LAMOST-II Medium resolution spectroscopic survey

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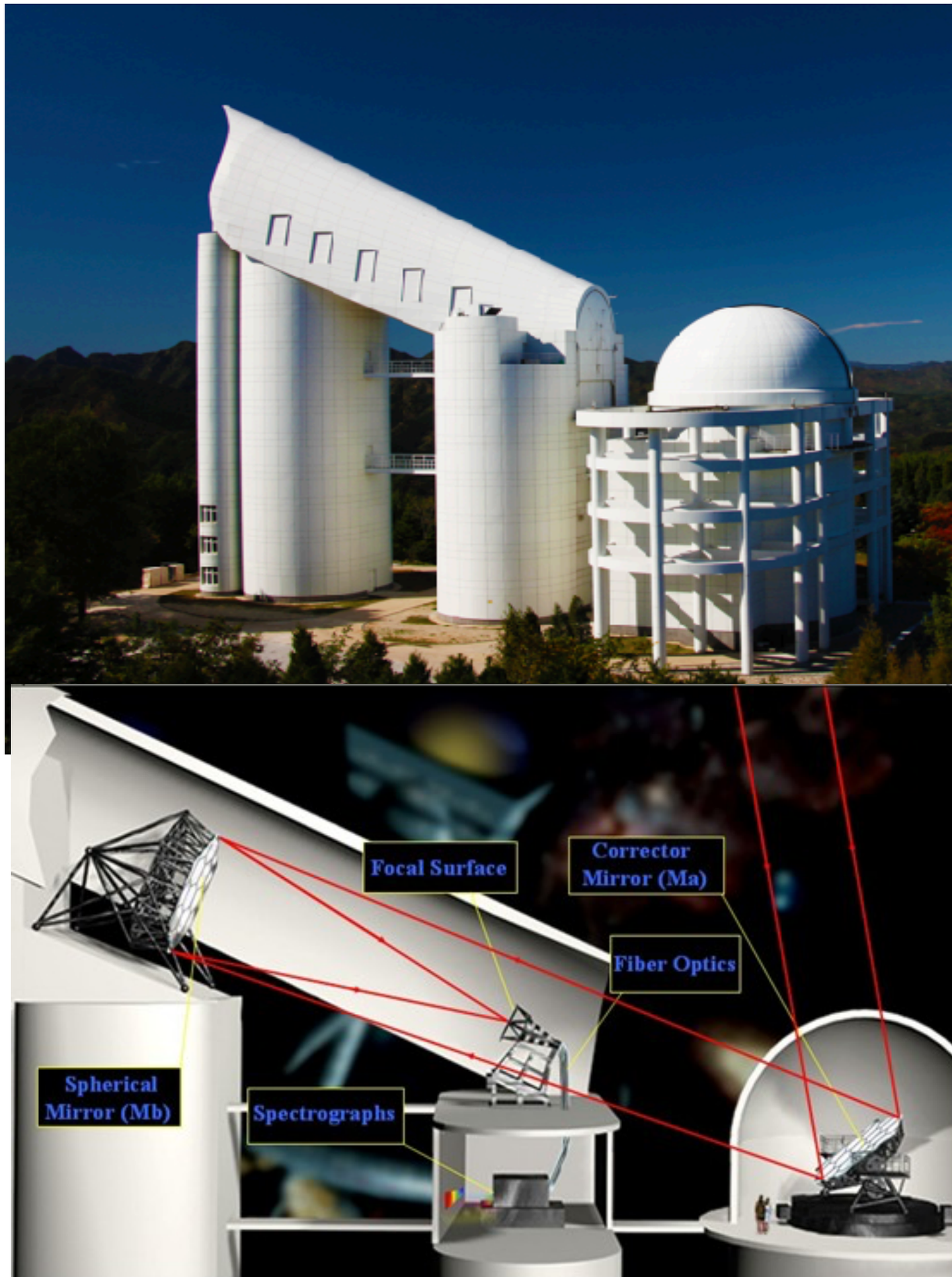
2019-03-13@Bamberg

LAMOST Telescope

- 4-meter reflective Schmidt telescope with segmental mirrors and active optics
- Quasi-meridian
- 4000 fibers on the 5 degree-FoV focal plane
- 16 spectrographs
- Low resolution spectra: R~1800, wavelength: 370-900nm



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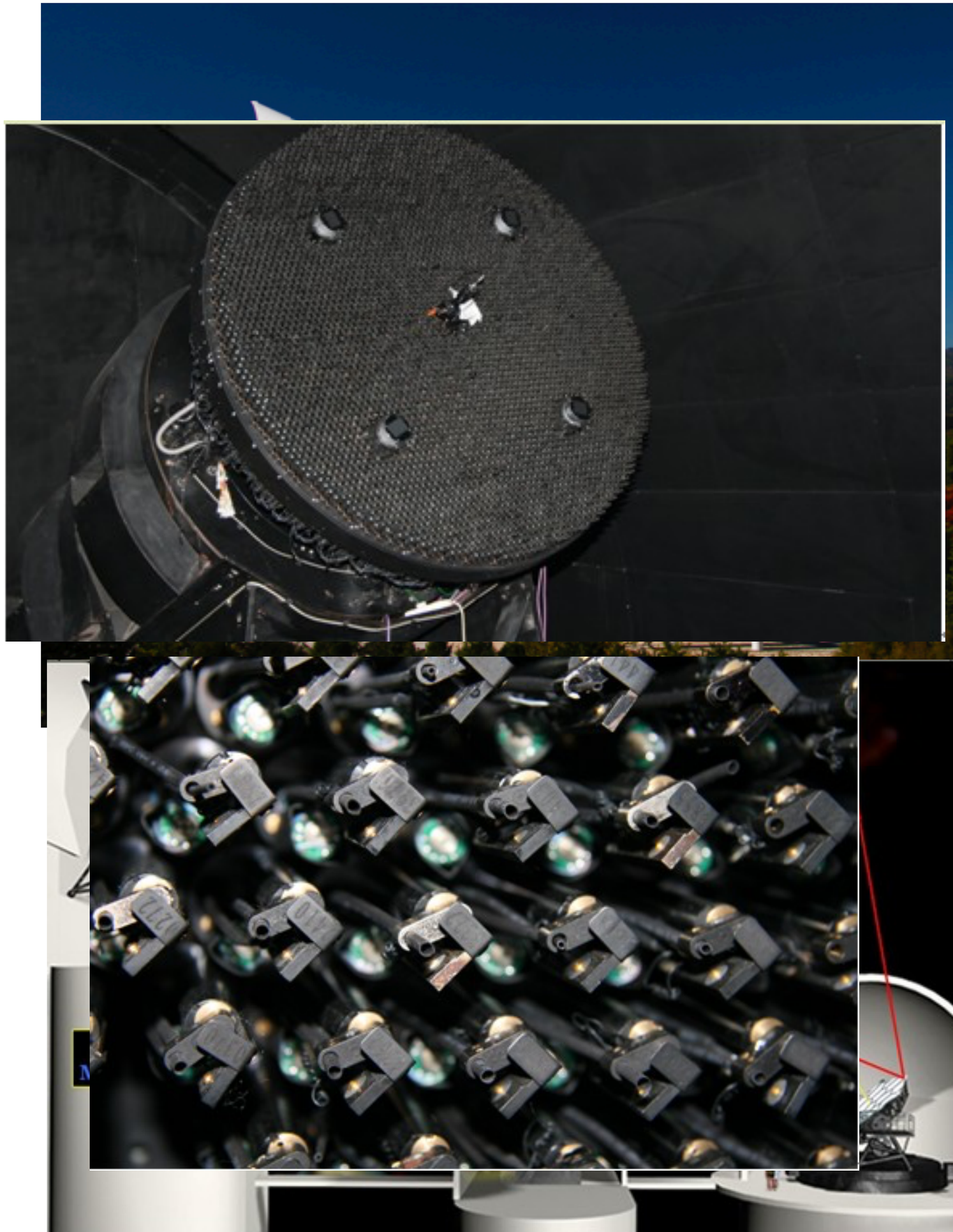

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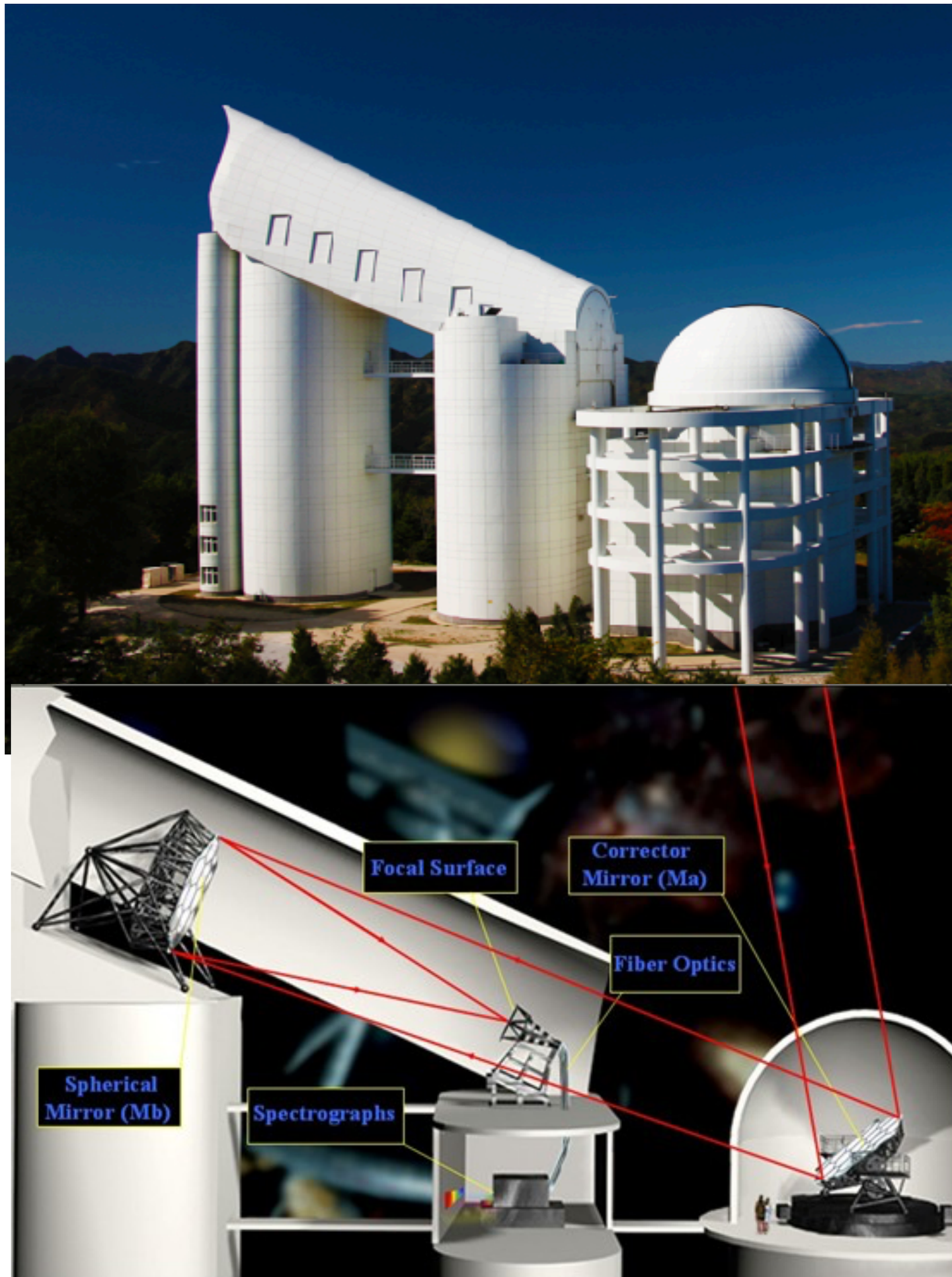
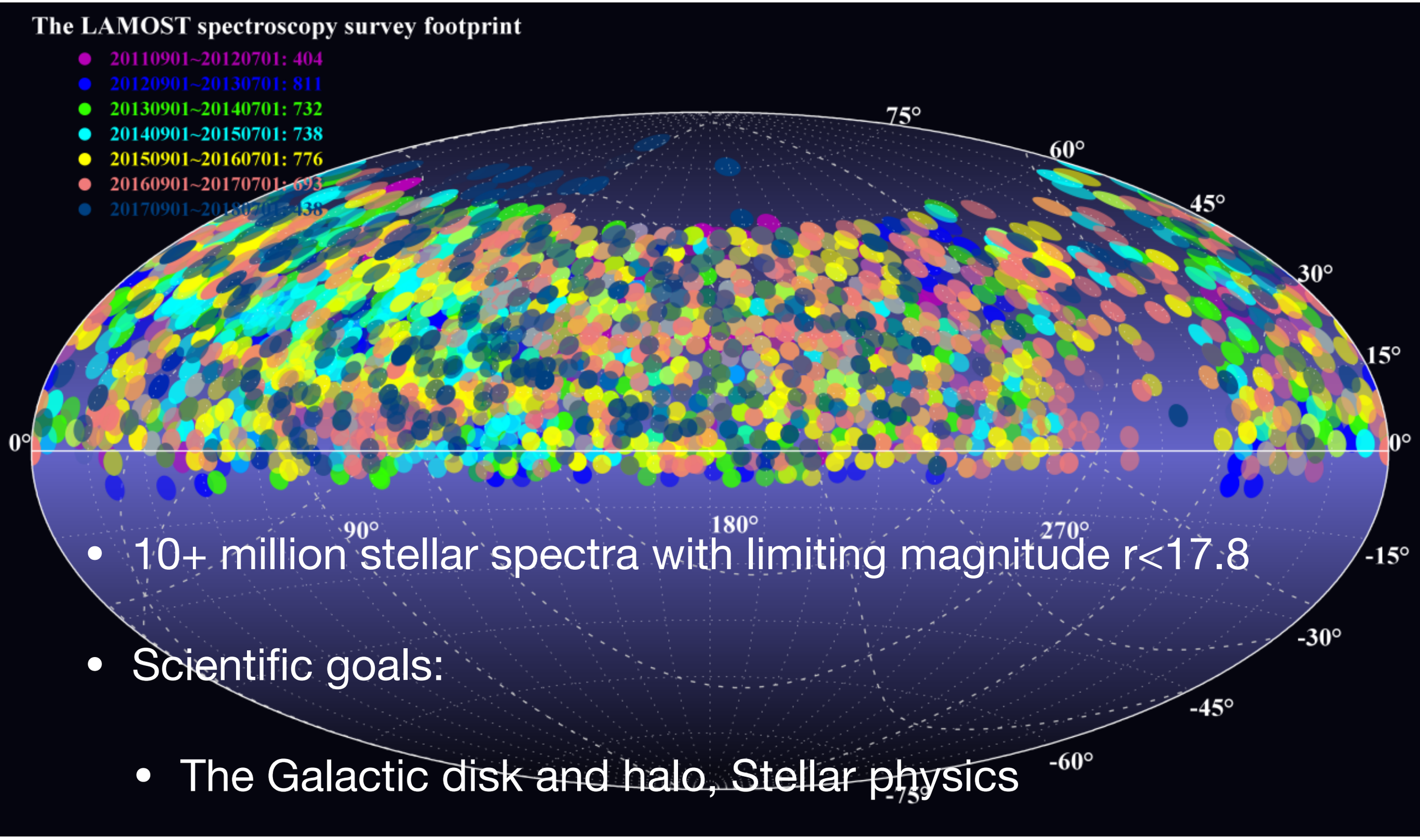
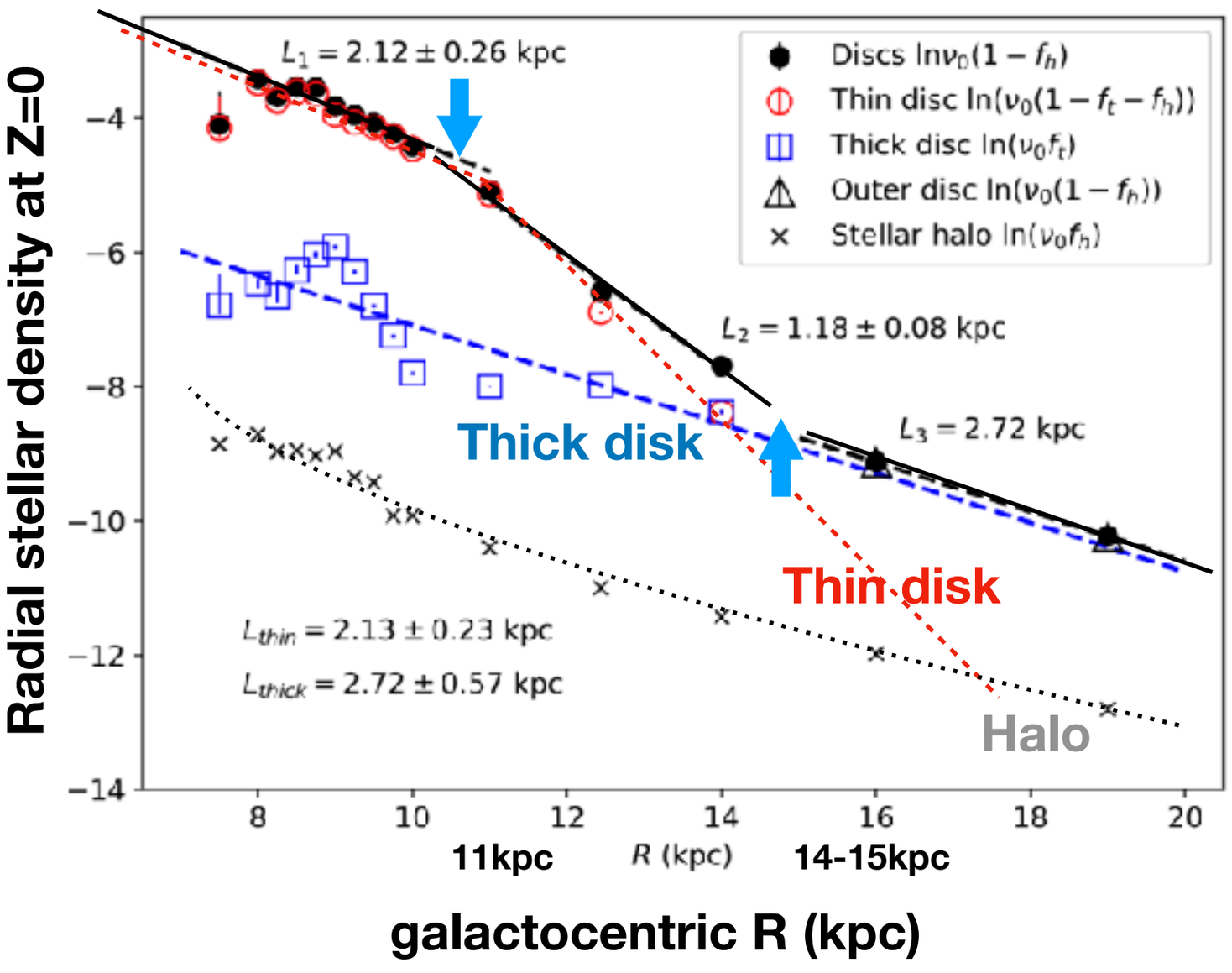


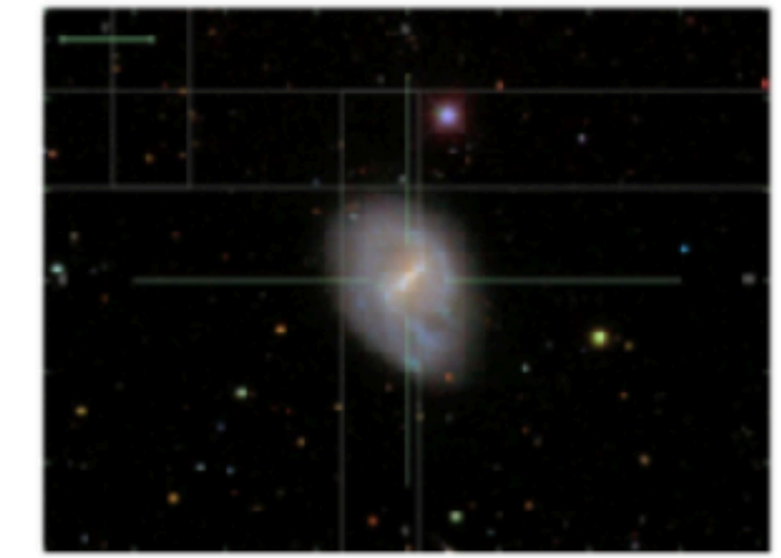


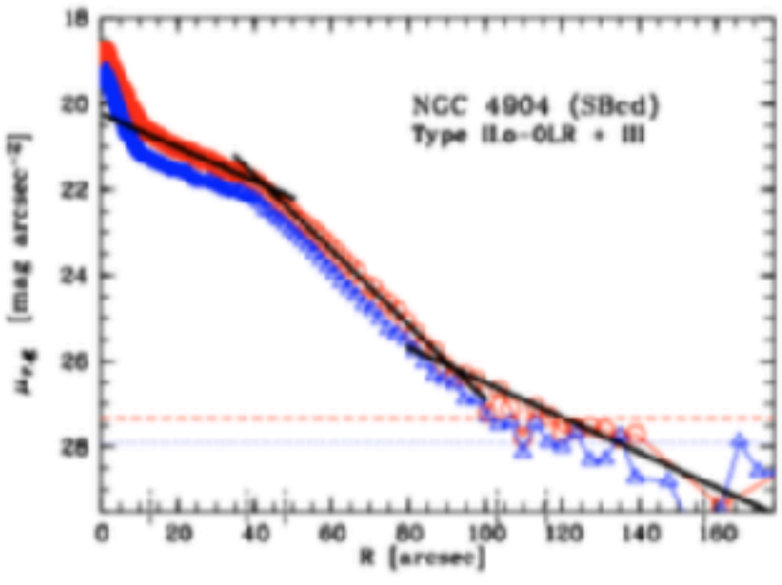
- 10+ million stellar spectra with limiting magnitude r<17.8
- Scientific goals:
  - The Galactic disk and halo, Stellar physics

Type II+III radial density profile

Thin+Thick disks



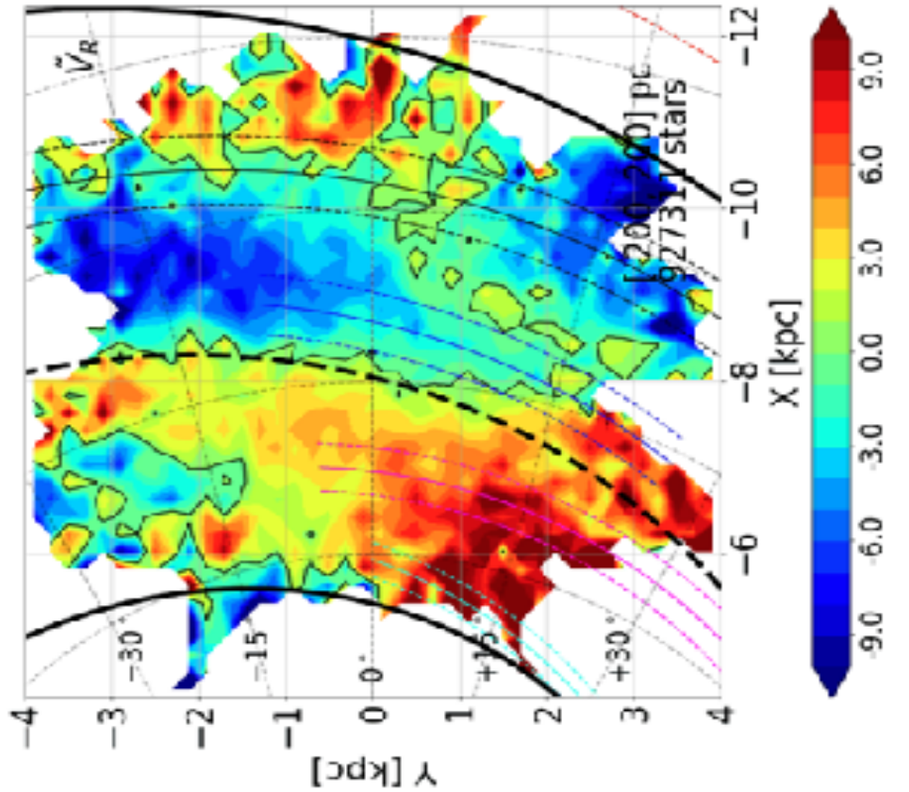




Pollen et al. 2006

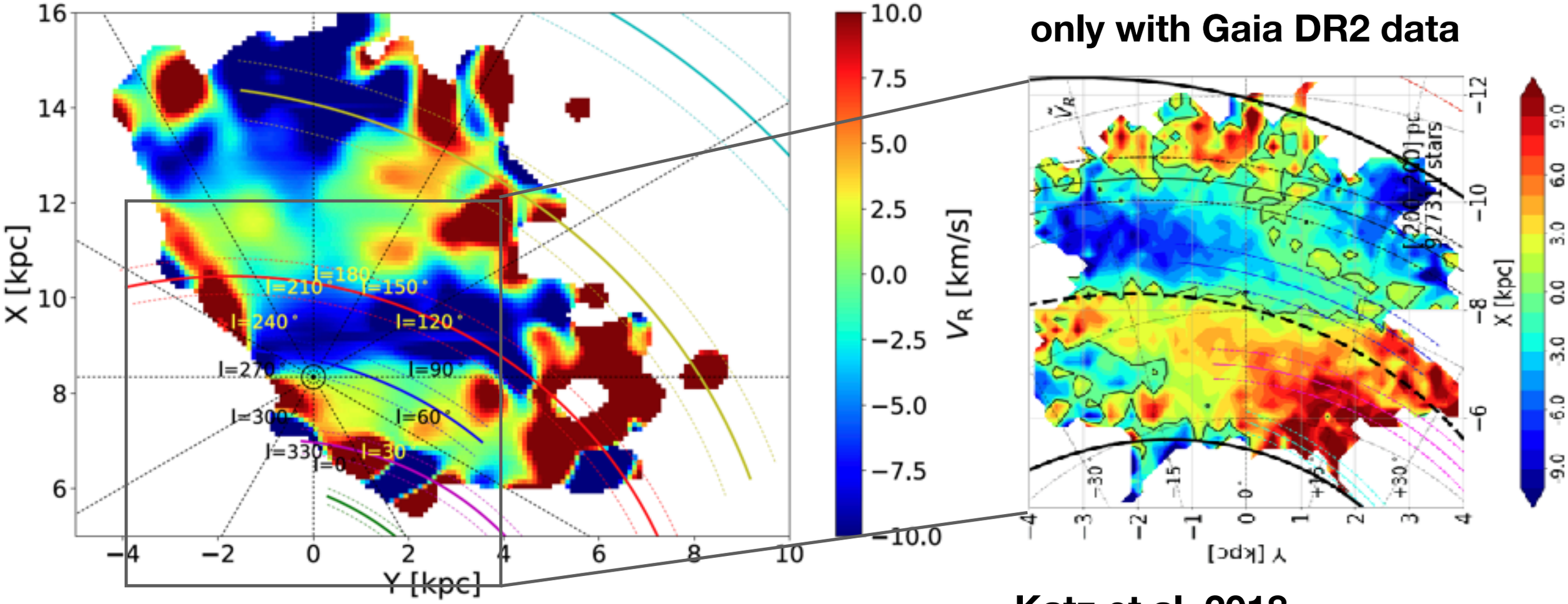
Wang, **LC** et al. 2018

only with Gaia DR2 data



Katz et al. 2018

Cheng, LC et al. 2019, using 12000 OB stars



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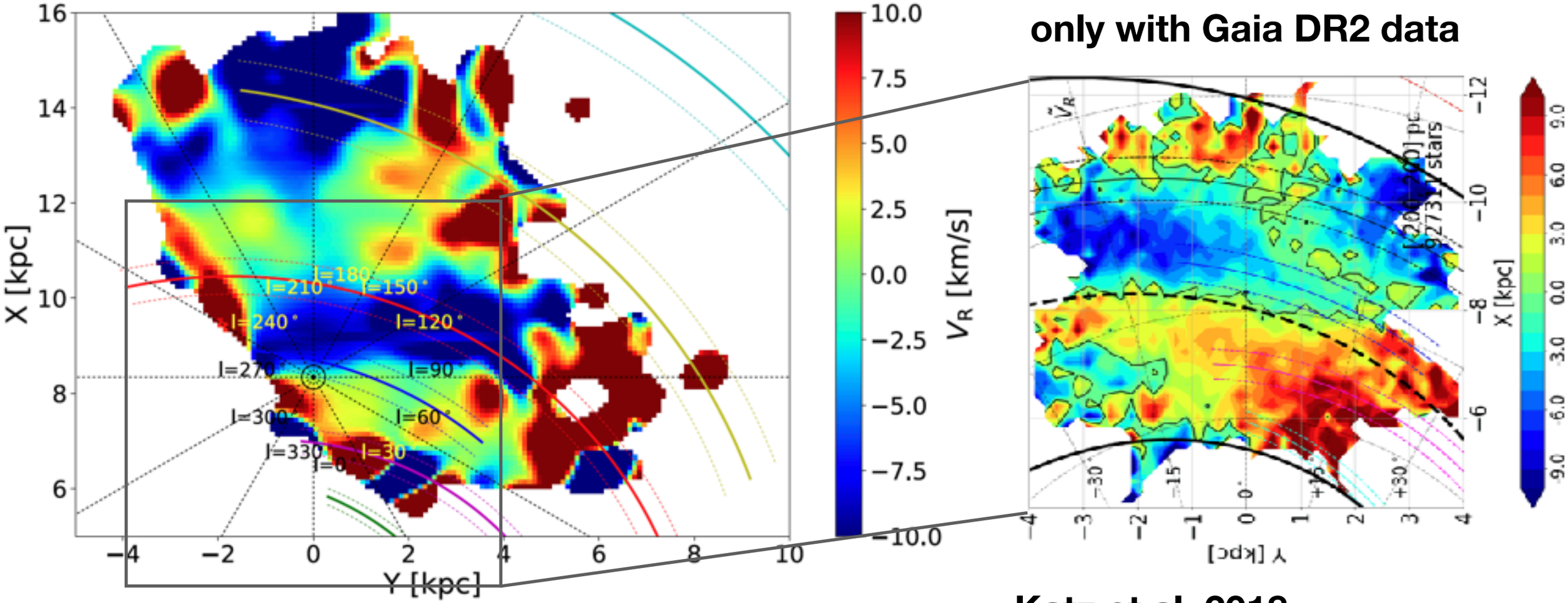
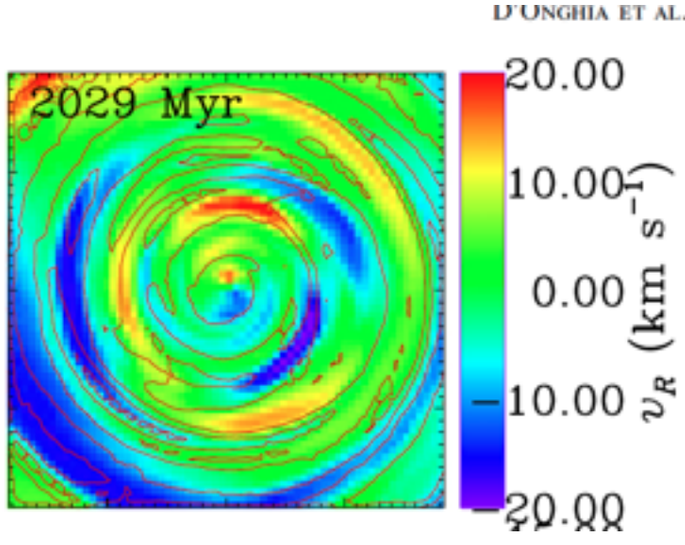


Katz et al. 2018

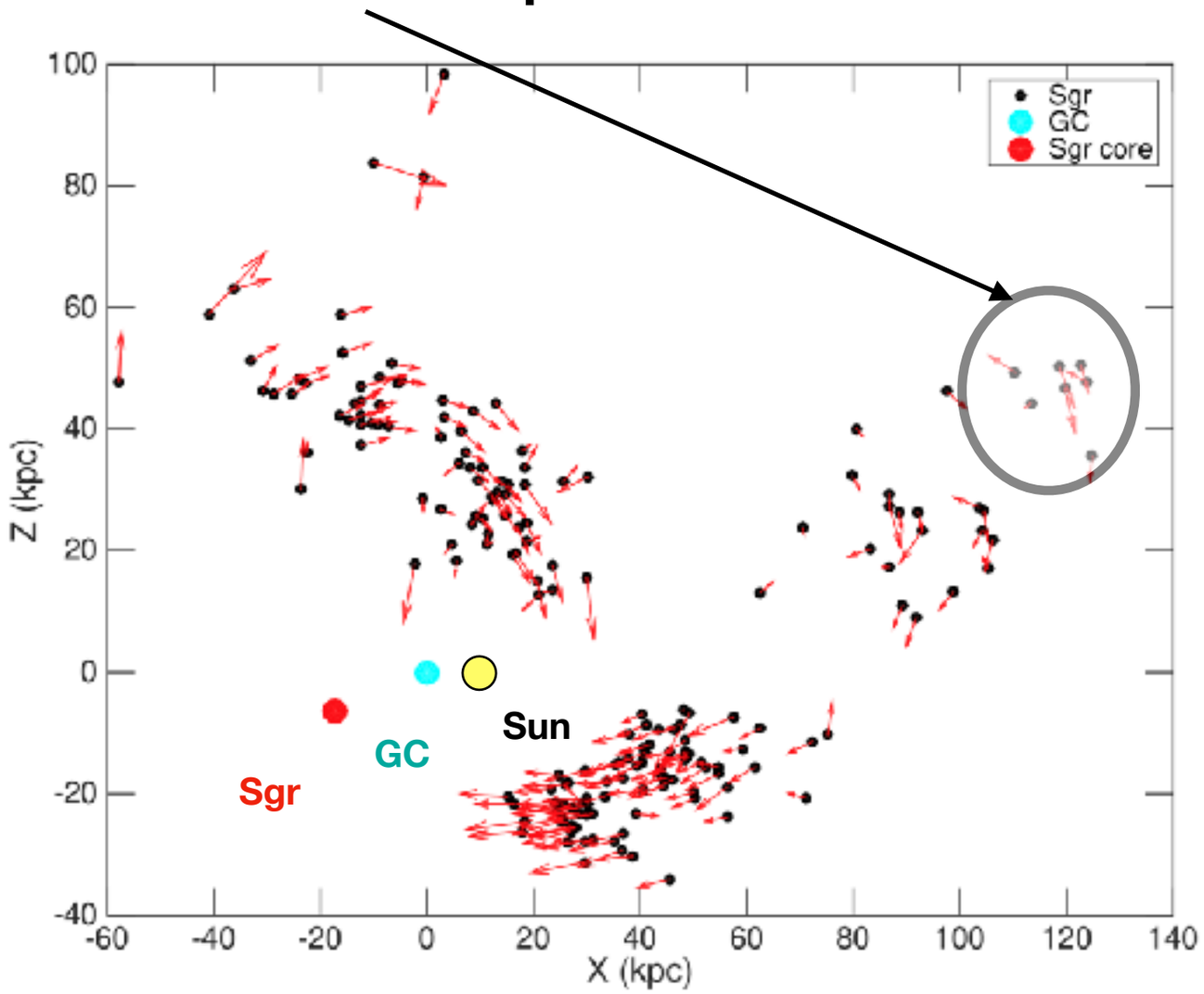


D'Onghia et al. 2016, simulation

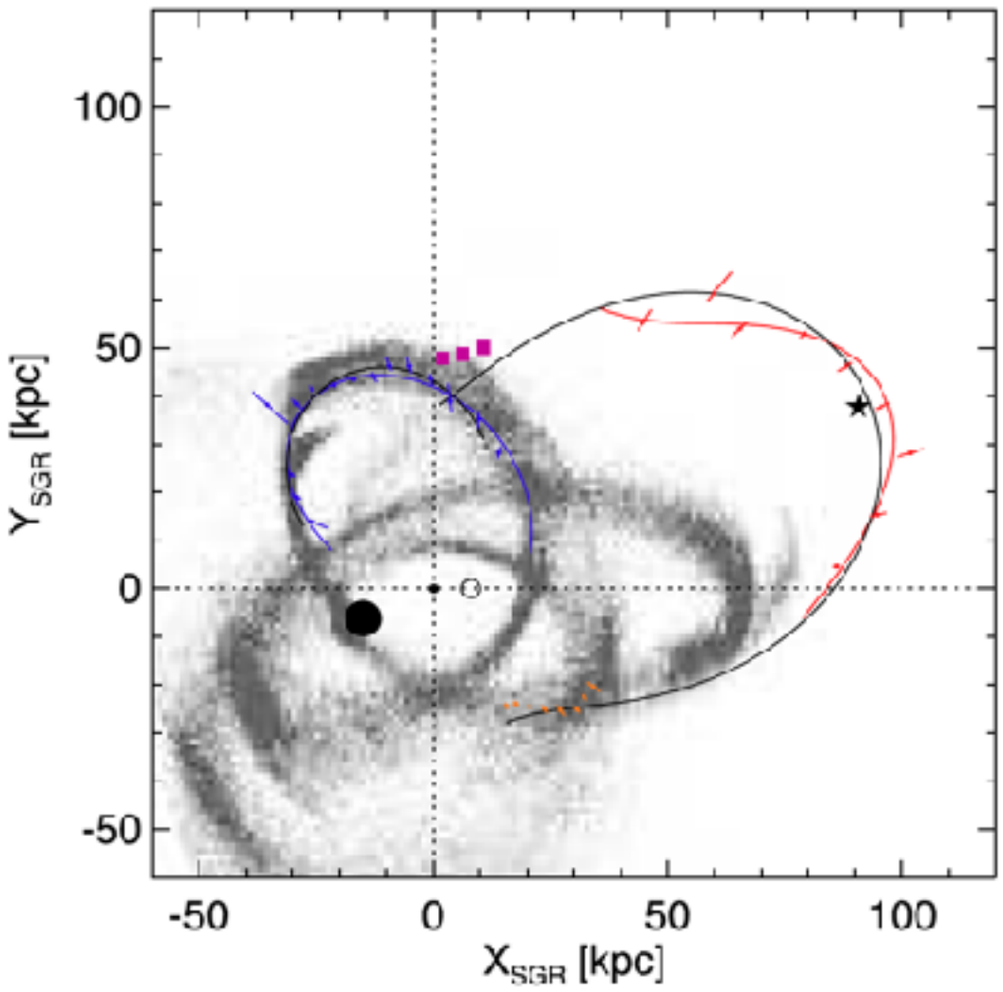
Better view of Sgr stream

LAMOST M-giants + Gaia proper motions

More than 100 kpc



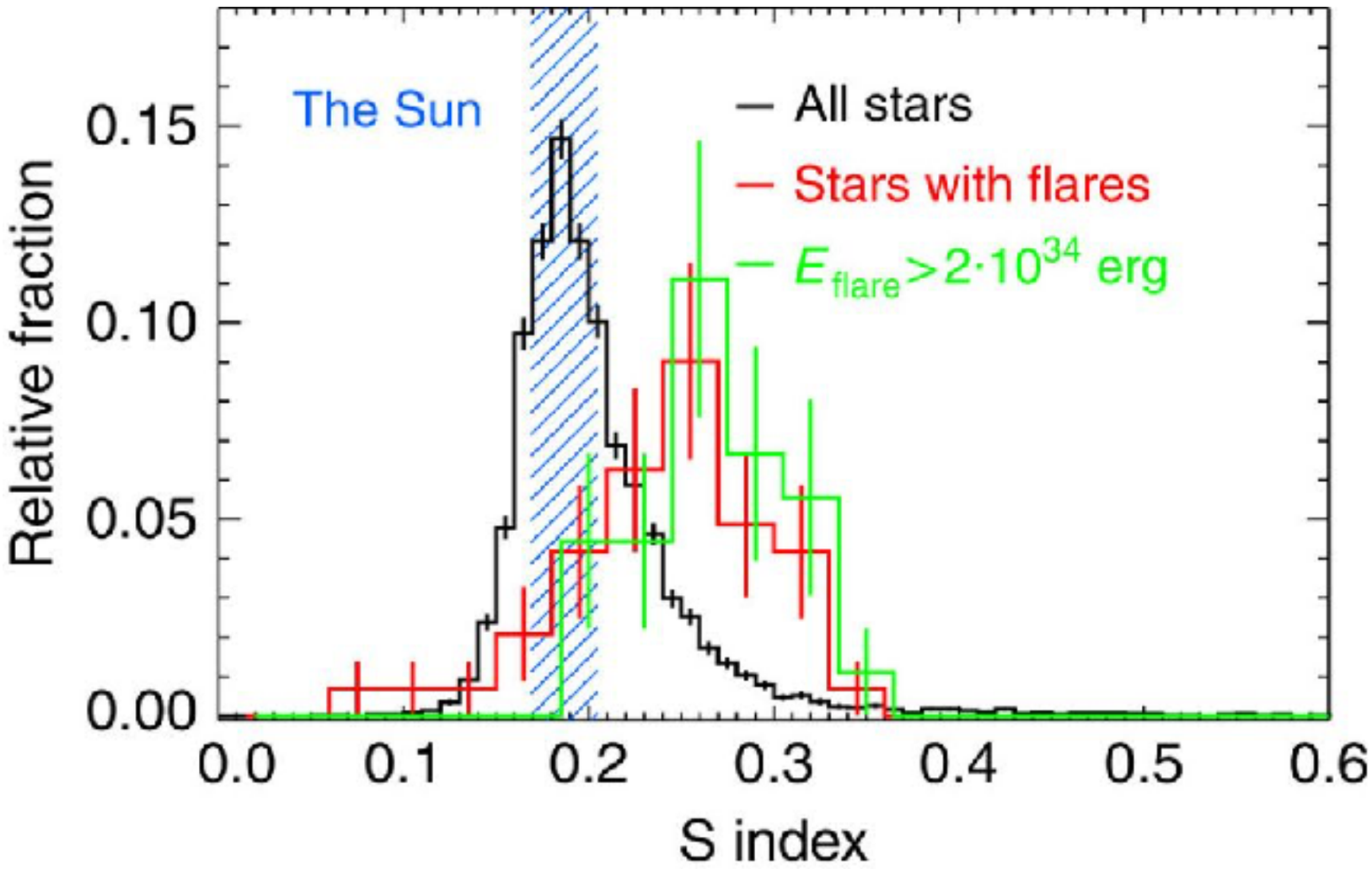
Li, **LC** et al. 2019



Belokurov+2014

Stellar physics

Karoff et al. 2016



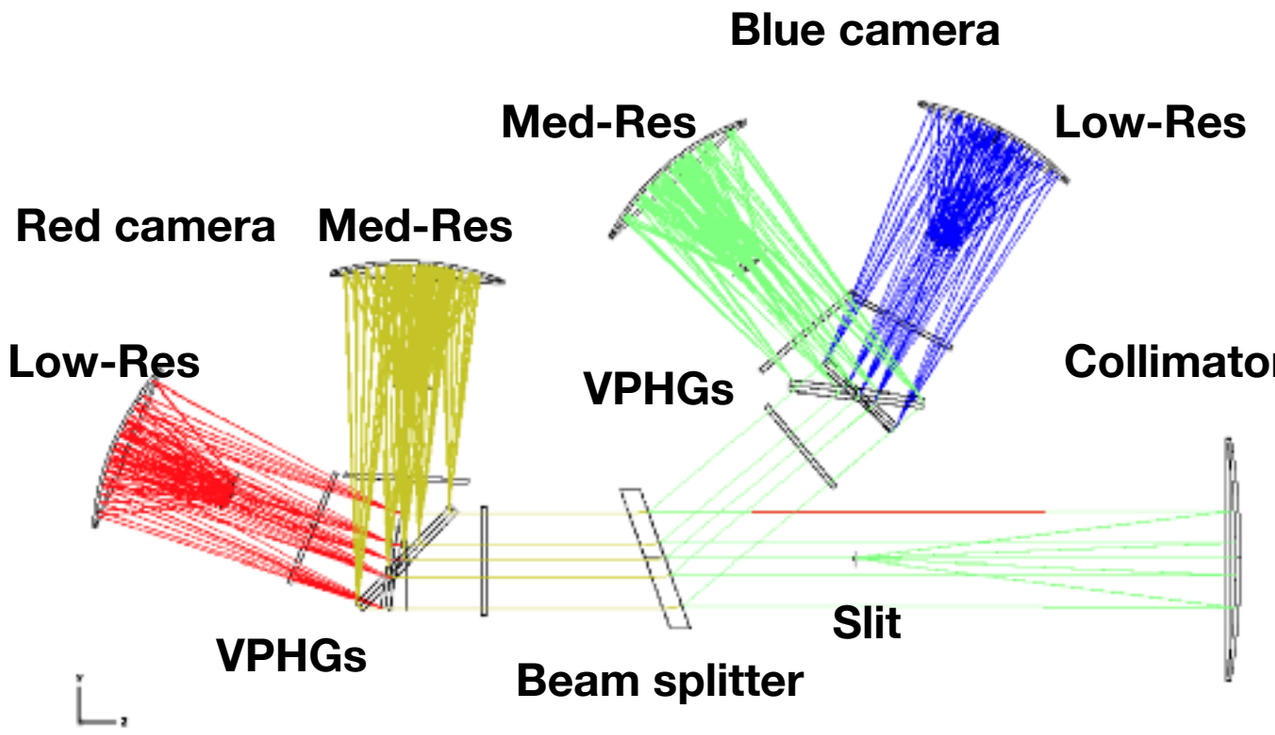
Chromospheric activity

Upgrade the spectrographs

- Gratings are upgraded to R~7500

- Blue arm: 496-533 nm (Mg Triplet, metal lines)

- Red arm: 630-680 nm (Halpha, Li)



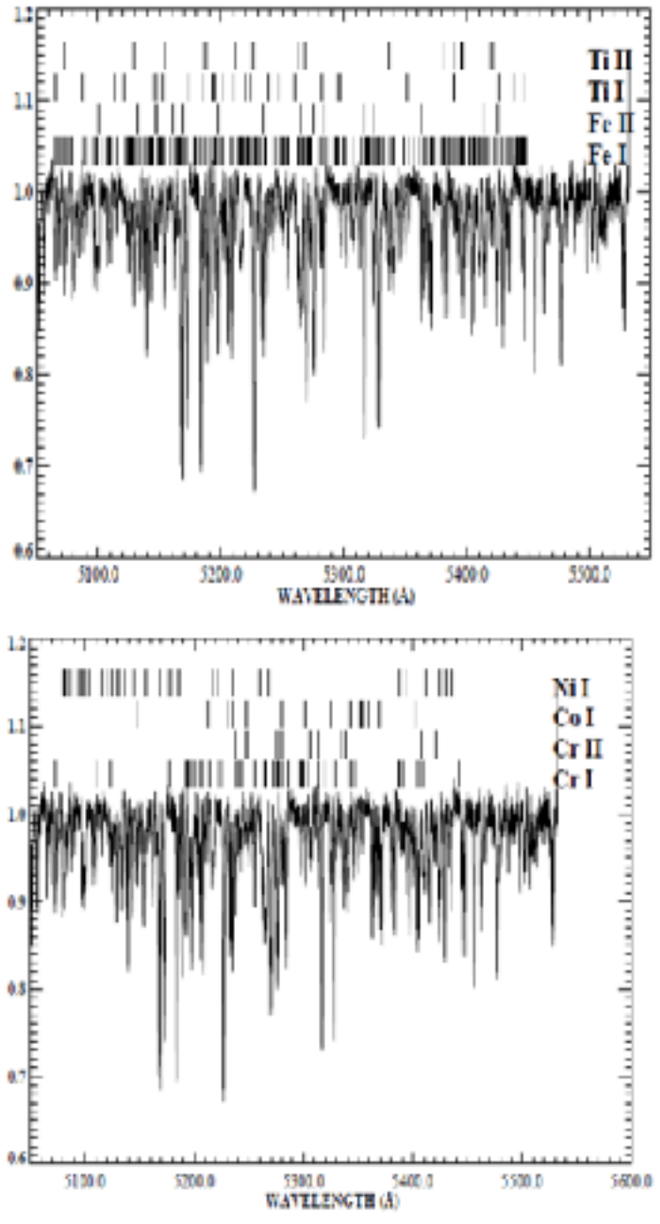
Information extracted from med-res spectra

- Teff, logg, [Fe/H], [alpha/Fe]

- around 20 elemental abundances: C, Na, Mg, Ca, Si, Ti, Sc, Cr, Fe, V, Mn, Co, Ni, Cu, Ba, Y, Sm, Nd, Li etc.

- accurate radial velocity ~1 km/s

- stellar rotation: vsini~10 km/s



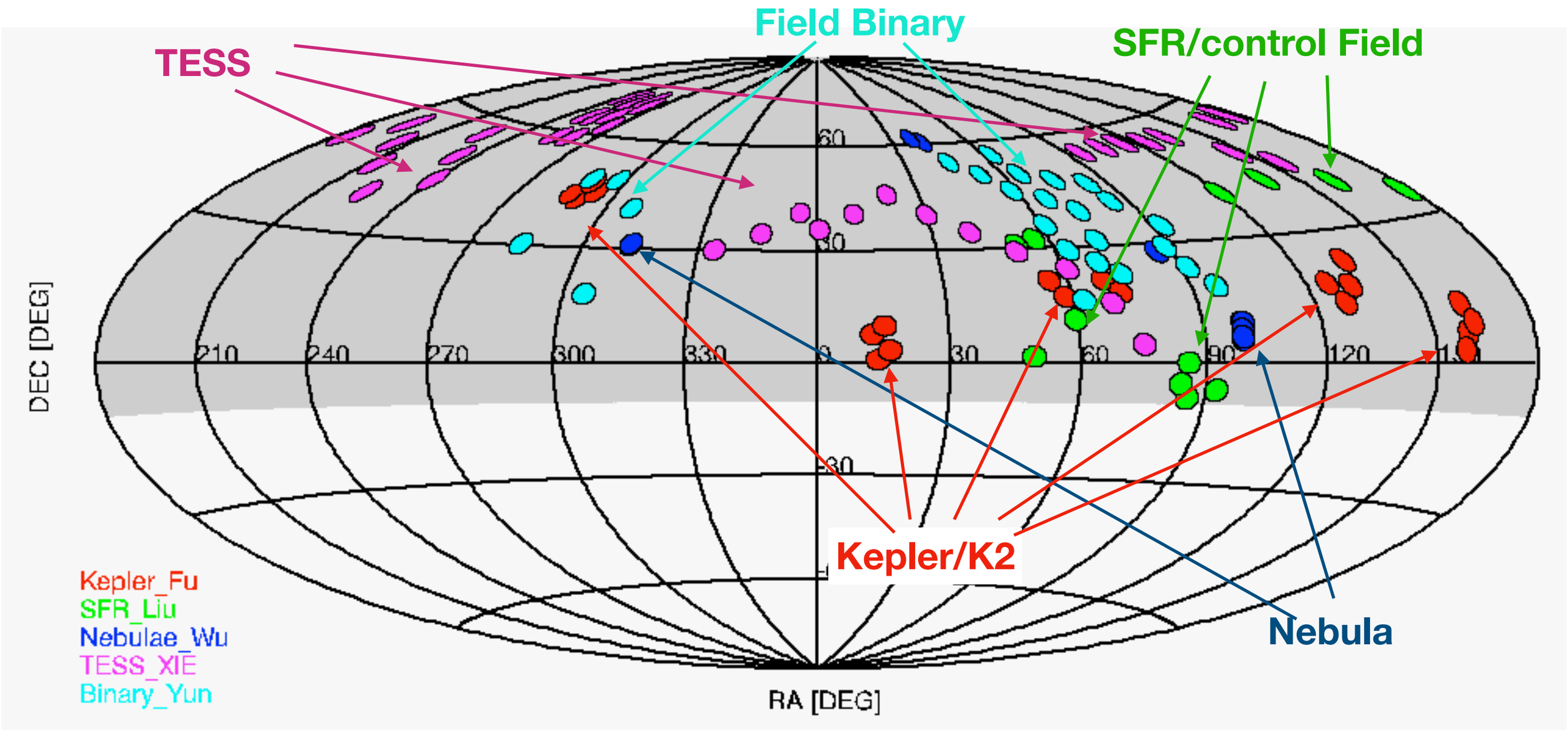
Survey plan of LAMOST II

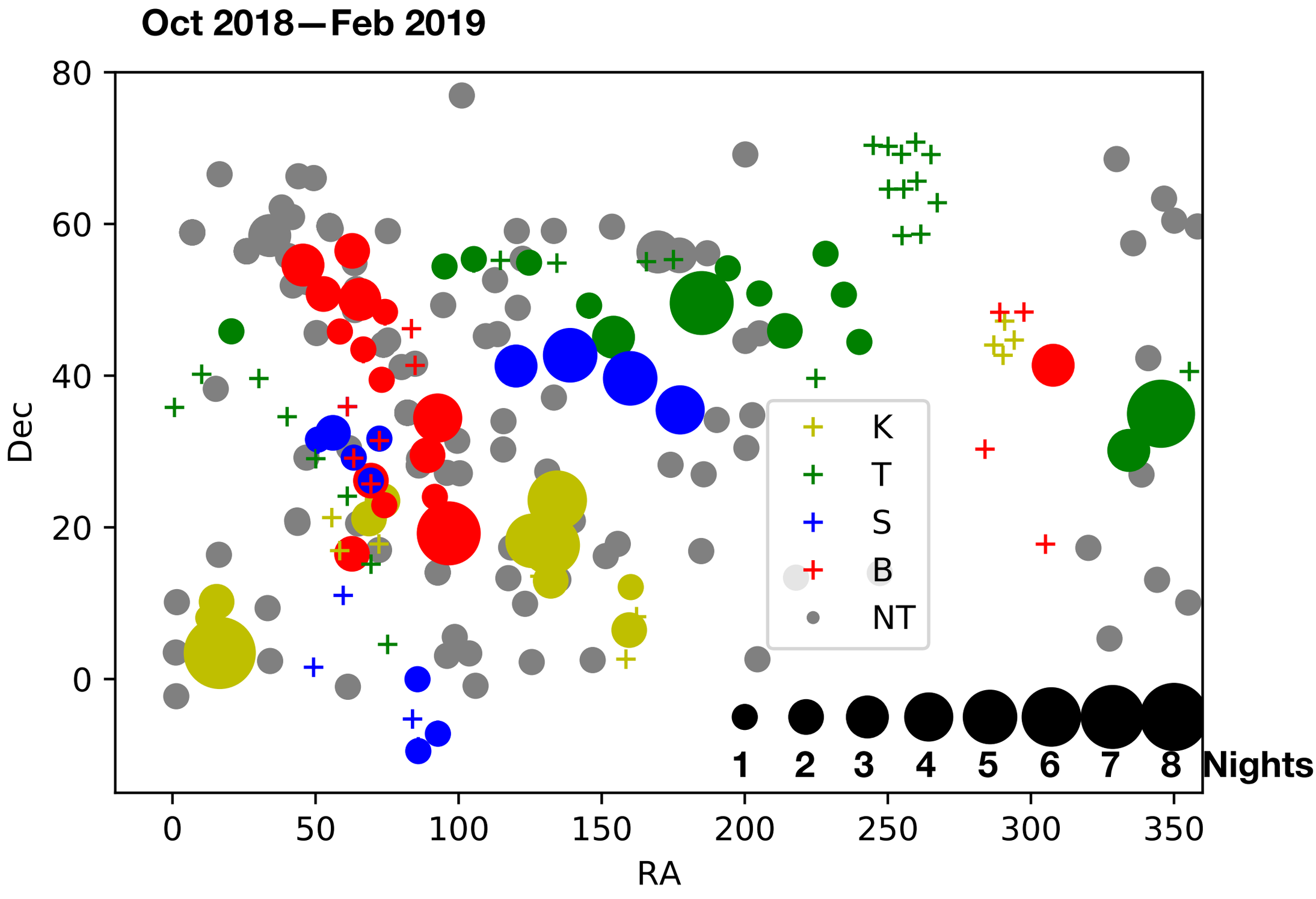
- 5-year survey: Oct 2018-Jun 2023
- Dark/gray nights (13-14 nights/month): low-res survey same as LAMOST I
- Bright/gray nights (13 nights/month): med-res survey (MRS)
- Expected numbers of spectra
    - low-res: ~3 million more spectra with 1.5h exposure (stars + galaxies + QSOs), r<~18
    - med-res: **~2 million stellar spectra** (20'*3 exposure),**G<15**
    - med-res: **~200 K stars with time-domain spectra** (20'*n_epoch, <n_epoch>~60), **G<14**

Time-domain spectroscopic survey

- Observation mode & products
    - short exposure (~20min) multiple epochs per night (~8 exposures per night)
    - each exposure reaches G<14 at S/N>10
    - average 60 epochs for each field in 5 years
    - In total 100 time-domain fields with 20 sq. deg.

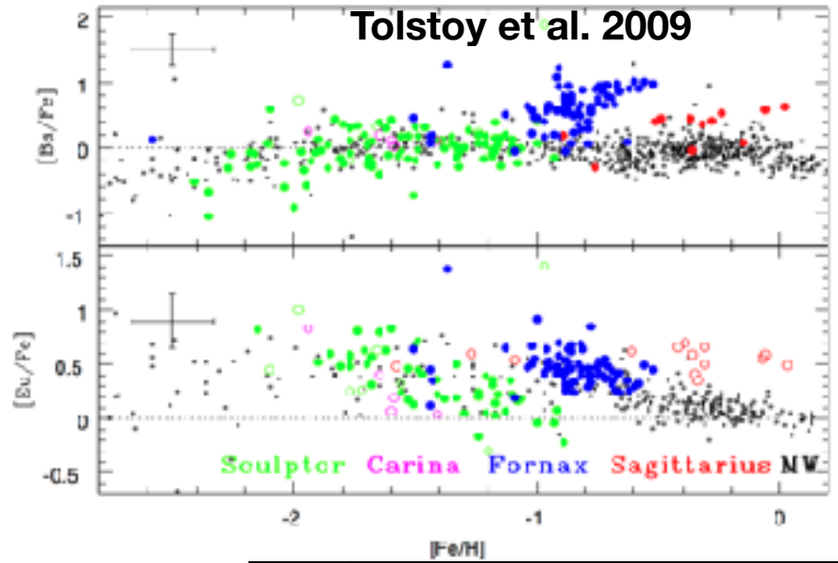
Footprints of time-domain regions

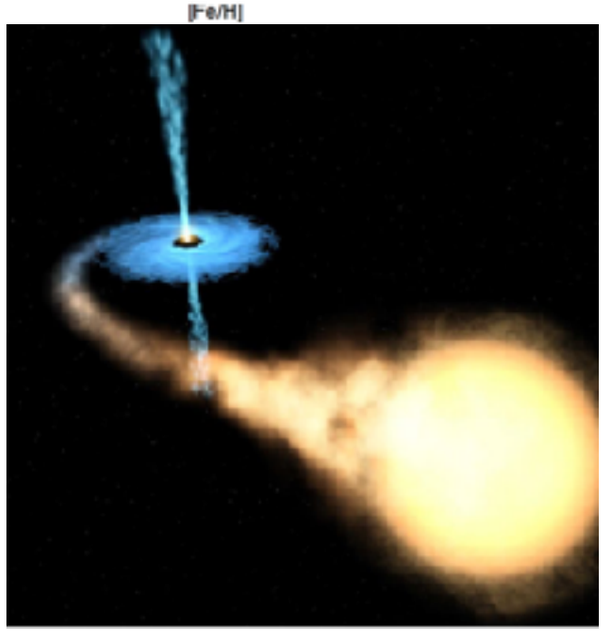


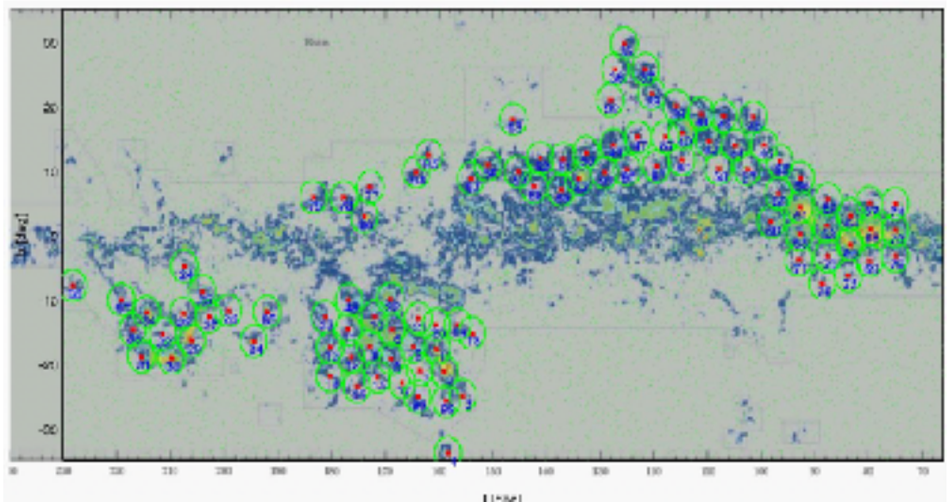

Oct 2018—Feb 2019
80
60
40
20
0
Dec
0
50
100
150
200
250
300
350
RA
K
T
S
B
NT
1
2
3
4
5
6
7
8
Nights

Scientific goals

- Galactic archeology
- Star forming region: Young populations
- Kepler/K2 & TESS: Variables, binaries, exoplanet hosts
- Fields: binaries
- Open clusters
- Galactic nebula: HII region, SNR, PNe

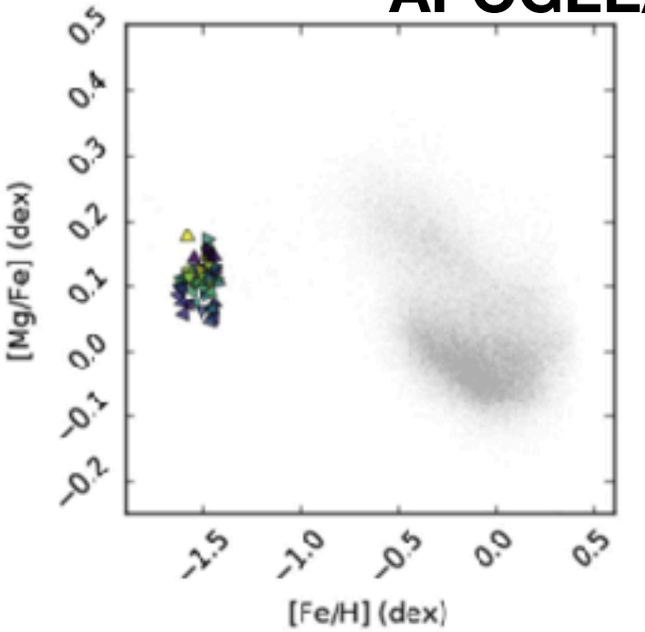


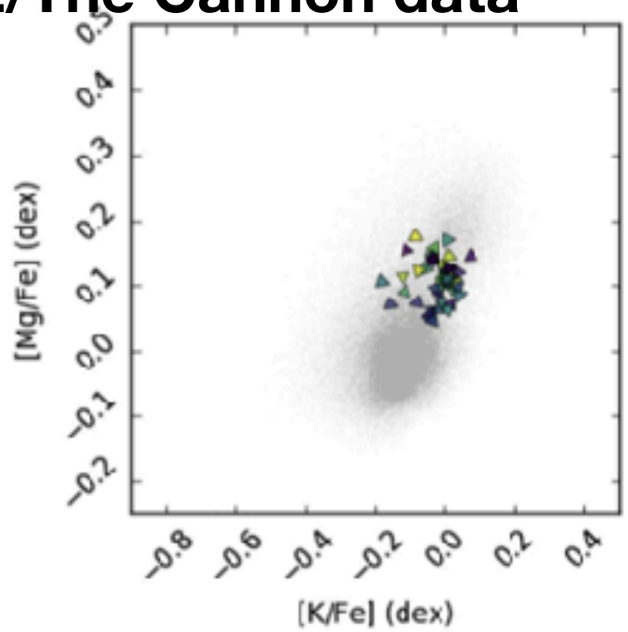


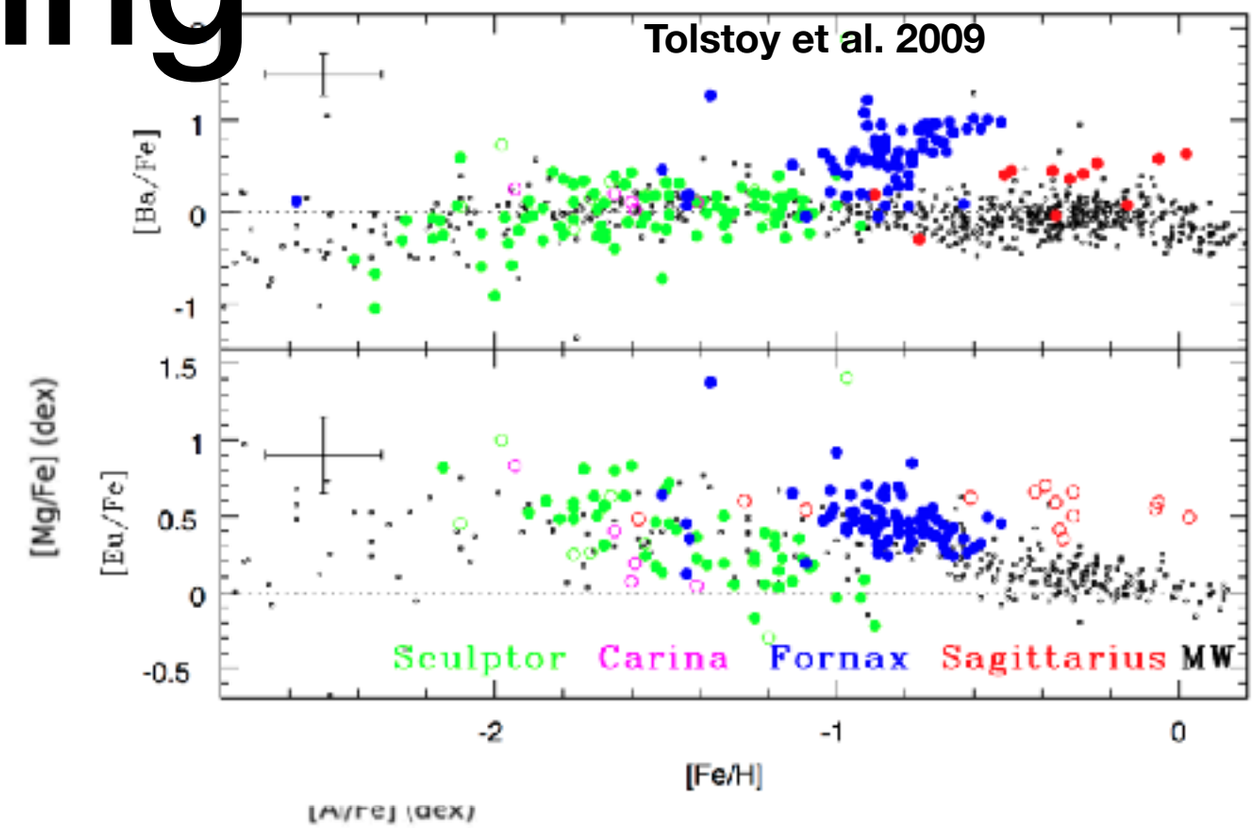


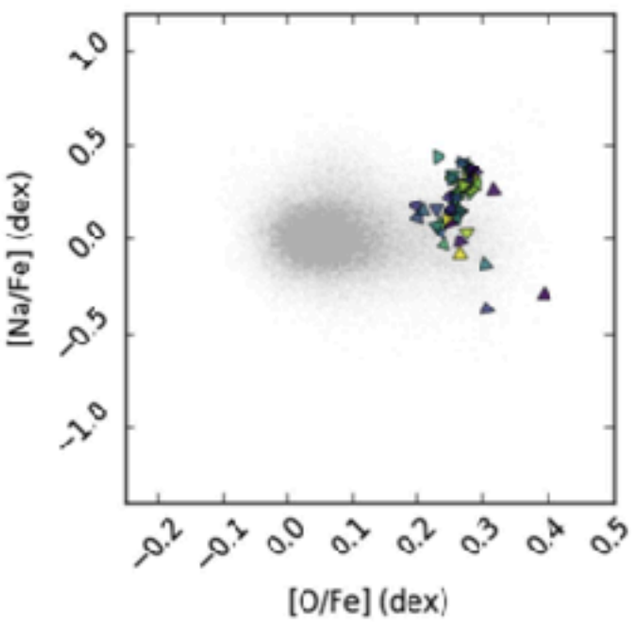
Chemical tagging

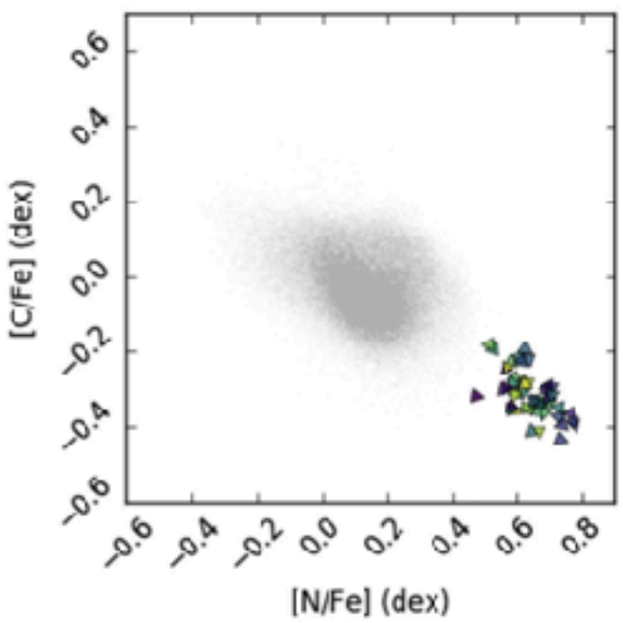
APOGEE/The Cannon data

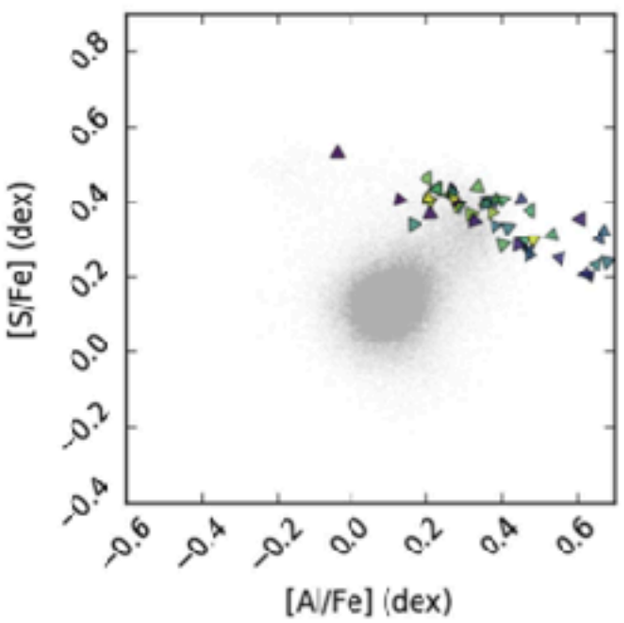






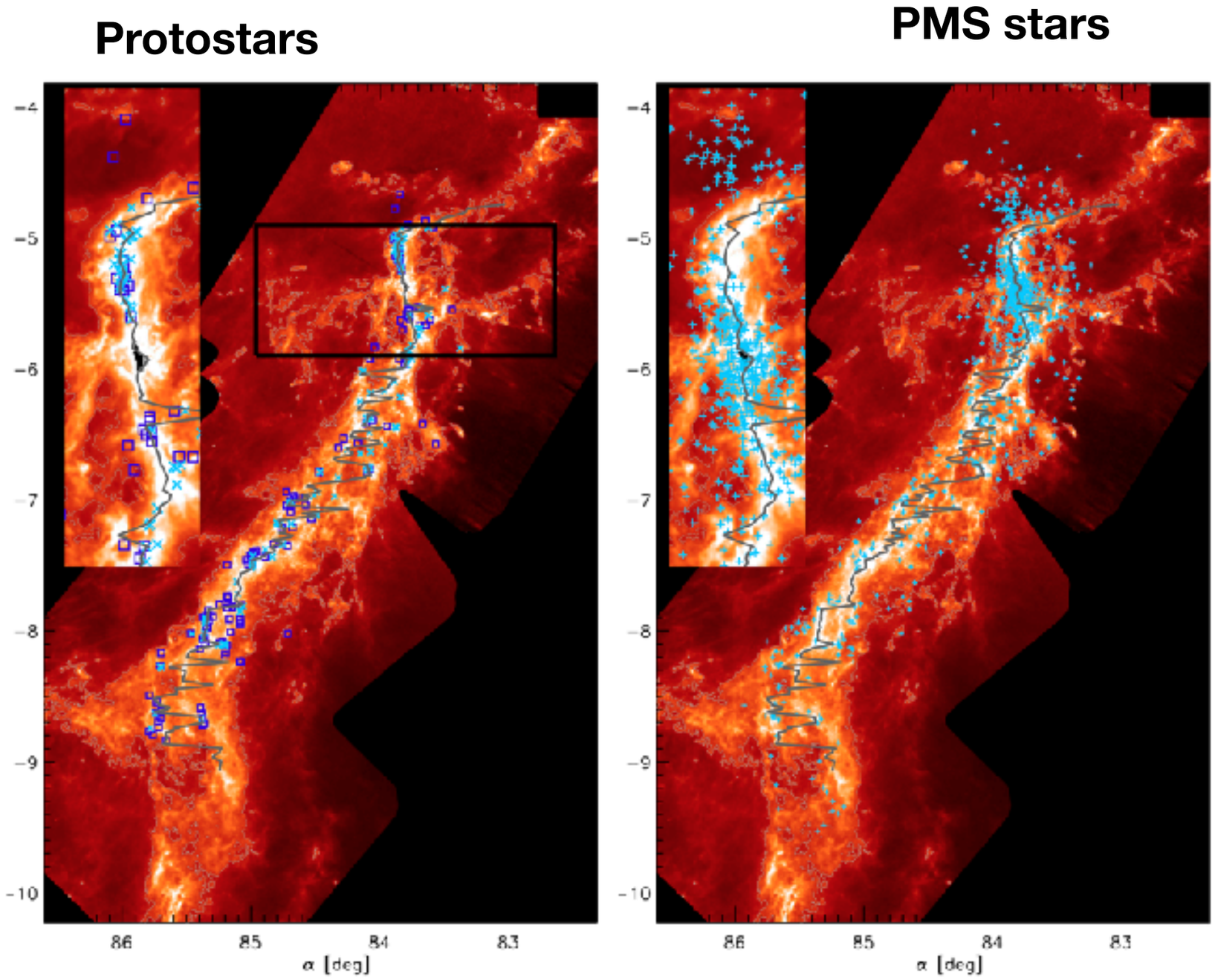






Hogg et al. 2016

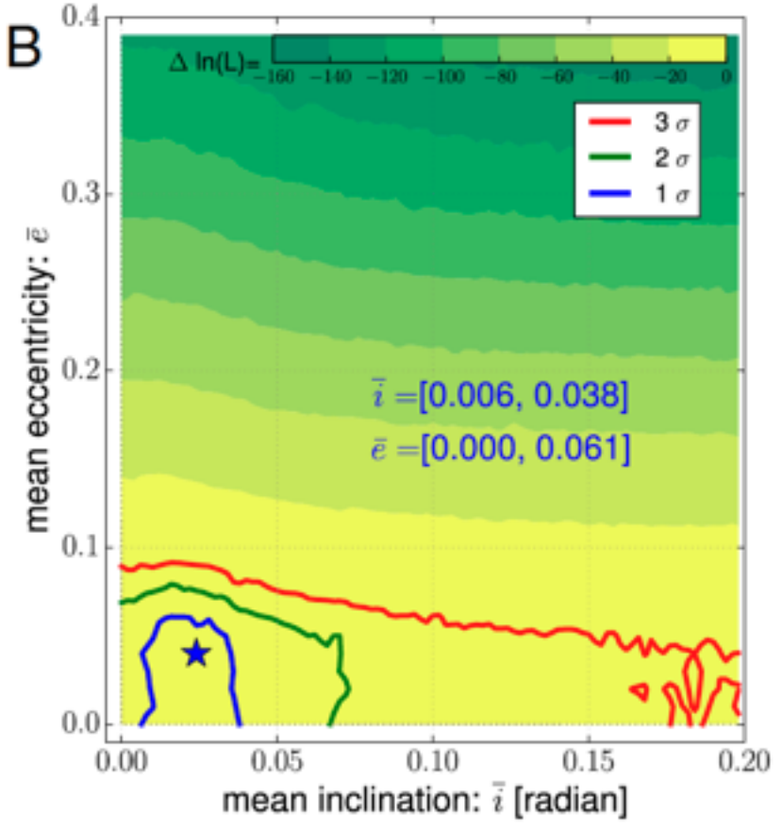
Young stellar populations



Stutz et al. 2016

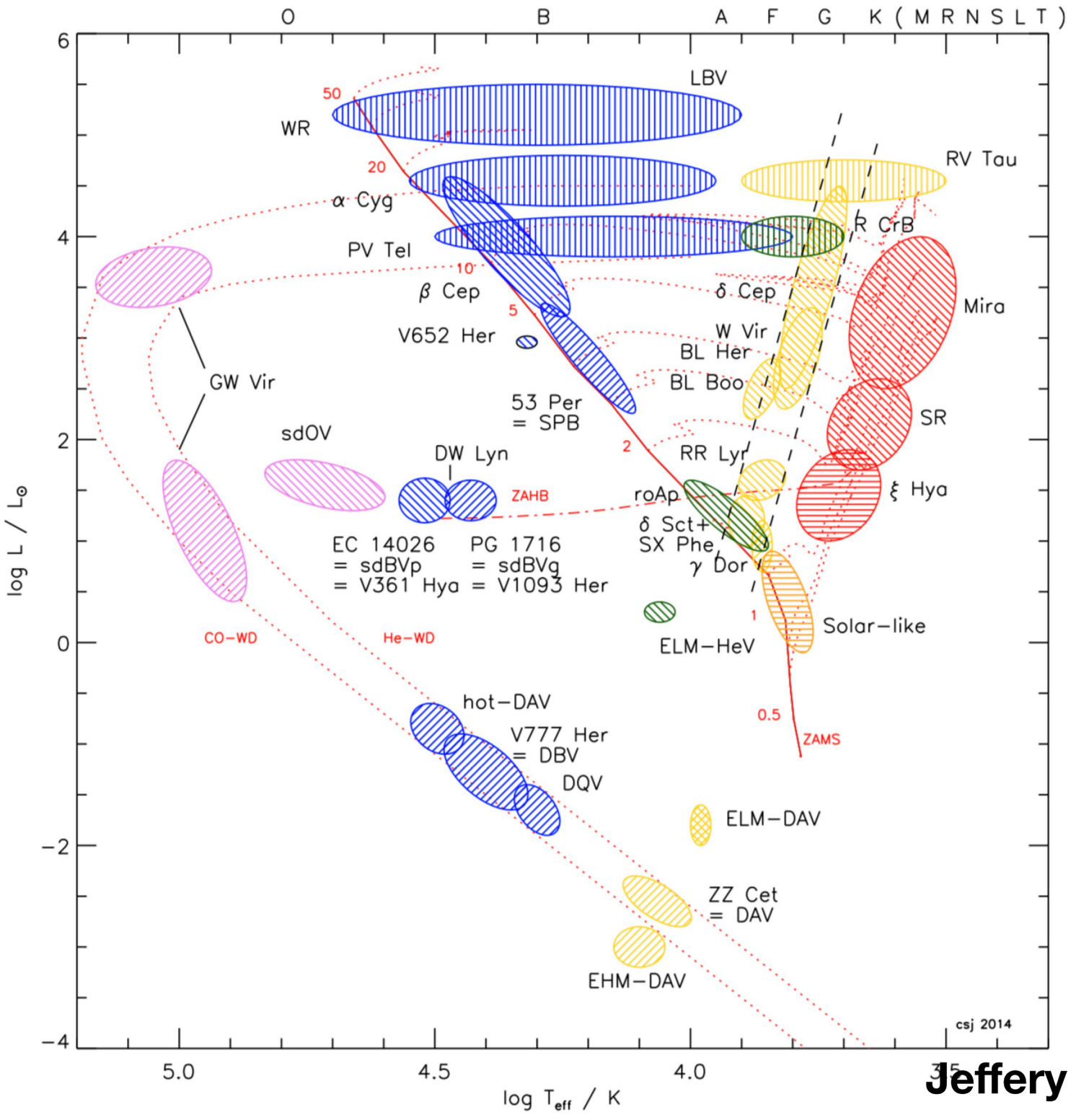
Exoplanet host stars

- Knowing the properties of the host stars of exoplanets is critical in the studies of planet formation and evolution



Xie et al. 2016

Variable stars



Jeffery et al. 2016

Binary stars

- Searching stellar mass black hole
- Gravitational wave progenitor (NS+NS, BH+BH)
- Supernova type Ia progenitor (WD+*, WD+WD)
- Evolution of massive stars
- Binary formation/evolution

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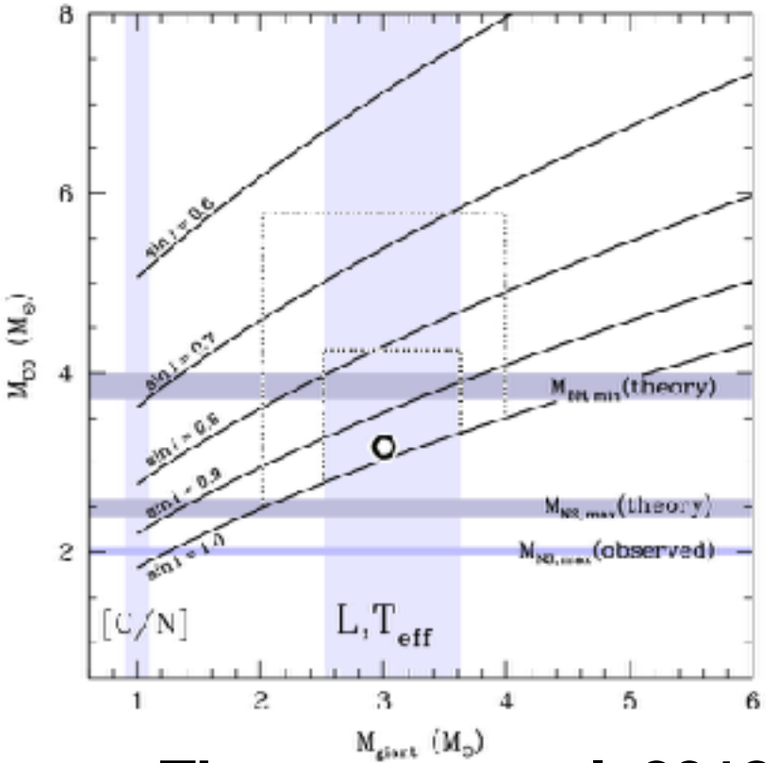

Thompson et al. 2018

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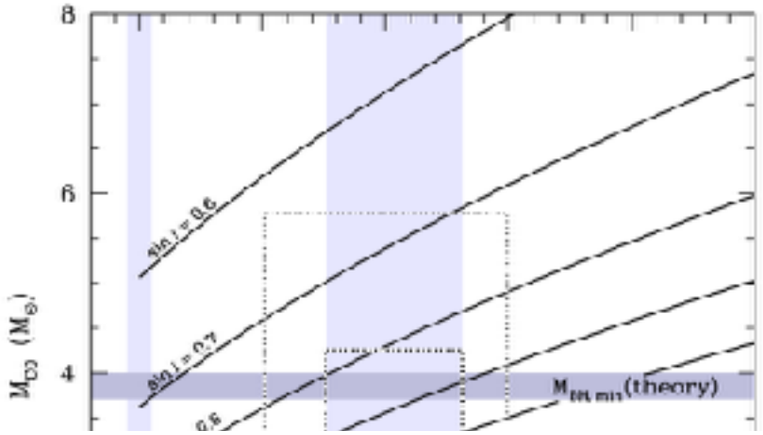

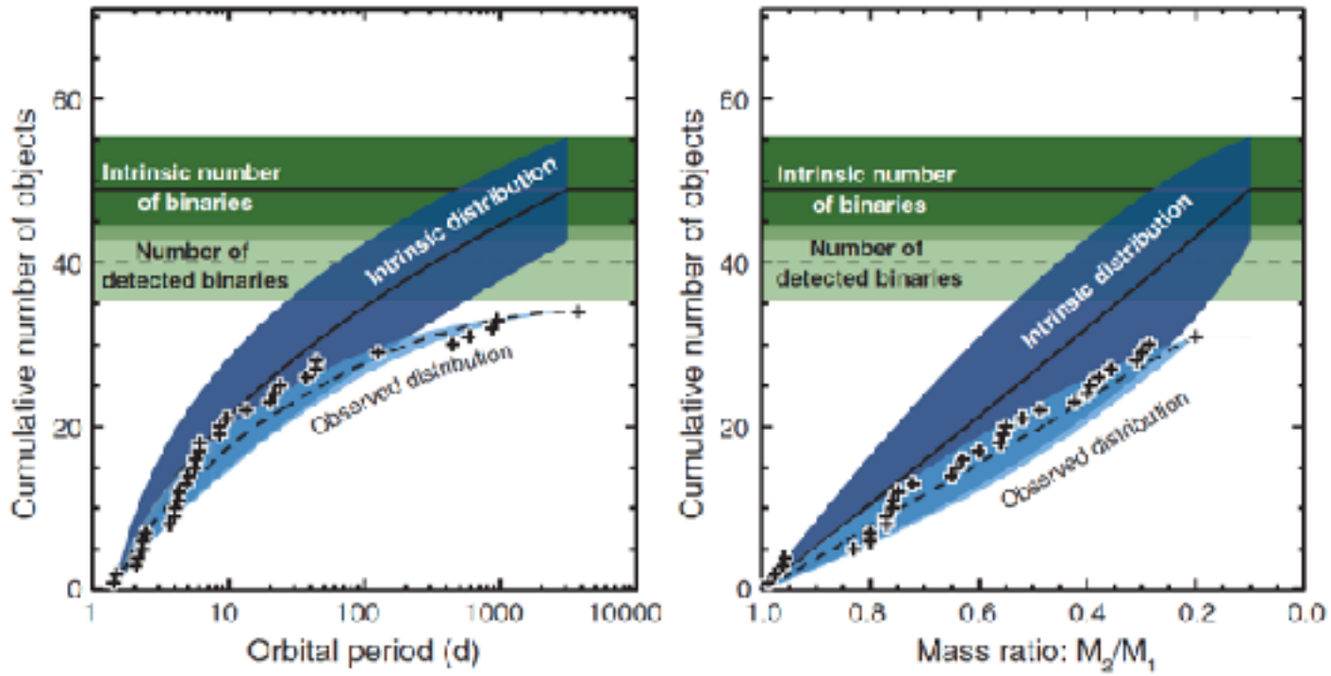

Sana et al. 2012

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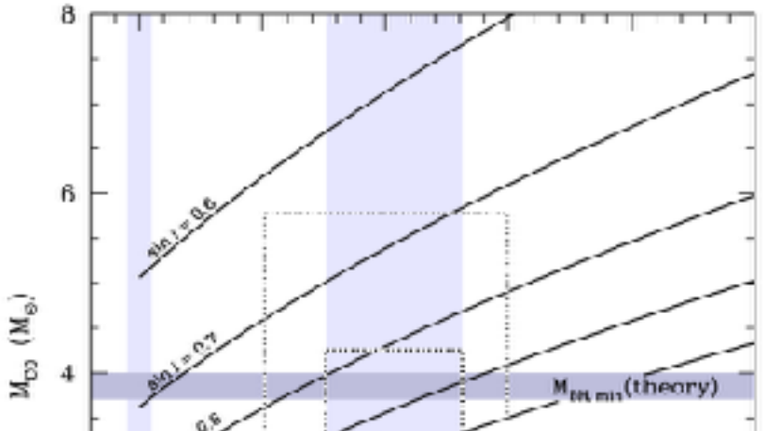
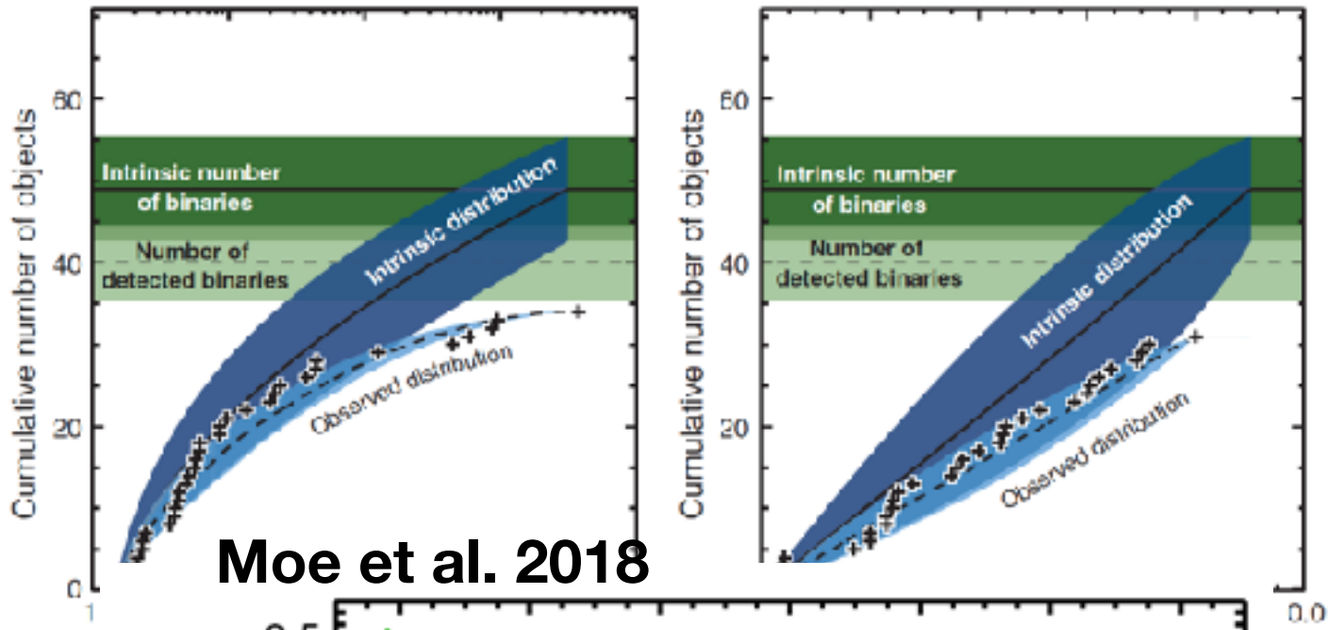
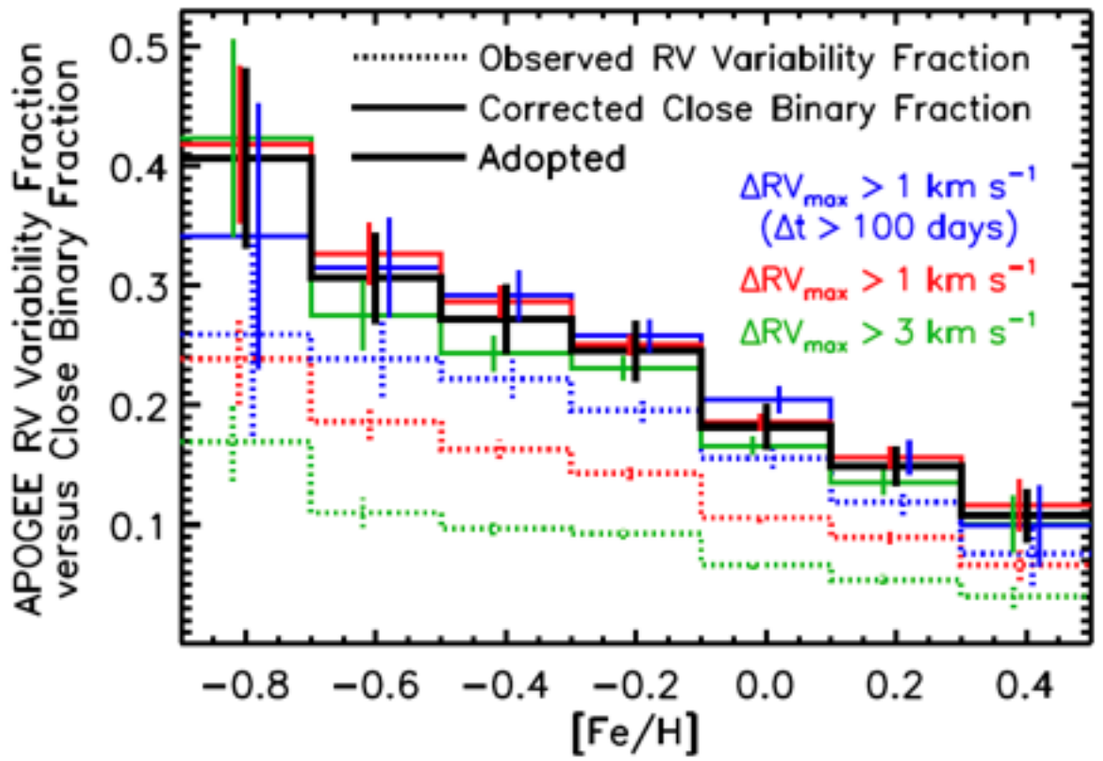




Moe et al. 2018



Summary

- LAMOST II = Low-res + Med-res
- LAMOST II ==> Med-res Time-domain survey
- Future products:
  - 200K stars with time-domain med-res spectra (G<14)
  - 2 million single-epoch med-res spectra (G<15)
  - ~13 million low-res spectra (inc. LAMOST I) (r<~18)