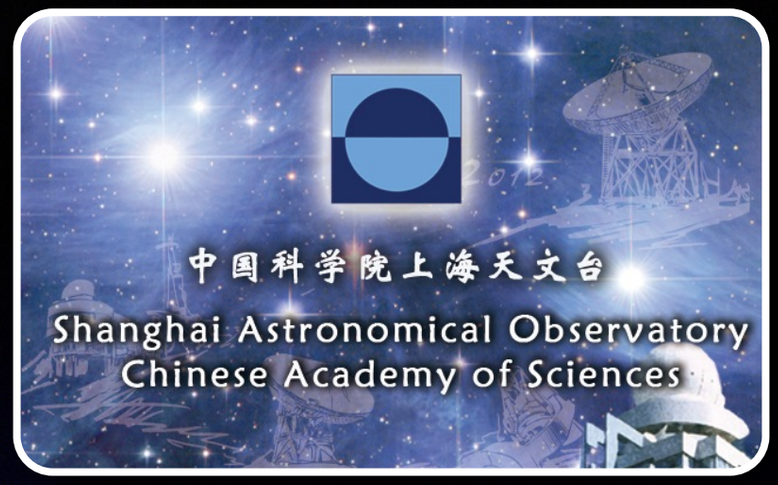

The Large Sky Area Multi-Object Spectroscopic Telescope (LAMOST)

The Milky Way and its Stars
February 2015
KITP

Martin C. Smith
Shanghai Astronomical Observatory
http://hubble.shao.ac.cn/~msmith/

LAMOST introduction

- China's largest optical telescope
- A 4-5m telescope with 4000 fibers across a 20 sq deg field of view, at R = 2,000
- Full surveys started in 2012, obtaining over 1M good stellar spectra (S/N > 10) each year, current total of over 3M spectra
- Fields cover halo/disc/anti-centre, with ancillary projects such as LAMOST-Kepler led by Fu & De Cat (~60k good spectra in the Kepler field)
- Five-year survey, with possibility of higher-resolution (R=5,000-10,000) in future

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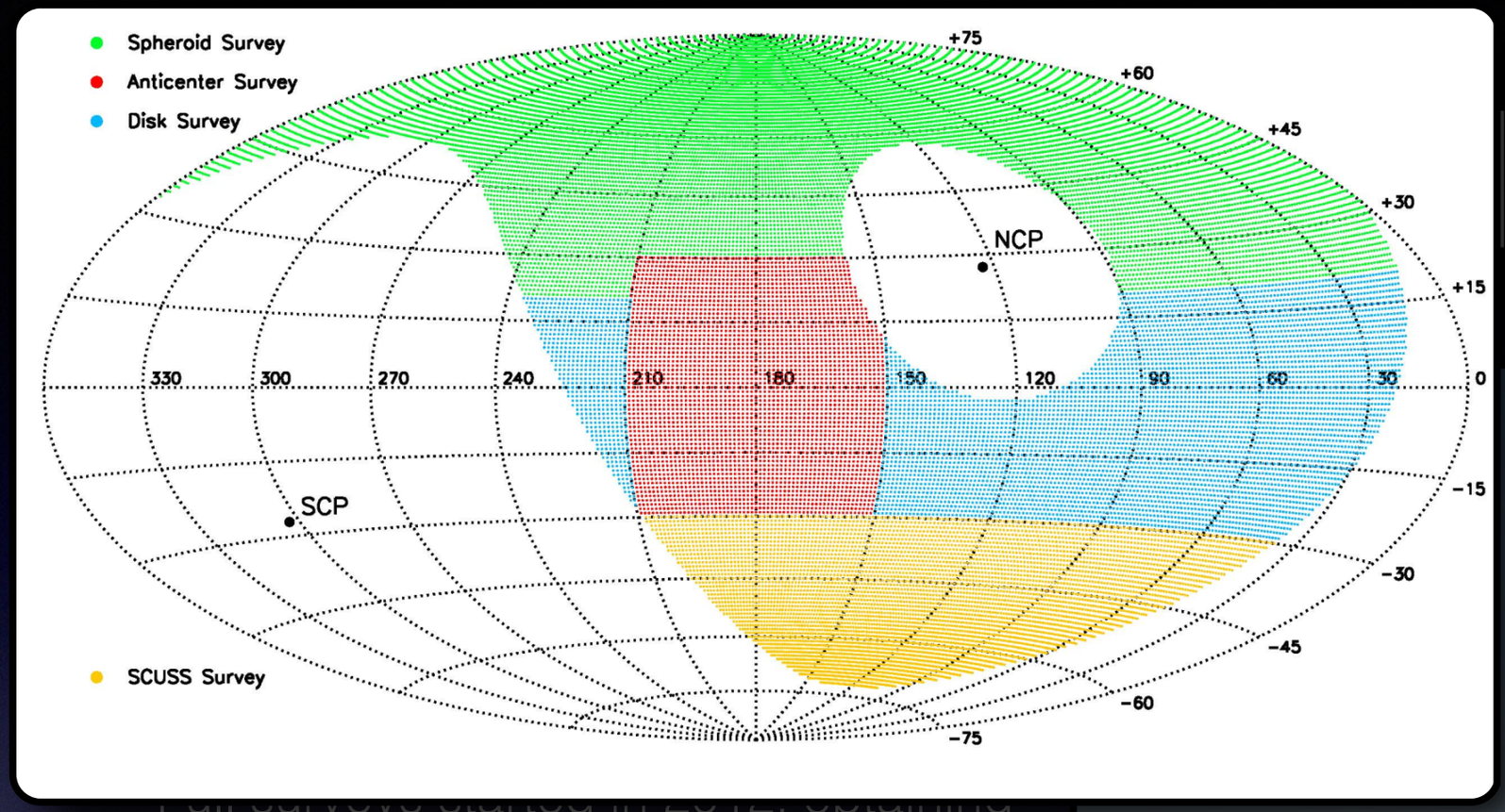

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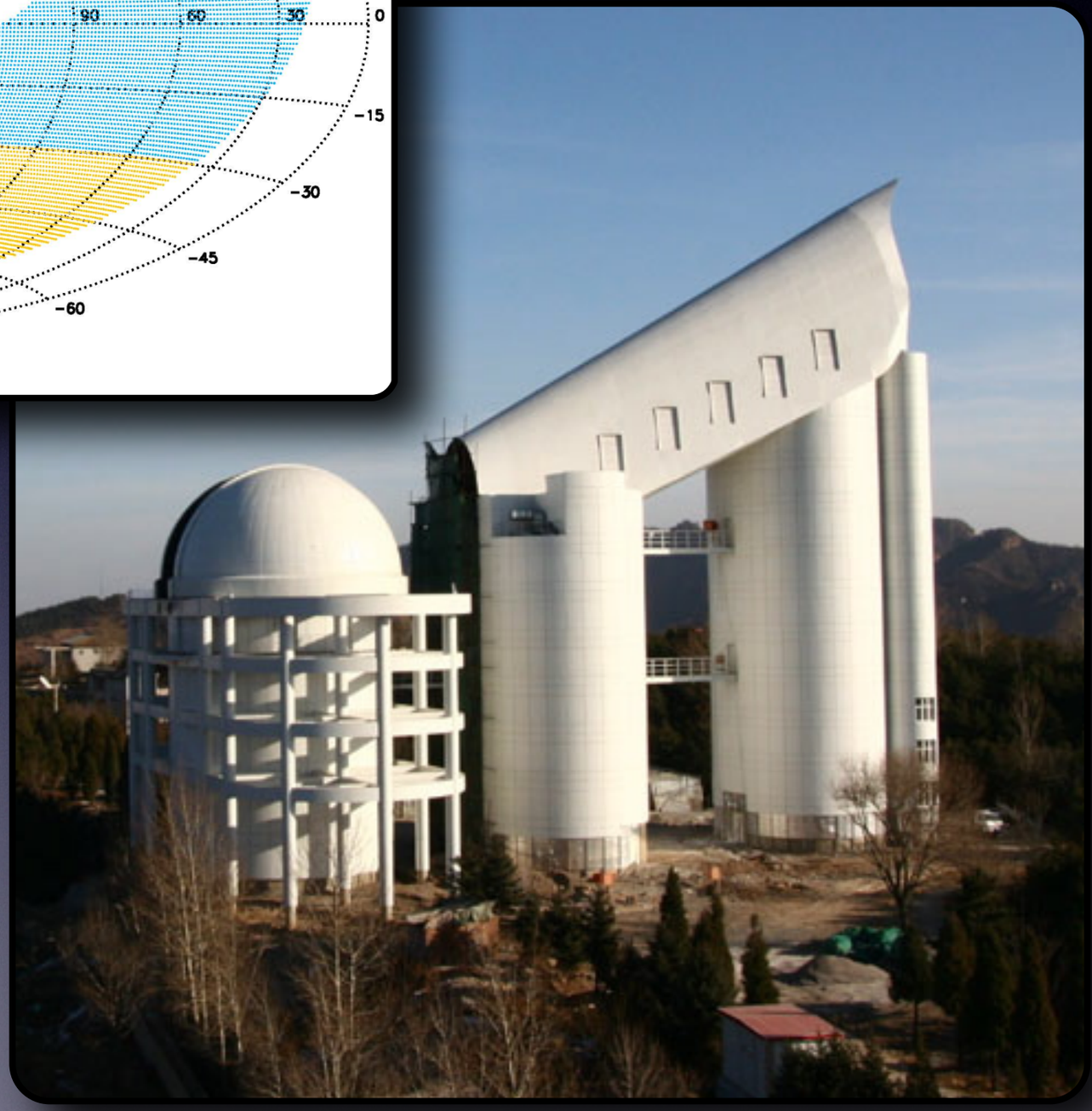

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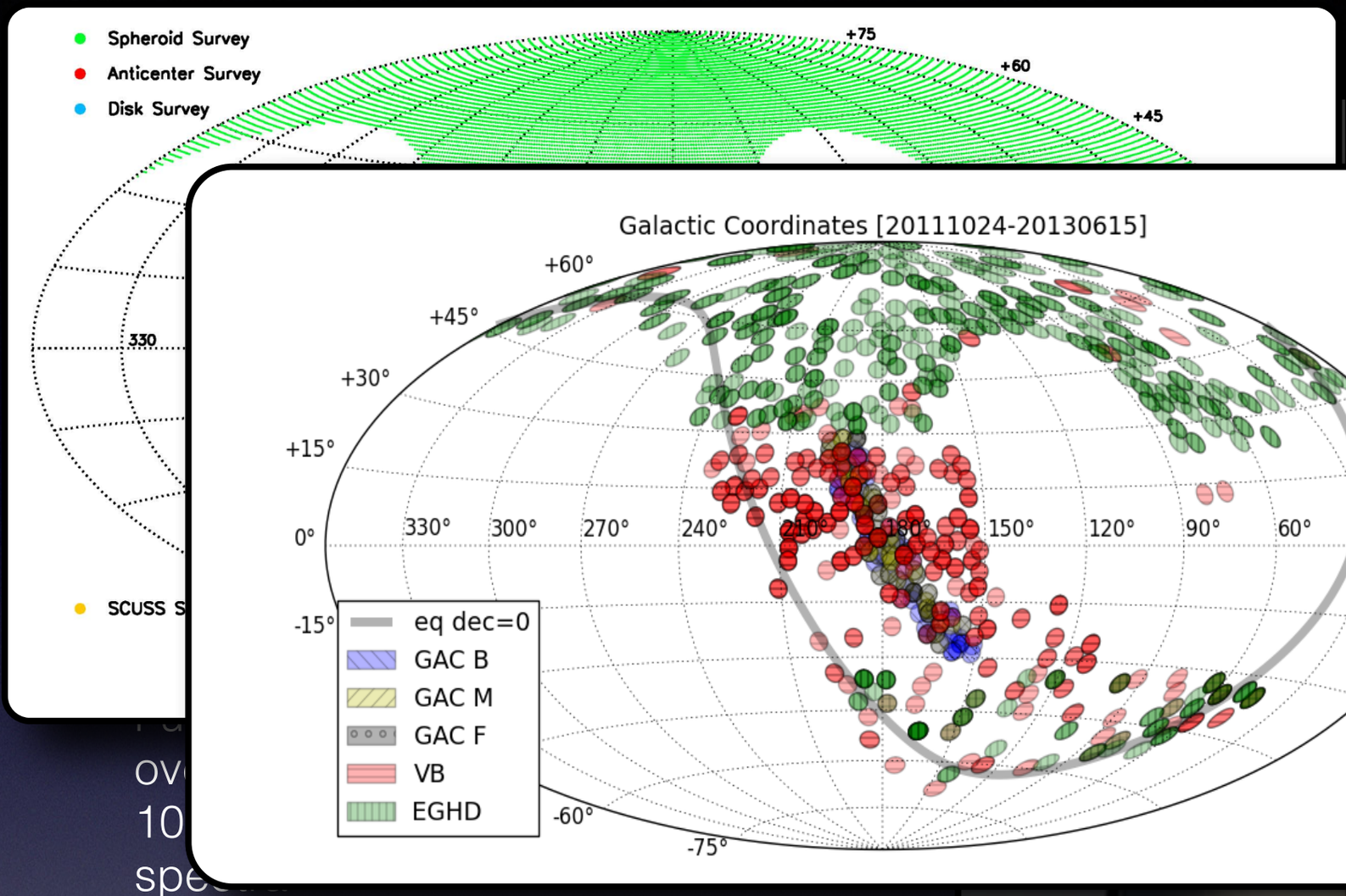

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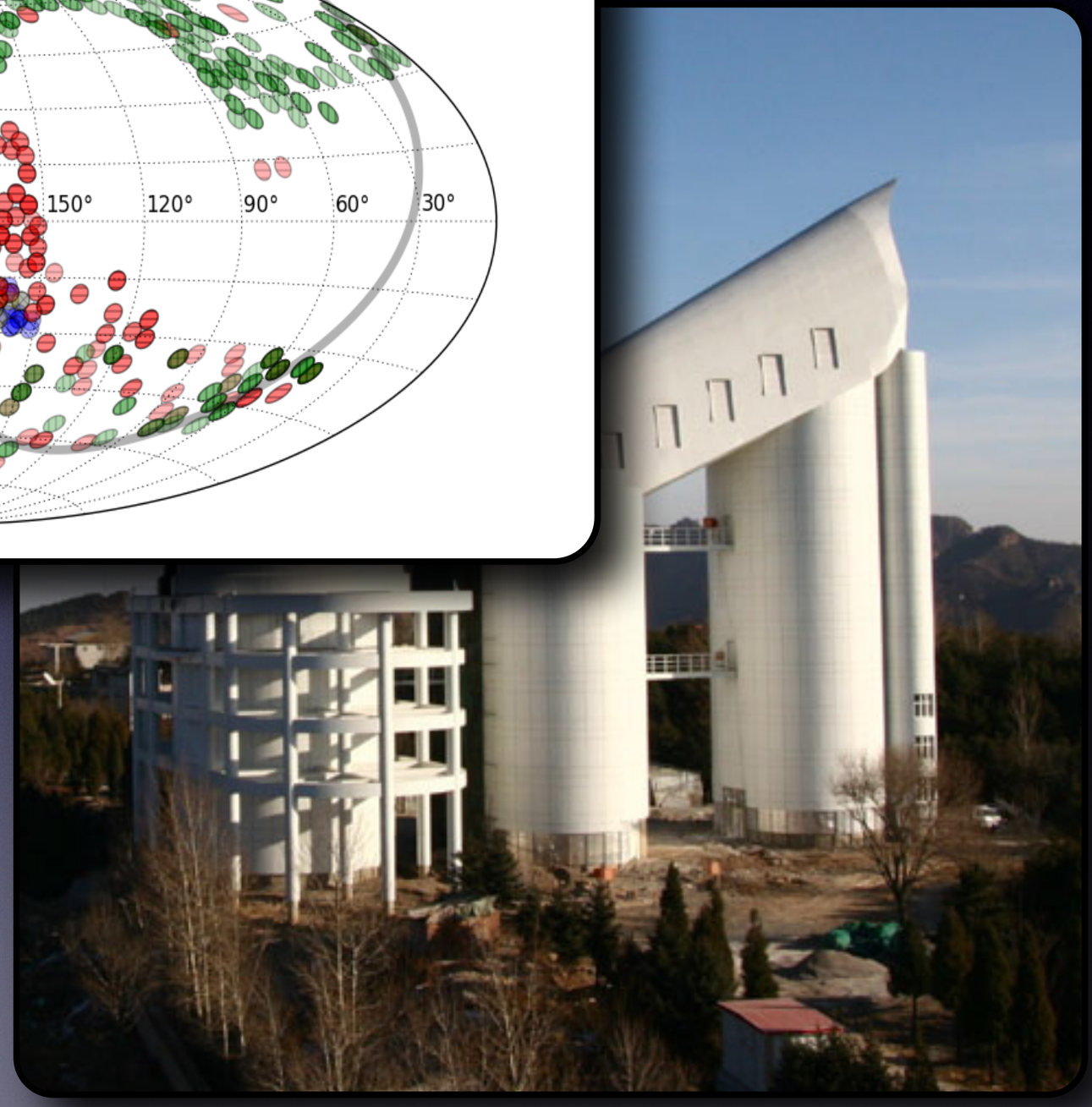
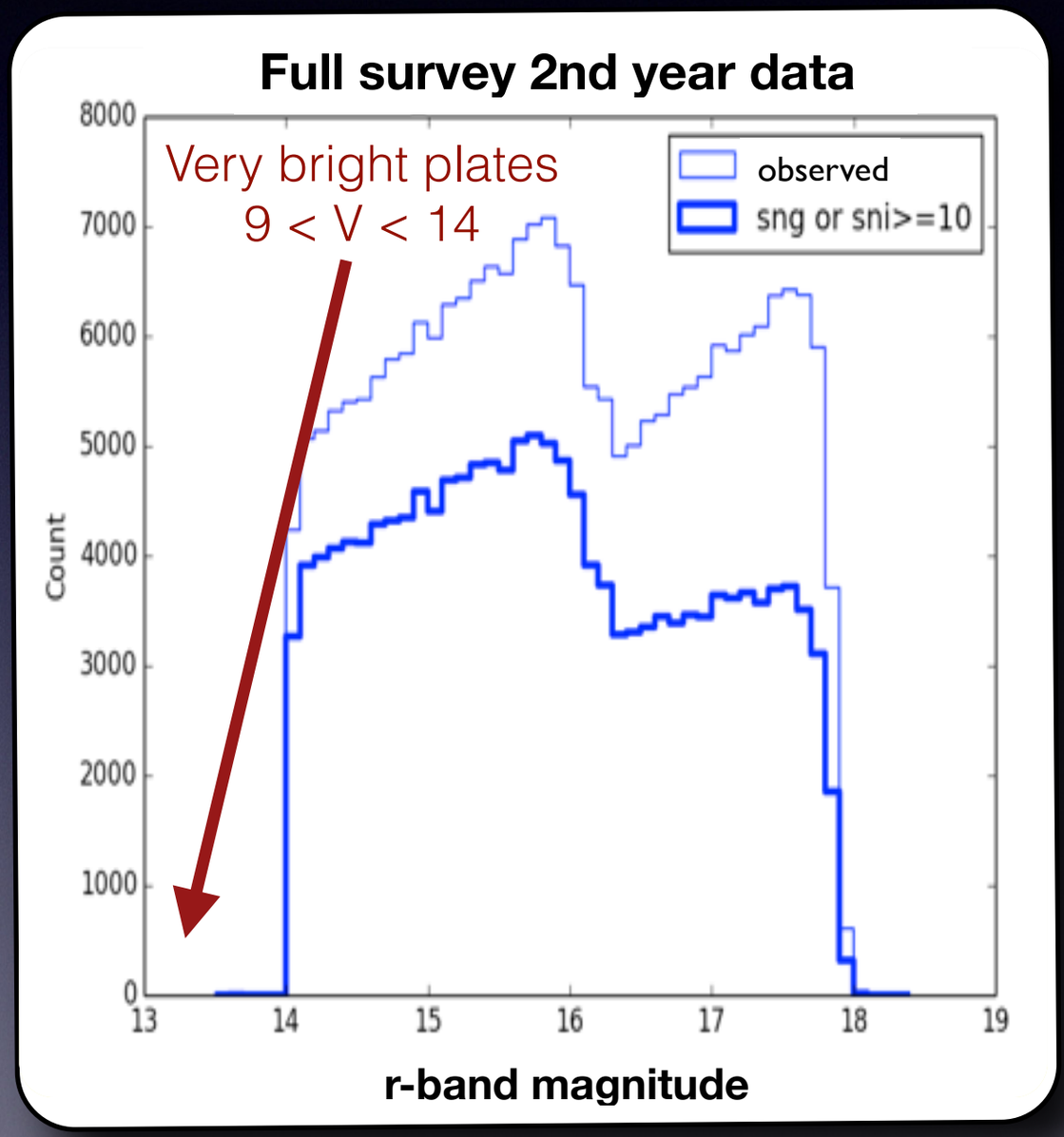


Overview of data quality

- Success rate (S/N > 10) around 70%, with a limiting magnitude of r ~ 17, so great synergy with Gaia
- Pipelines in place, with 2.2M FGK stars with parameters from first two years
- Similar accuracy to SDSS (~0.15 dex in [Fe/H], ~0.2 dex in log(g), ~100K in T_{eff}) although issues with gravities
- Various plans to estimate alphas, although not currently implemented



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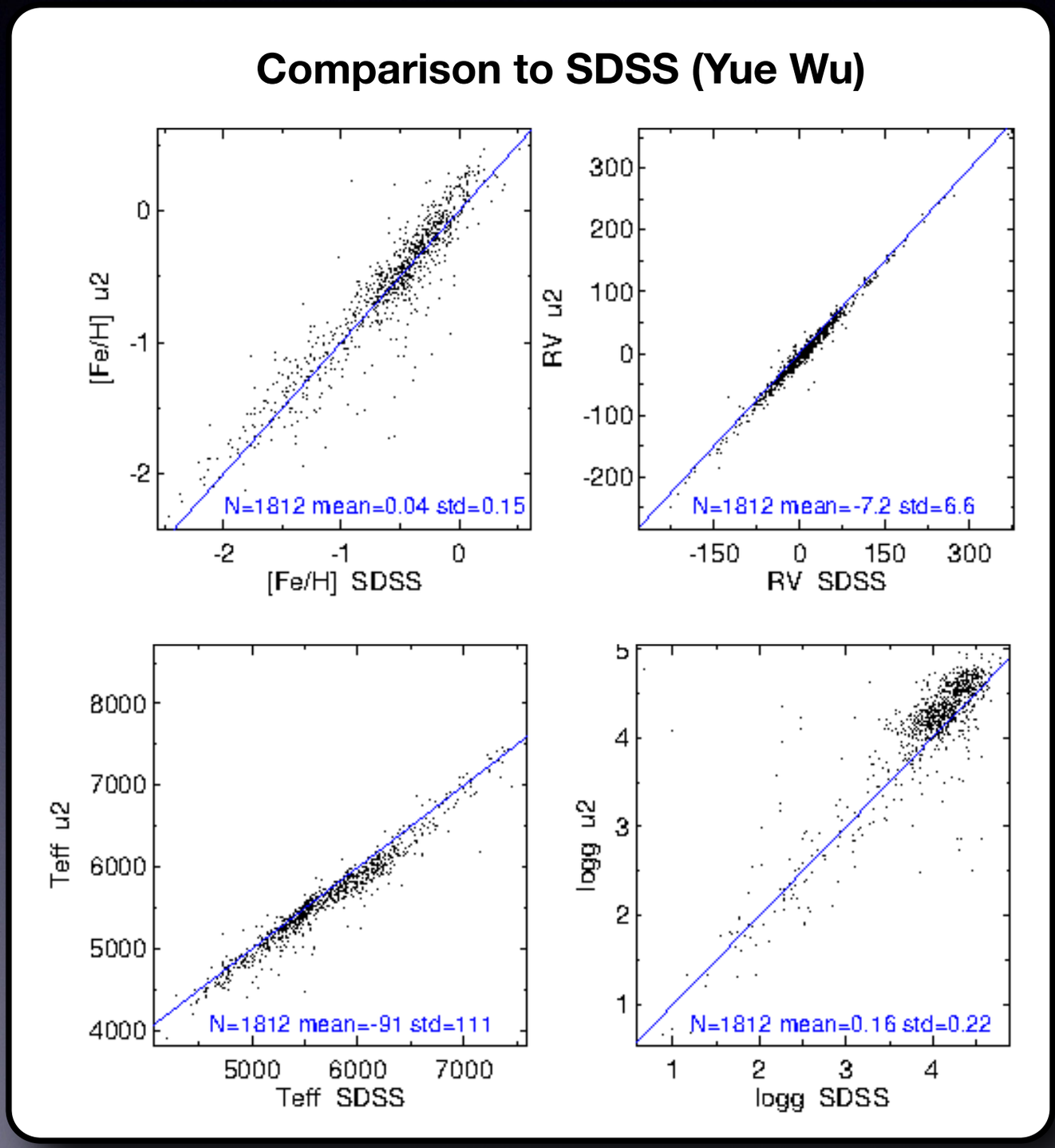

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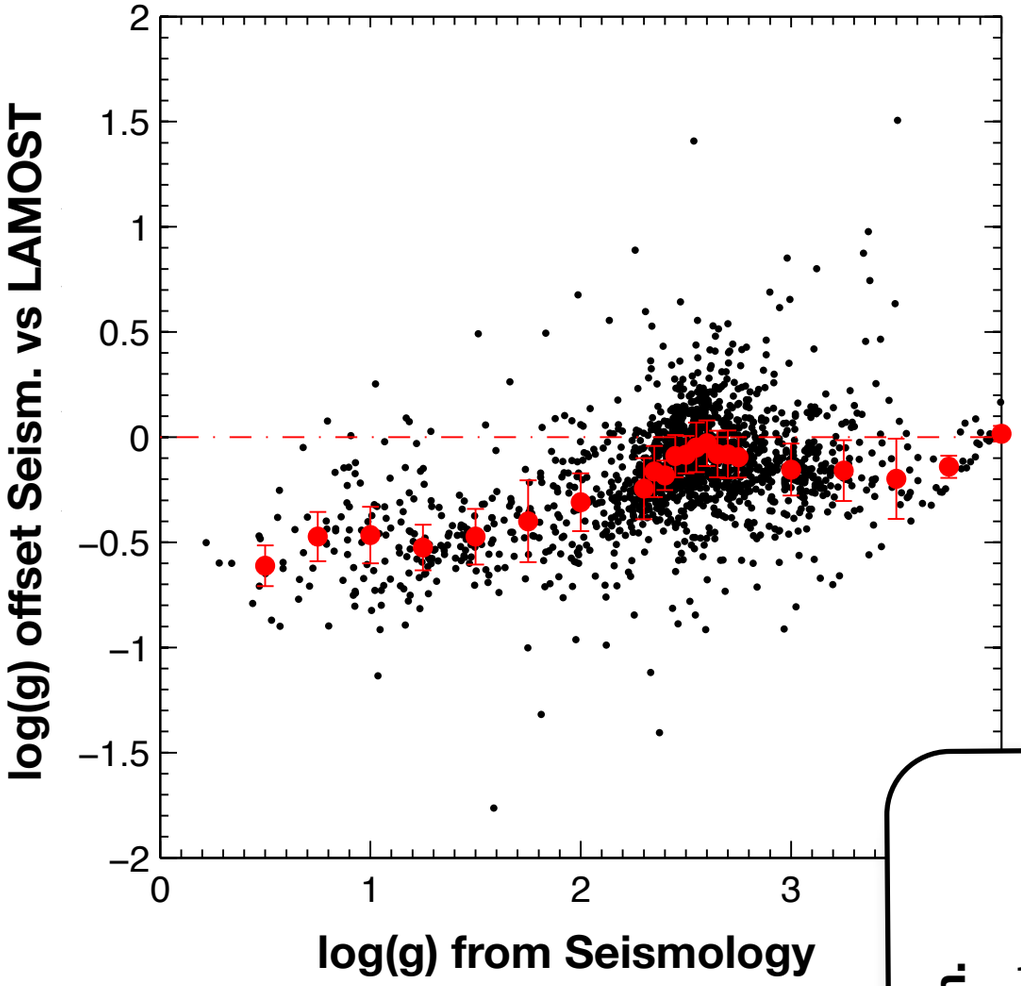

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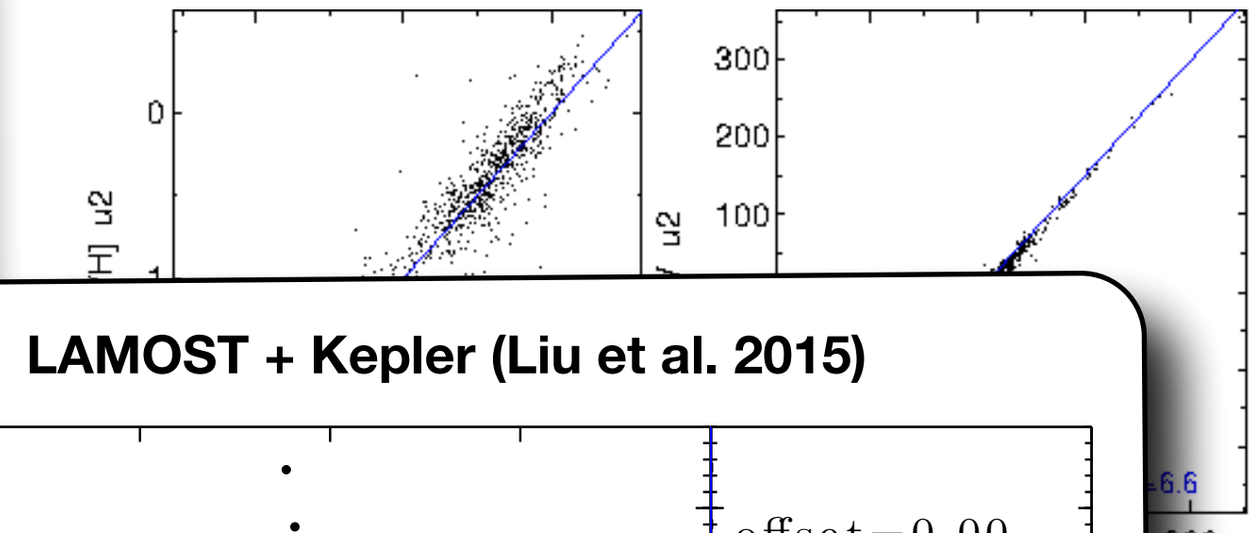
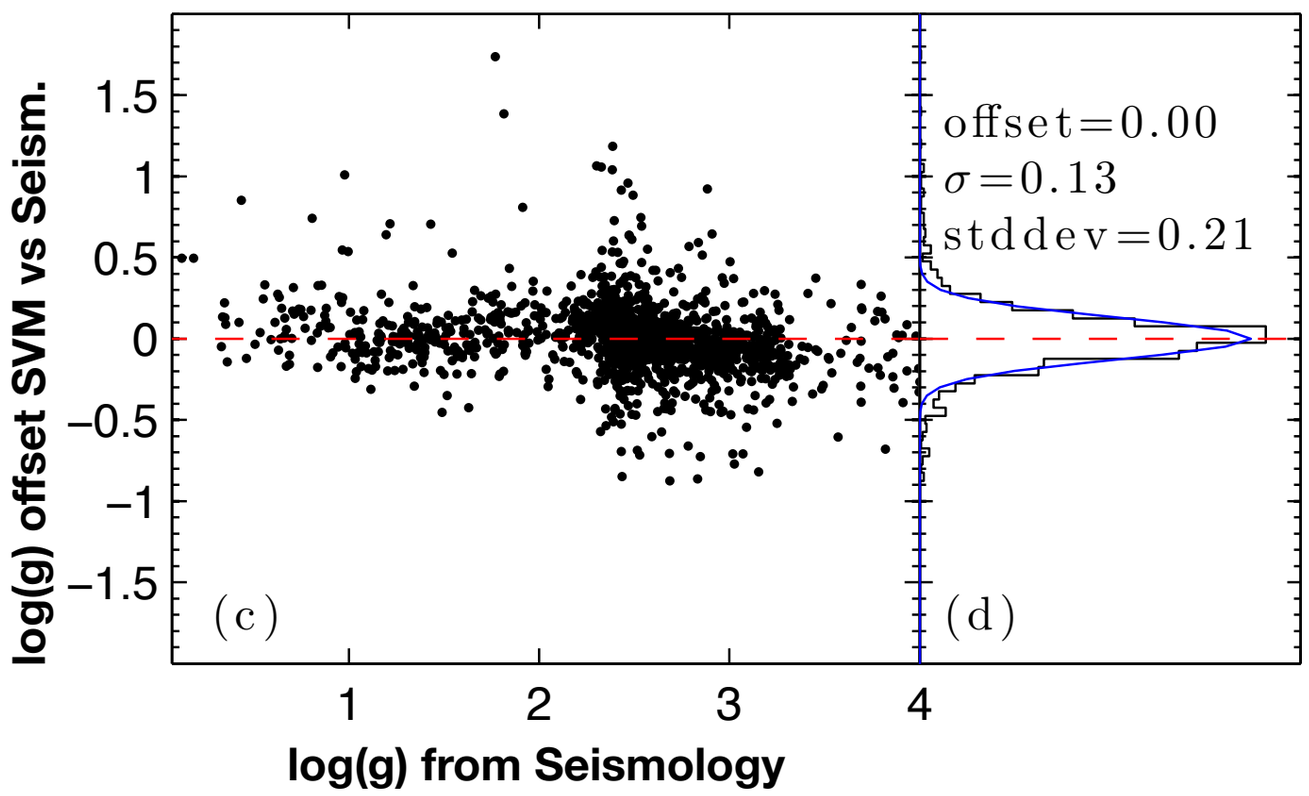


LAMOST + Kepler (Liu et al. 2015)



Science highlights

- **Binaries** (Gao et al. 2014) & RR Lyrae (Yang et al. 2014)
- K-giants (Liu et al. 2014)
- Local **UV-velocity distribution** from 15,000 F/G dwarfs (Xia et al. 2015)
- Distance papers (in prep)
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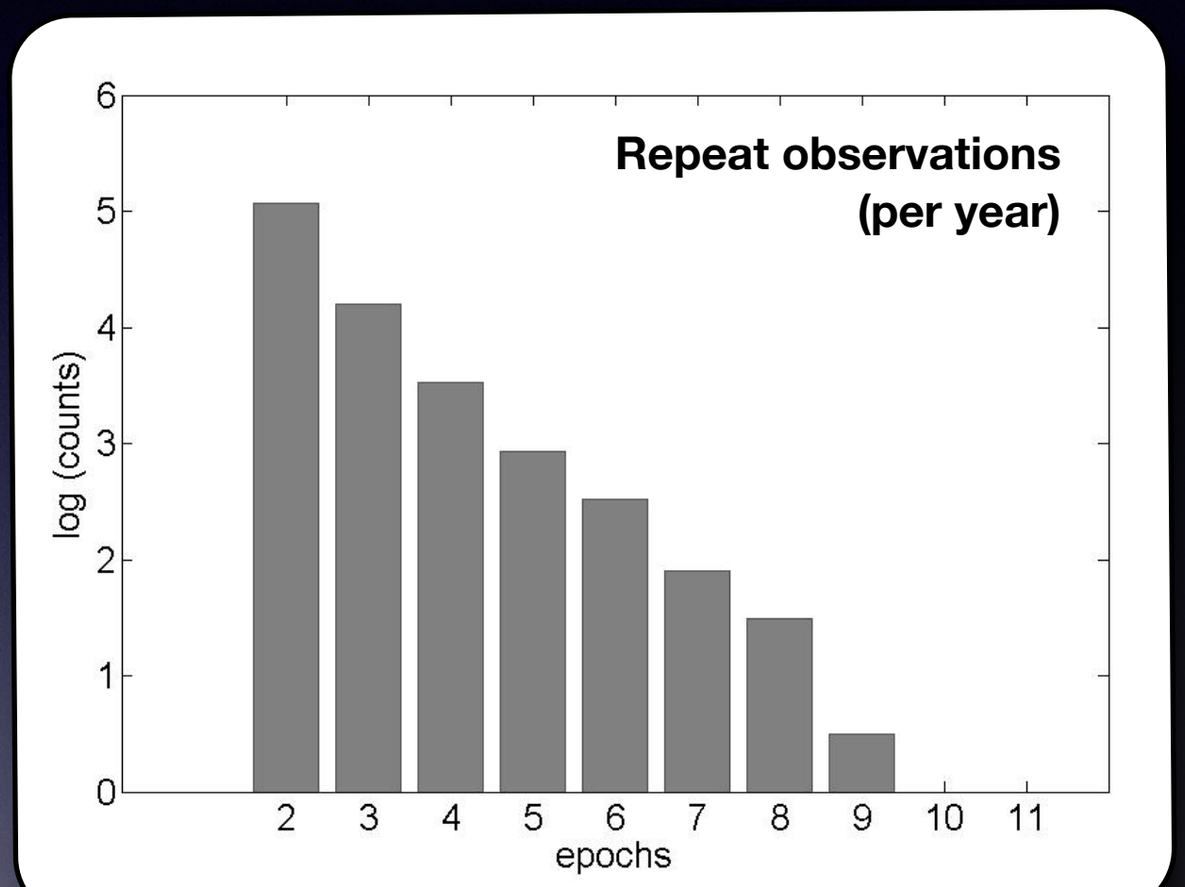

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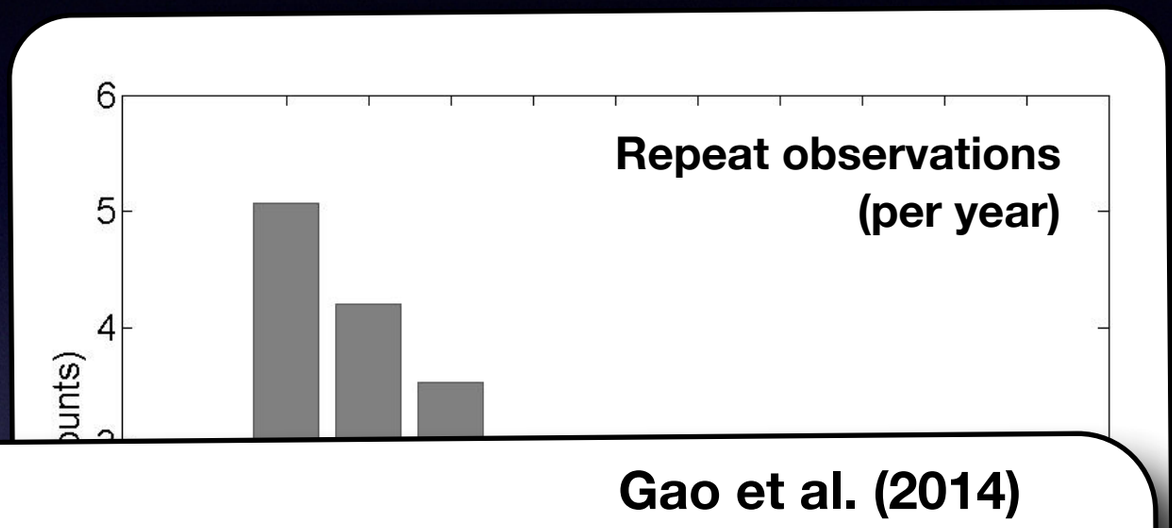
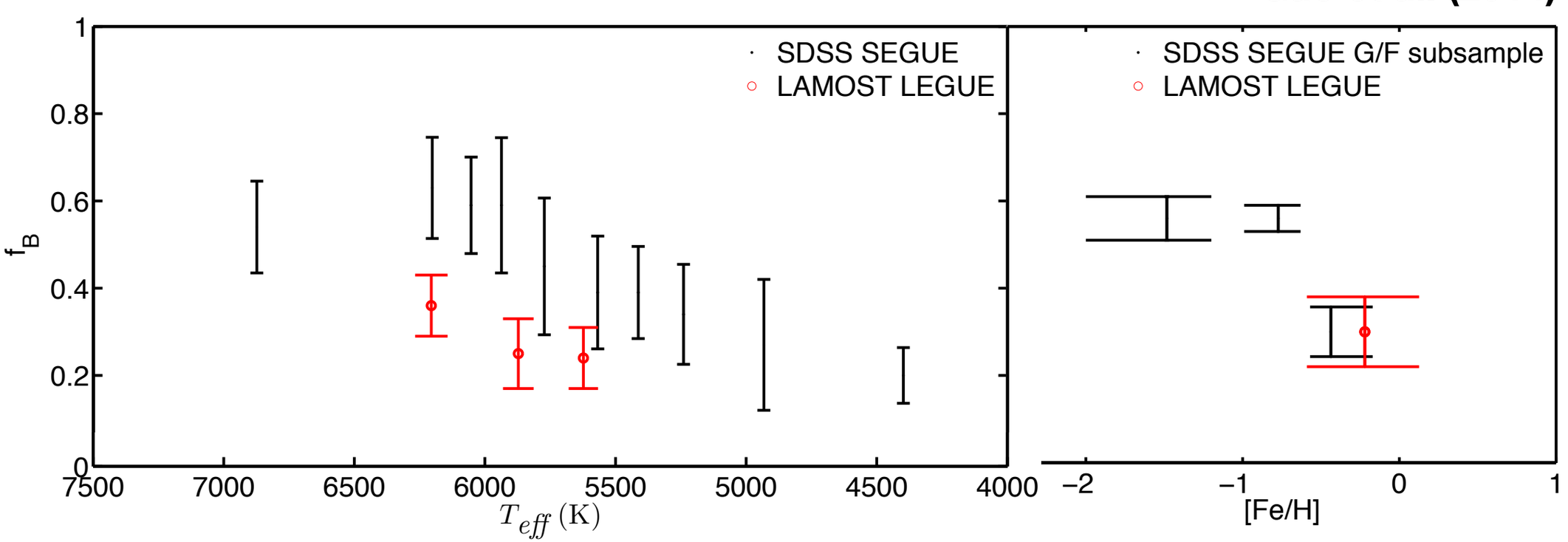


Gao et al. (2014)



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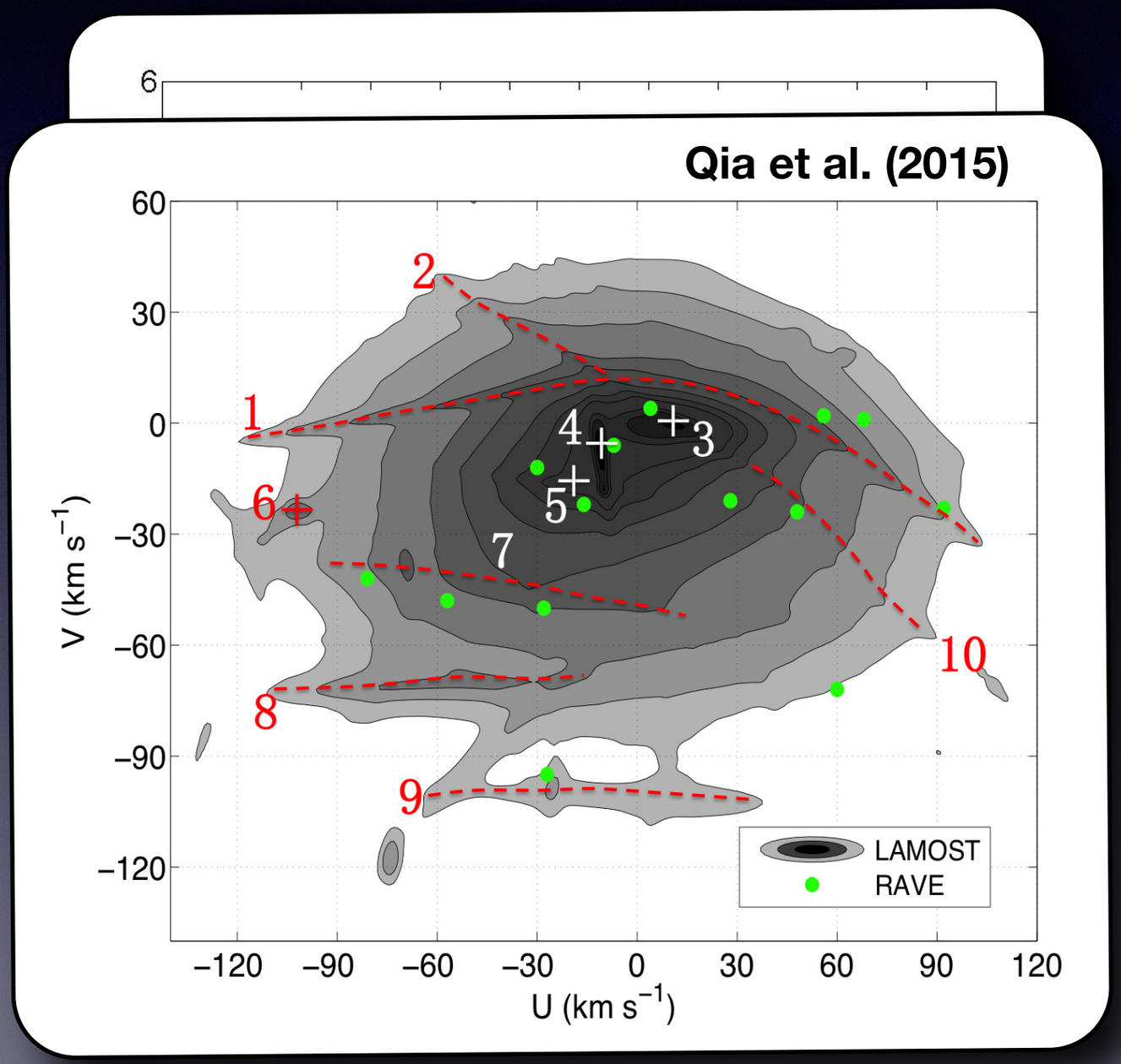

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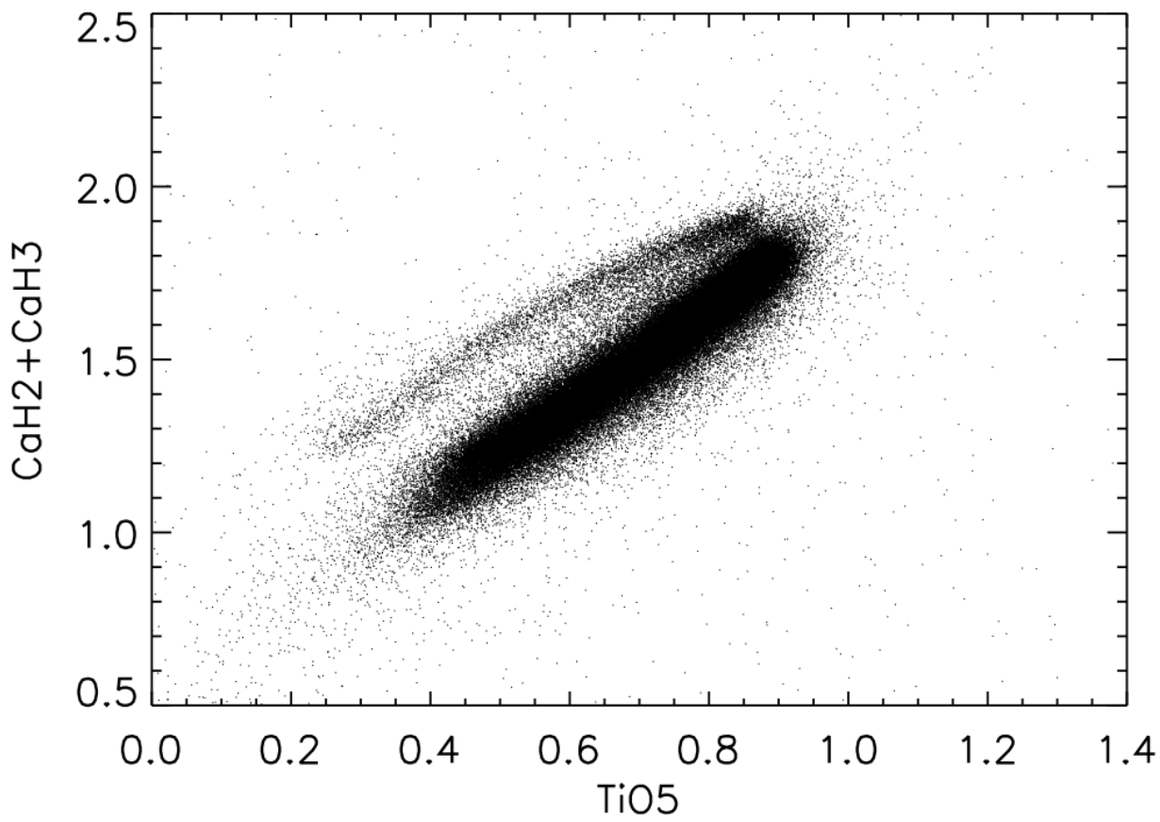

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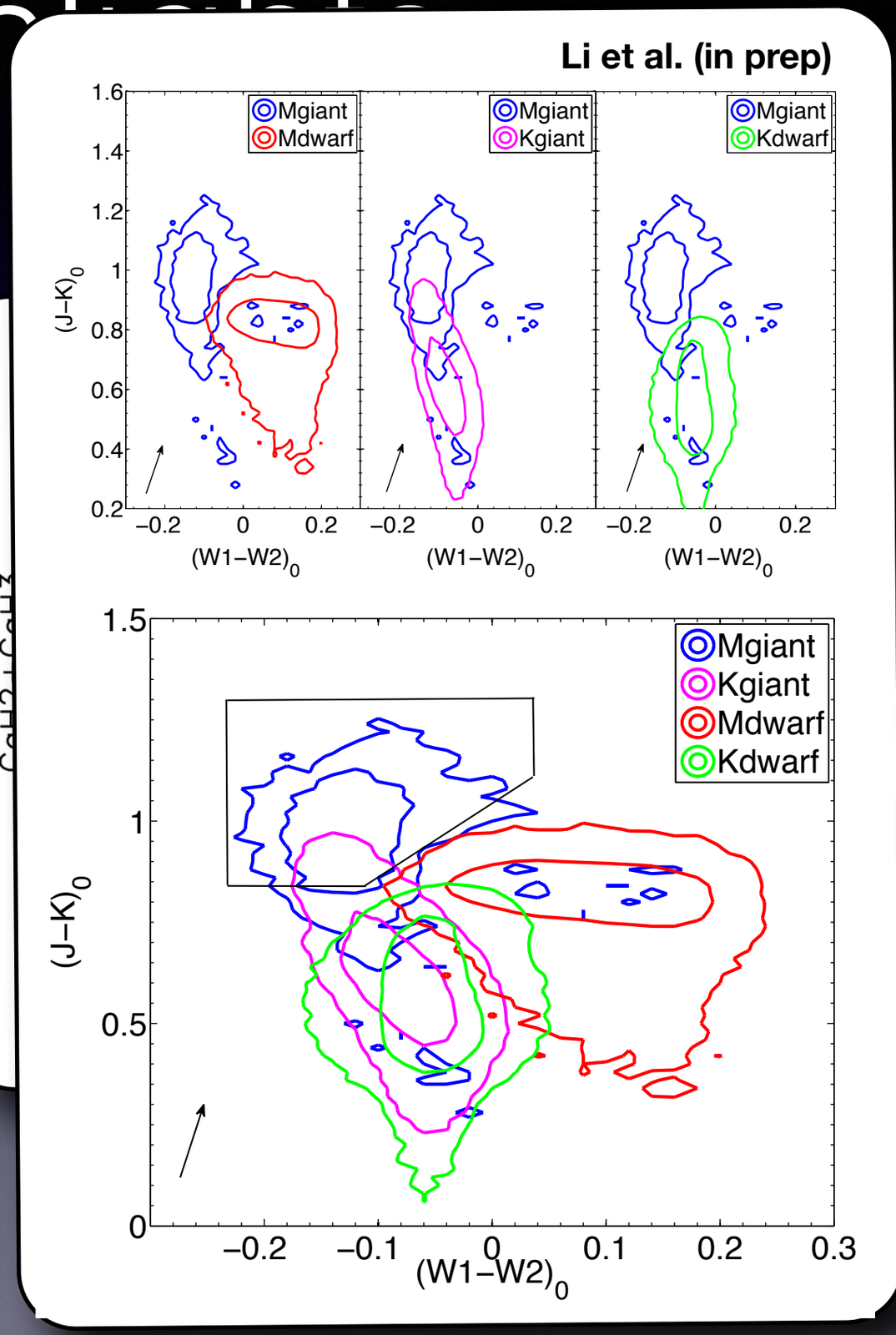

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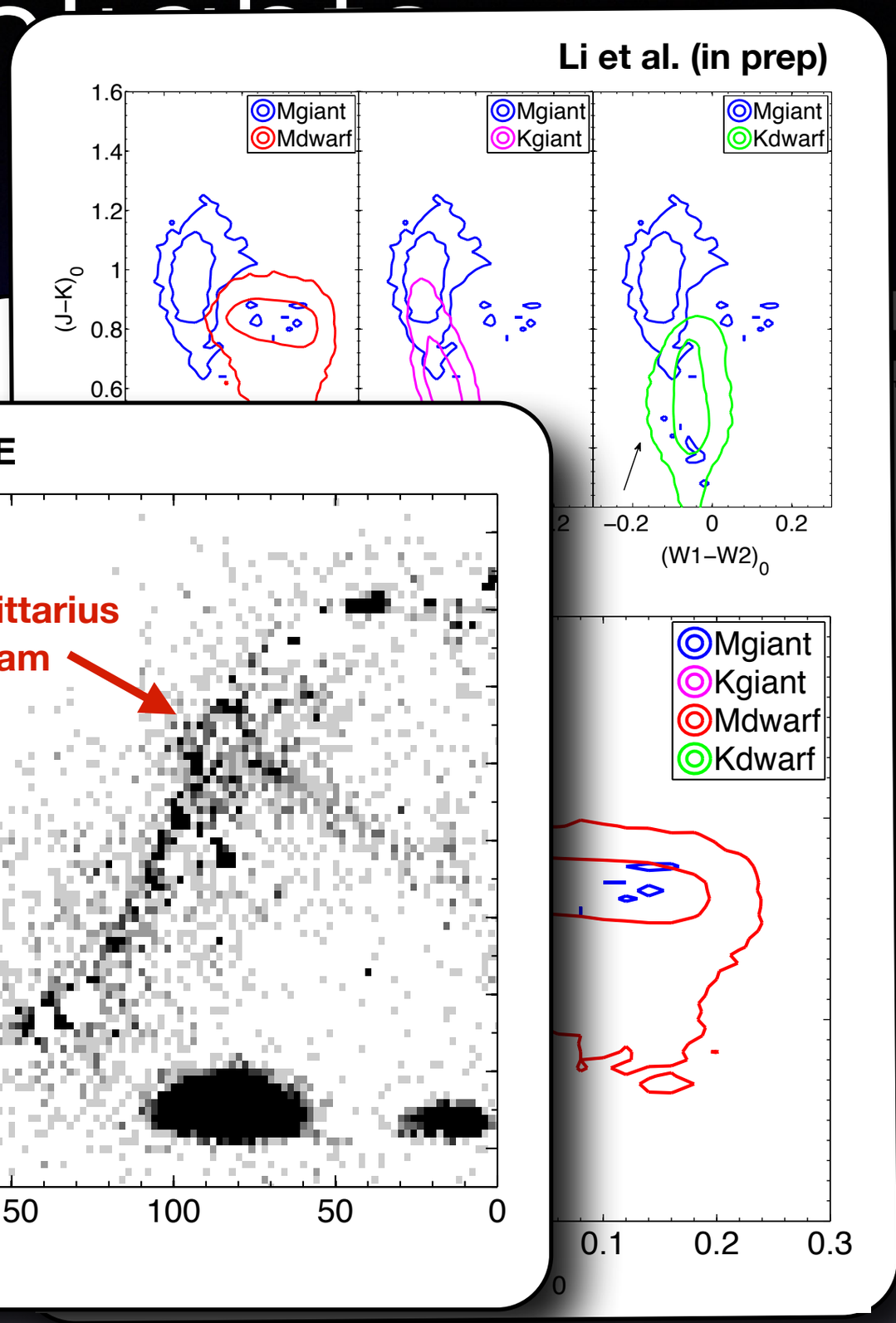

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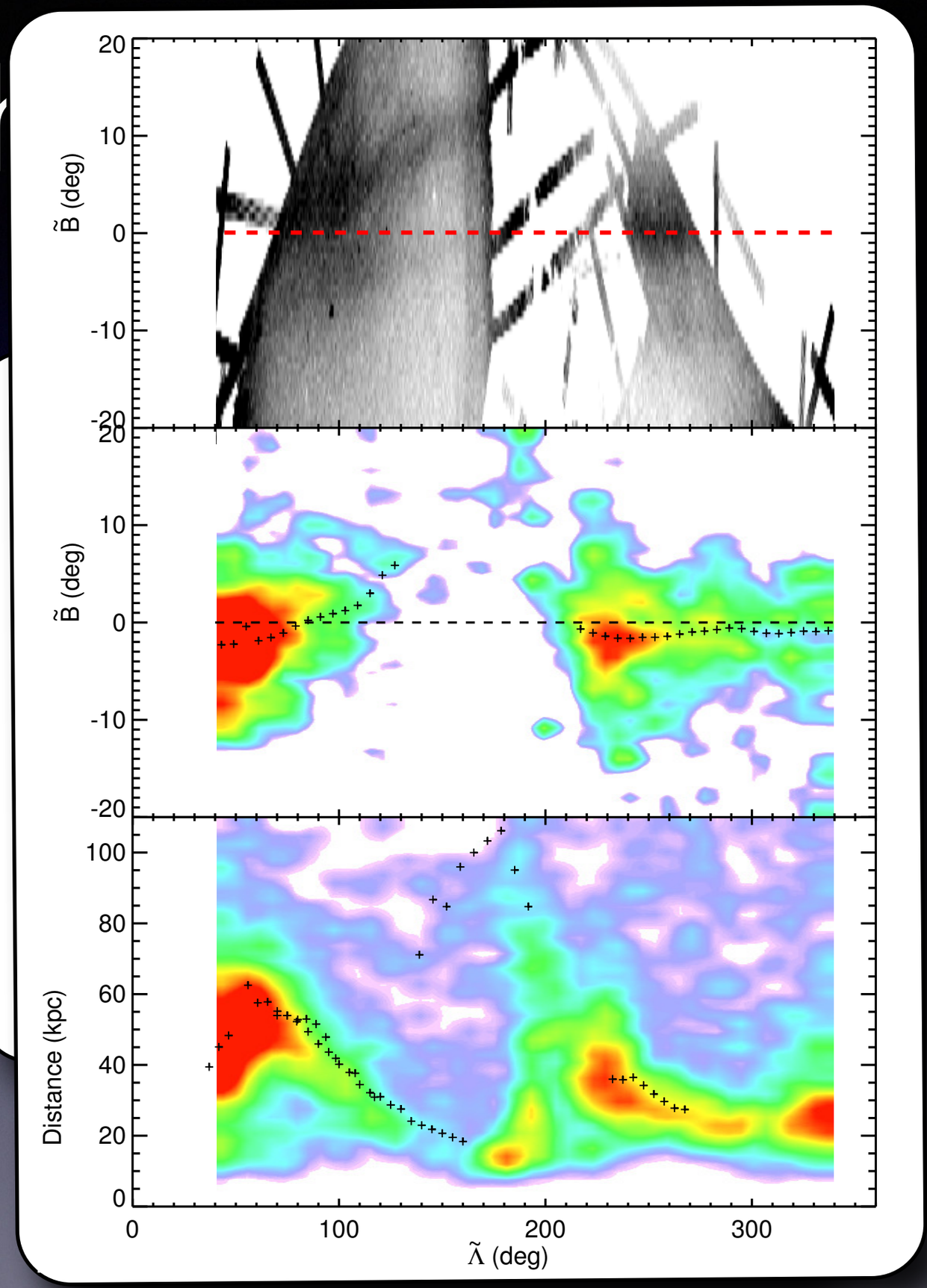

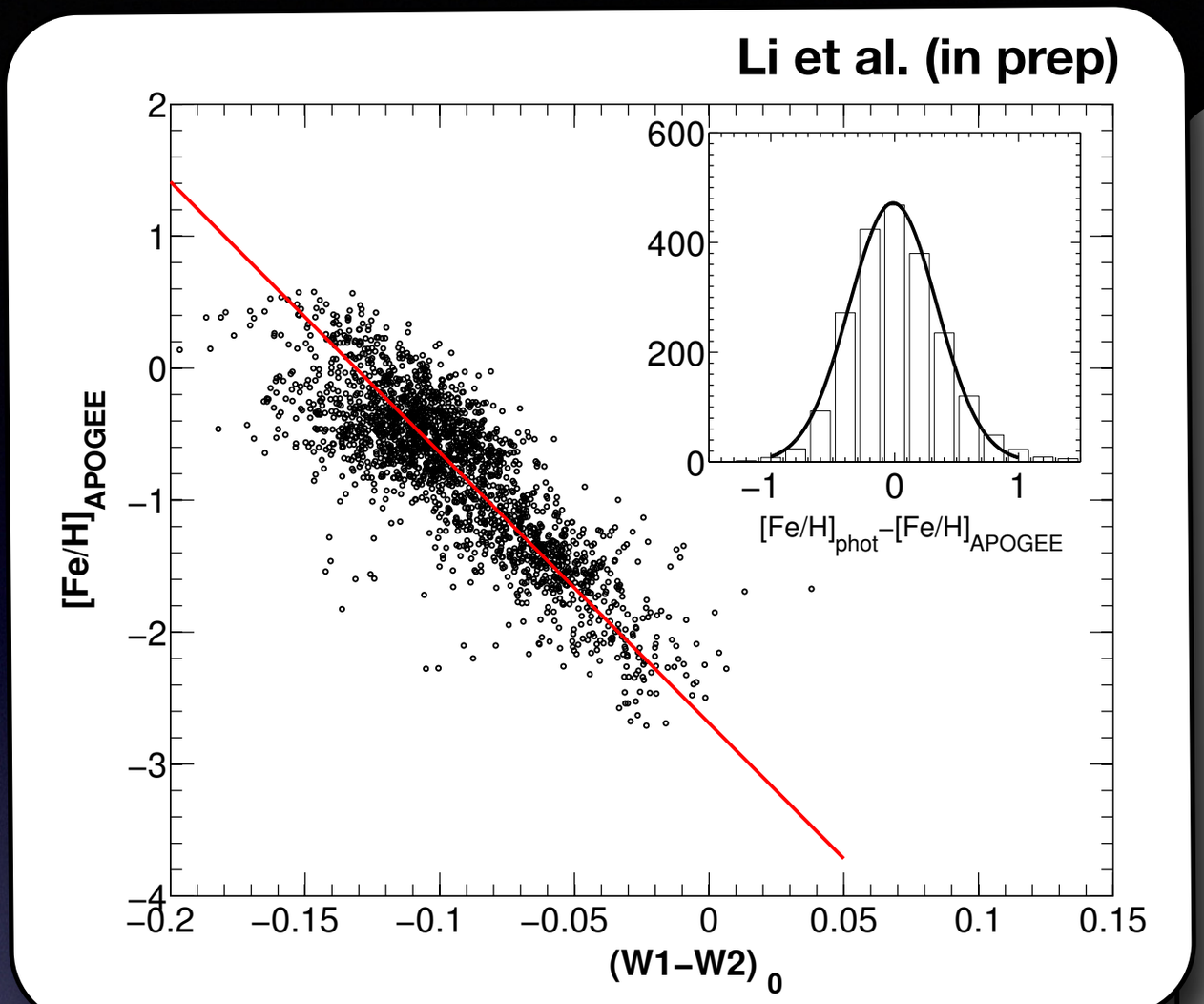

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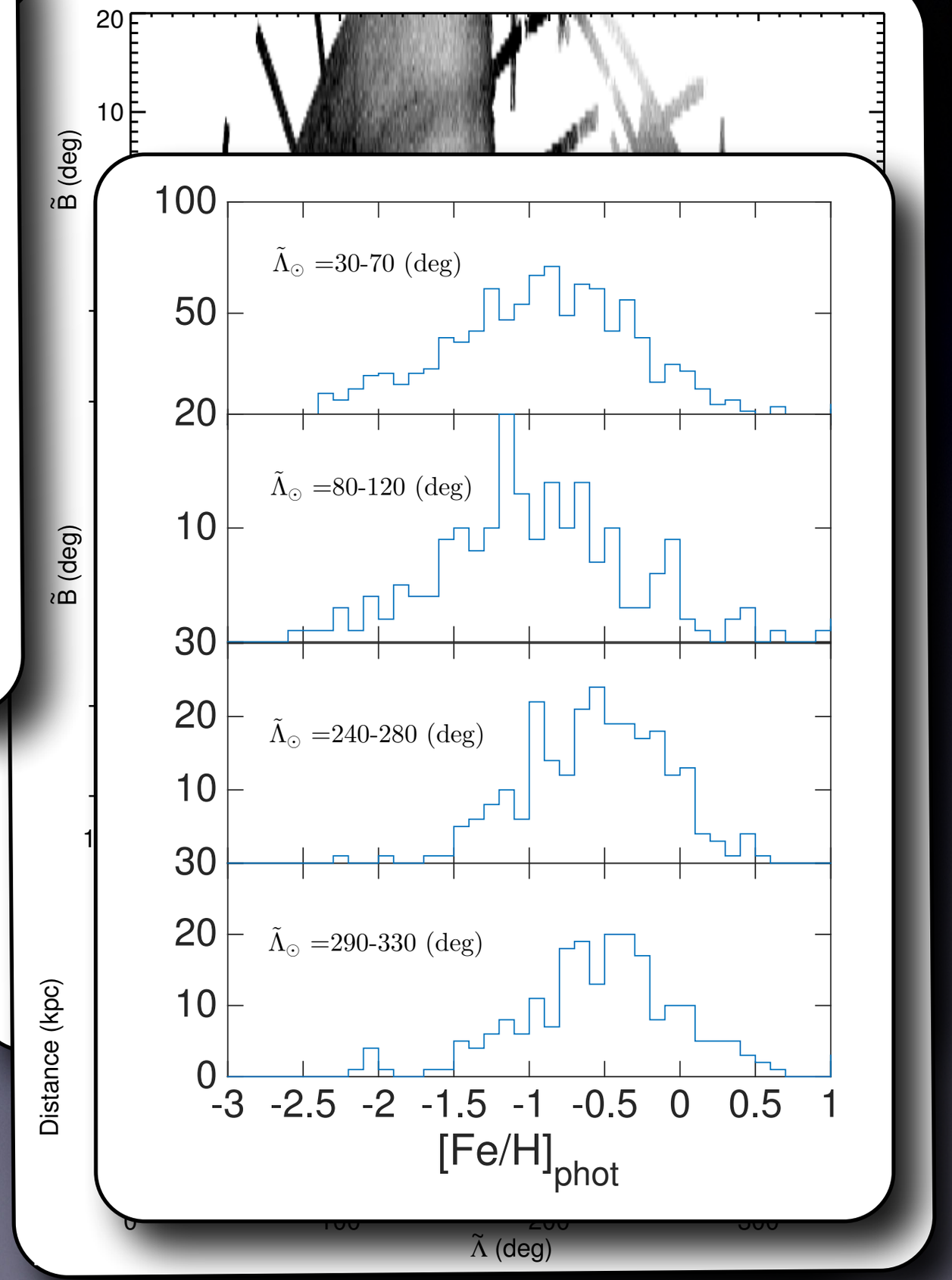

LAMOST summary

- Full survey is making good progress, obtaining over 1M stars each year to 17th mag
- Pipelines are relatively robust and continually being improved
- Large number of spectra for Kepler/K2 fields
- A lot of great science underway
- DR1 will be released internationally in March, including catalogues and spectra (1.8M with S/N > 10; 1M FGK star parameters)

Other projects

- Hills & hypervelocity stars (Yanqiong Zhang & John Vickers -SHAO, Shanghai)
- Alphas & ages for LAMOST stars, starting with LAMOST-KEPLER (Emma Small & John Vickers - SHAO, Shanghai; Corrado Boeche - ARI, Heidelberg)
- Orbital structure of disc & bulge stars from N-body models, currently analysing the APOGEE bulge high-velocity peaks (Matthew Molloy - KIAA, Beijing)
- Outer-halo substructures using BHBs from deep u-band photometry, including a comprehensive characterisation of the Pisces over-density (Jundan Nie - NAOC, Beijing)
- Pulsar microlensing (Dai Shi - PKU, Beijing)

Discussion points

- **What aspects of the data analysis would you like to see worked on?** Alphas are being coming, as I have shown gravities can be calibrated (with caveats), but is there anything else?

- **Future plans for LAMOST?** The five year survey will end in Summer 2017. What next? The higher-res grating is an option (see below), especially useful if this will provide reliable alpha-element abundances. Or time domain for binaries or variables? Or just keep going, making a complete survey of the disc.

This is what they said back in 2012 regarding the higher-resolution option: “The survey will also include an R = 5000-10,000 mode, which will yield two pieces of the spectrum that are 350A wide, one in the red and one in the blue.The blue wavelength coverage is centered around 5300A to sample many metal lines,including the prominent Mg b (5175A) triplet. The red segment covers the spectral range 8400-8750A, sampling the CaII triplet, Fe I, Ti I, and other lines, which are ideal for measuring the RV and [Fe/H]. This R = 5000 mode wavelength coverage and dispersion is similar to that of the RAVE experiment.”