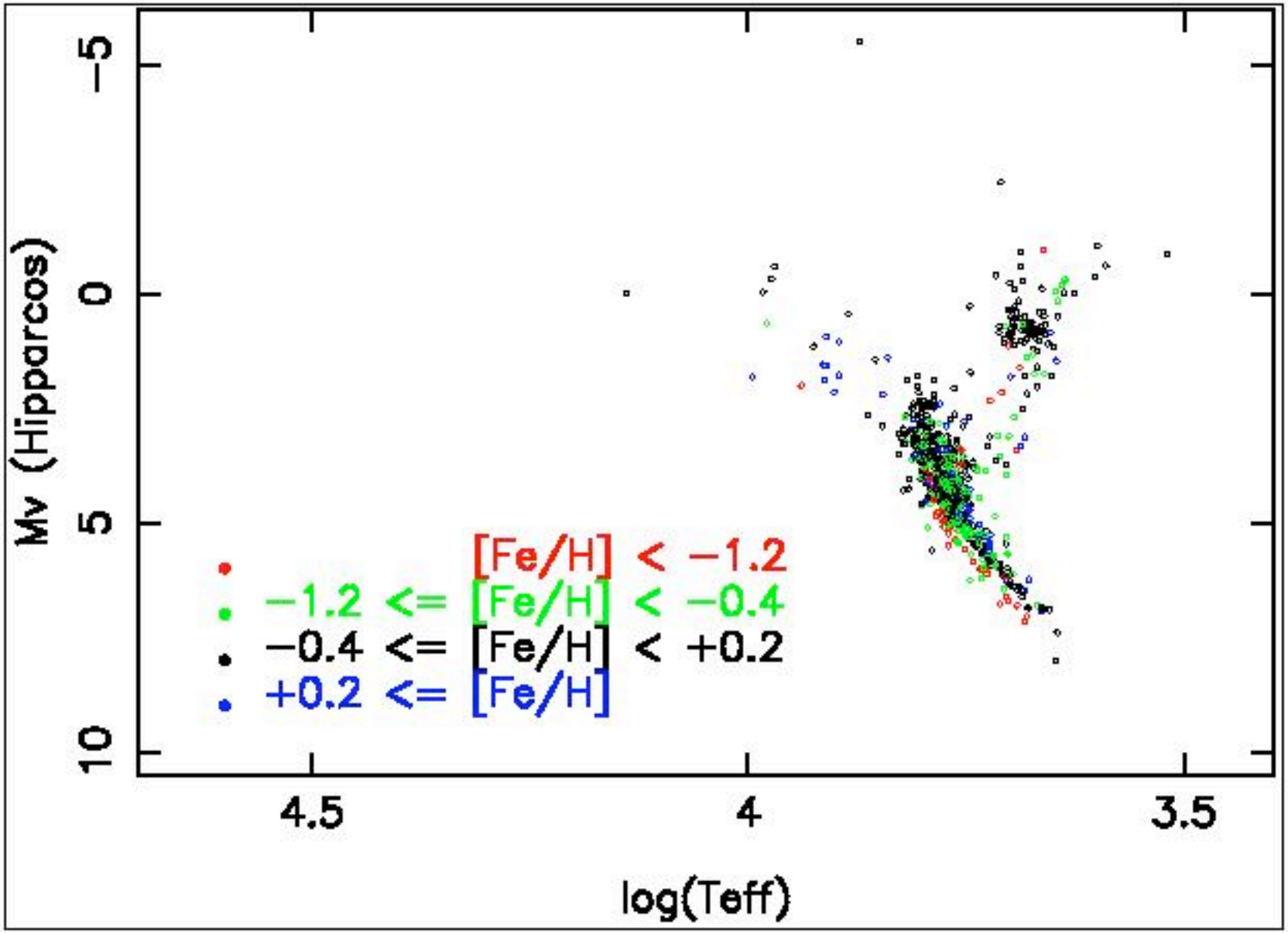

Teff (Blackwell) − Teff (Di Benedetto)
500
0
−500
4000
6000
8000
10^4
Teff (Blackwell)



Teff (Chen 2000) − Teff (Other)
400
200
0
−200
−400
5500
6000
6500
Teff (Chen 2000)


Teff (Santos 2004) – Teff (Other)
400
200
0
−200
−400
4500
5000
5500
6000
6500
Teff (Santos 2004)


[Fe/H] (Santos) − [Fe/H] (Others)
0.4
0.2
0
−0.2
−0.4
−1
−0.5
0
0.5
[Fe/H] (Santos)


Mv (Hipparcos)
−5
0
5
10
4.5
4
3.5
log(Teff)
[Fe/H] < −1.2
−1.2 <= [Fe/H] < −0.4
−0.4 <= [Fe/H] < +0.2
+0.2 <= [Fe/H]

other parameters have to be collected

è reddening to allow photometric calibrations

è elemental abundances : a catalogue of 700 stars is being constructed

è radial velocities : several catalogues available

è proper motions : hipparcos, tycho2

è distances, luminosities : hipparcos

è vsini, binarity, activity, ...

conclusion

è information on stellar fundamental parameters is very dispersed

è lack of homogeneity

è calibration of parametrization methods is necessary

è validation of synthetic spectra is necessary

è observation at high spectral resolution of cool dwarfs is necessary

è a census of the best studied stars in progress to furnish a reference set

è related to efforts in distribution of a large flow of new data (Pollux, AVO,...)