Oscillations of Li-rich giant stars in LAMOST-Kepler fields

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The Li-rich K-giants in LAMOST

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OUTLINE

- Motivation of studying the Li-rich giants.
- Research methods
- Li-rich giants from LAMOST and Kepler
- Some latest results
- Summary

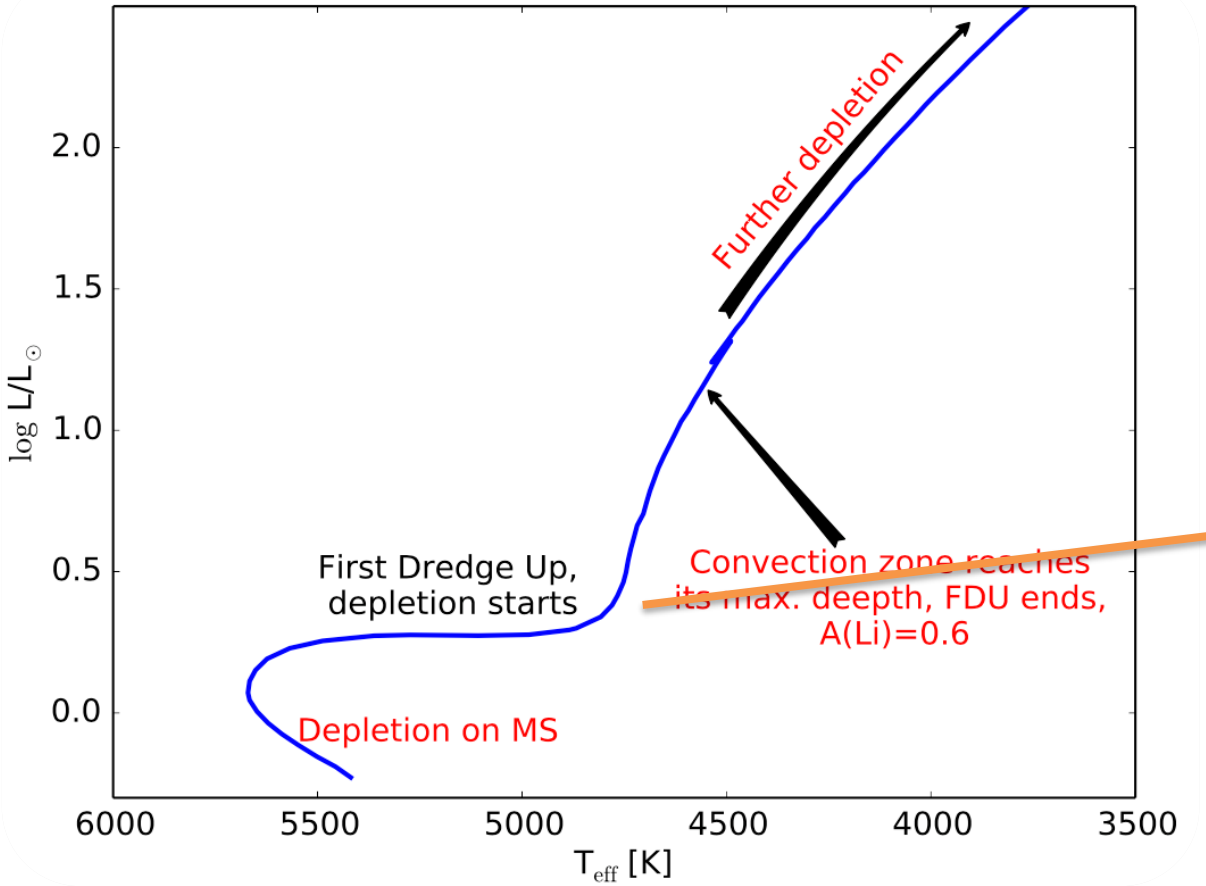
Motivation of studying the Li-rich K giants.

Convective shell deepens down surface materials ➔ Li free matters.

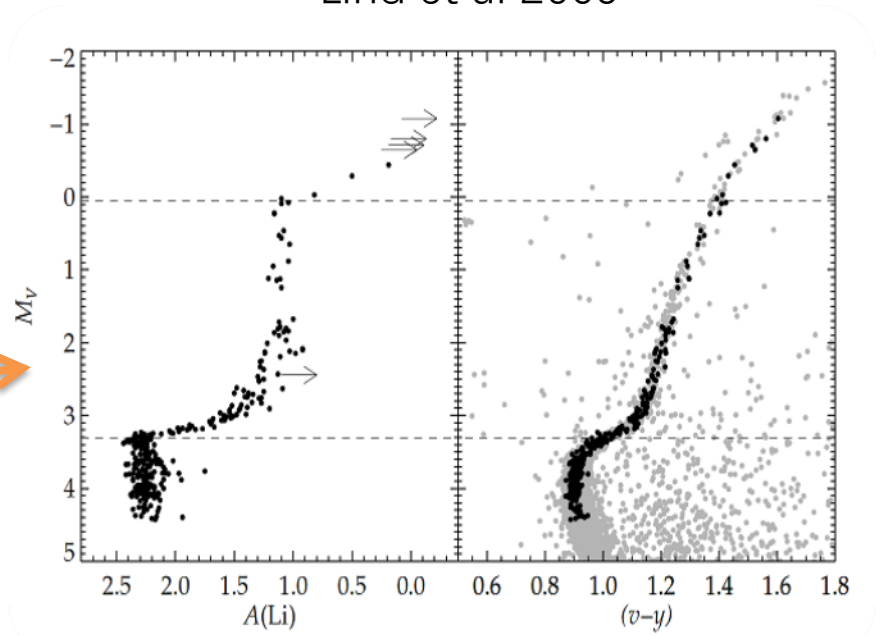
sharply dilute the surface Li abundance by a factor of 60,

$A(Li)_{init} \leq 3.3$ ➔ $A(Li) \leq 1.5$ (> 1.5, Li-rich)

The standard stellar evolutionary model has shown a clear picture on how a low-mass star evolves after its hydrogen core being exhausted.

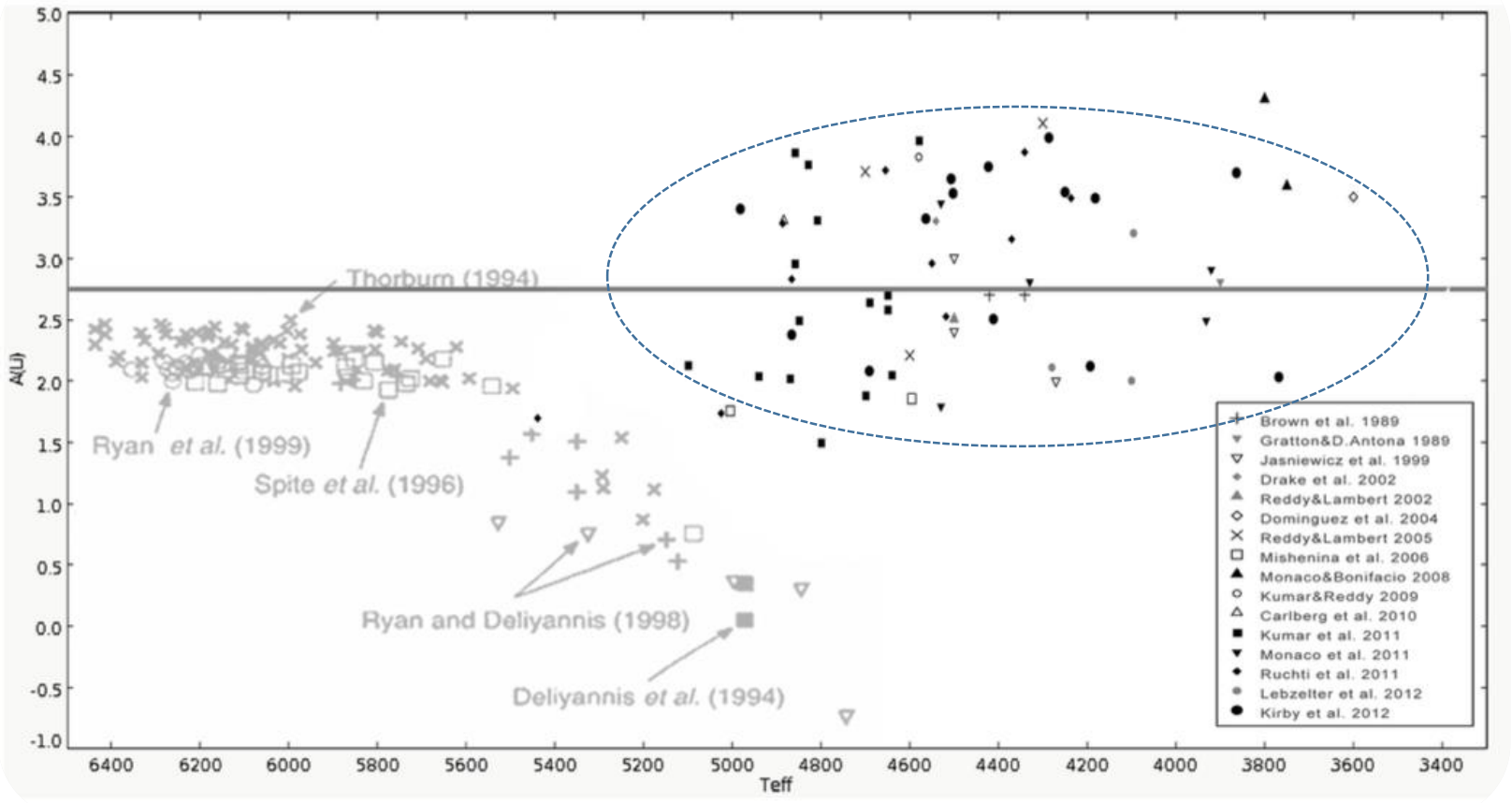


Lind et al 2009



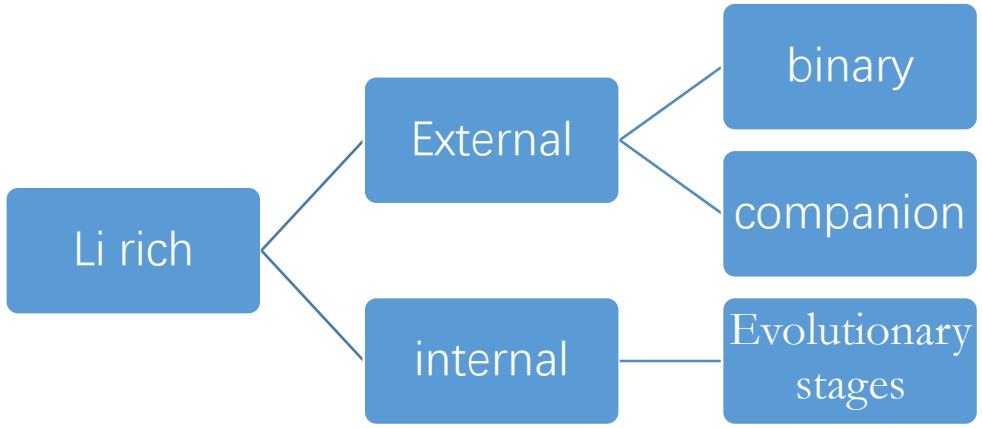
Motivation of studying the Li-rich K giants

More than 150 Li-rich giants have been found
Widely distributed
~ 20 super Li-rich giants
At most 5 of them have A(Li) > 4.0



Motivation of studying the Li-rich K giants

- Why Li-rich



- Decades of effort has been put into explaining why such outliers exist and a number of inspired ideas have been proposed

- The origins of the Li-rich giants are still in debate

Motivation of studying the Li-rich K giants

1% of giants are detected to be Li-rich giant stars

Discovery of the Li giant stars by the Large Surveys

First Li-rich K giant discovered serendipitously HD 112127 (Wallerstein & Sneden 1982)

Candidates	Properties	Li-rich	Rate	References
670	Nearby objects	10	1.5%	Brown et al. 1989
-	IRAS	19 (by-product)	-	De la Reza et al. 1996, 1997
280	Selected IRAS	5	1.7%	Castilho et al. 1998
26	High rotating giants	10	~50%	Drake et al. 2002
400	Galactic Bulge	2	0.5%	Gonzalez et al. 2009
401	Galactic Bulge	3	0.7%	Lebzelter et al. 2011
824	Galactic thick disk	6	0.7%	Monaco et al. 2011
2000	Extended survey	19	1.0%	Kumar et al. 2011
700	RAVE metal poor	6	0.8%	Ruchti et al. 2011
8535	SDSS	23	0.3%	Martell & Shetrone 2013
348	PTPS	7	2.0%	Adamow et al. 2014
2000	Gaia-ESO iDR4	20	0.4~1.0%	Casey et al. 2016

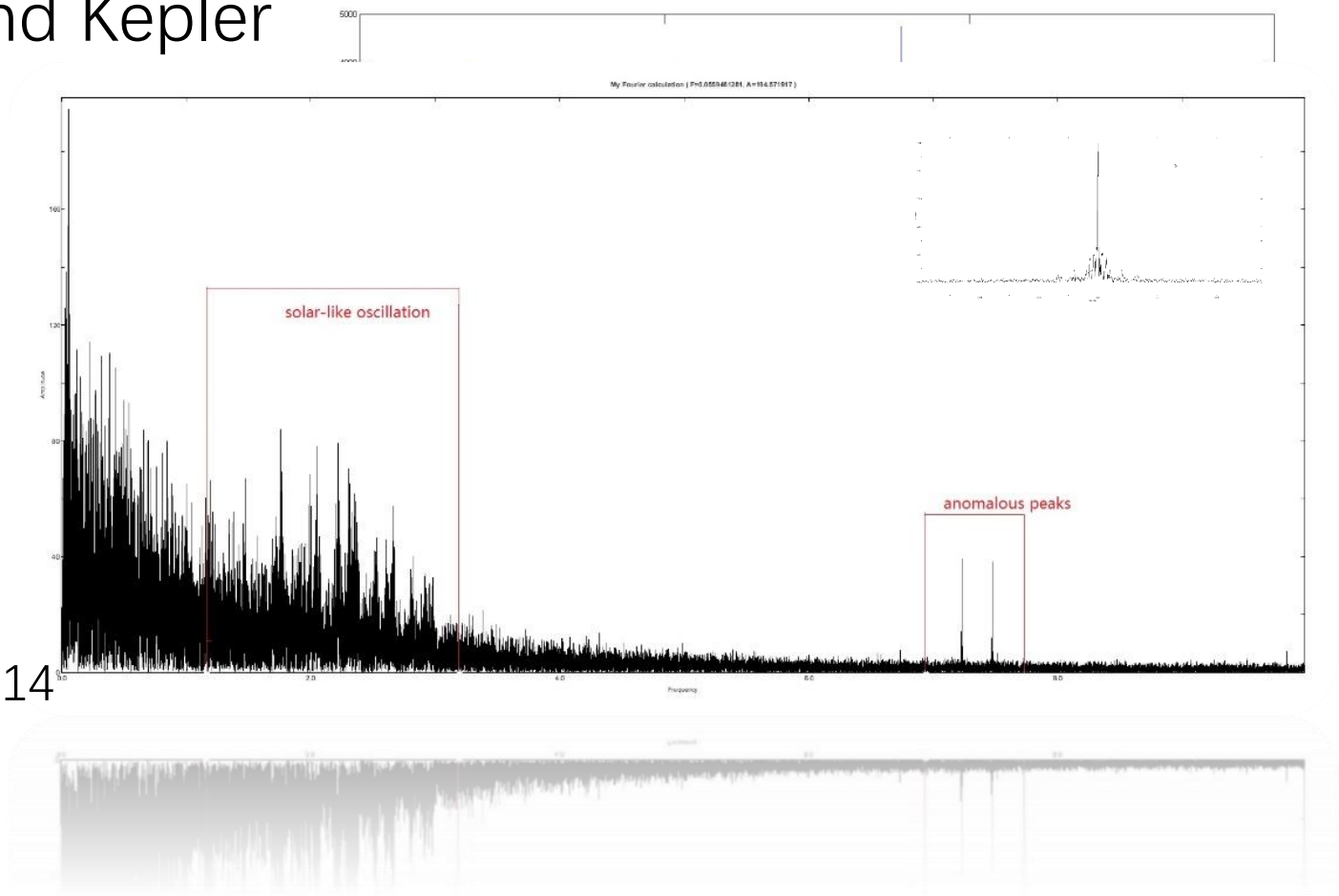
Research methods

- LAMOST select candidates
- Kepler data
- High resolution spectra
  - Telescope involved:
    Subaru8.4m, APO3.5m, APF2.4m, Lijiang2.4m,1.8m, Okayama1.88m

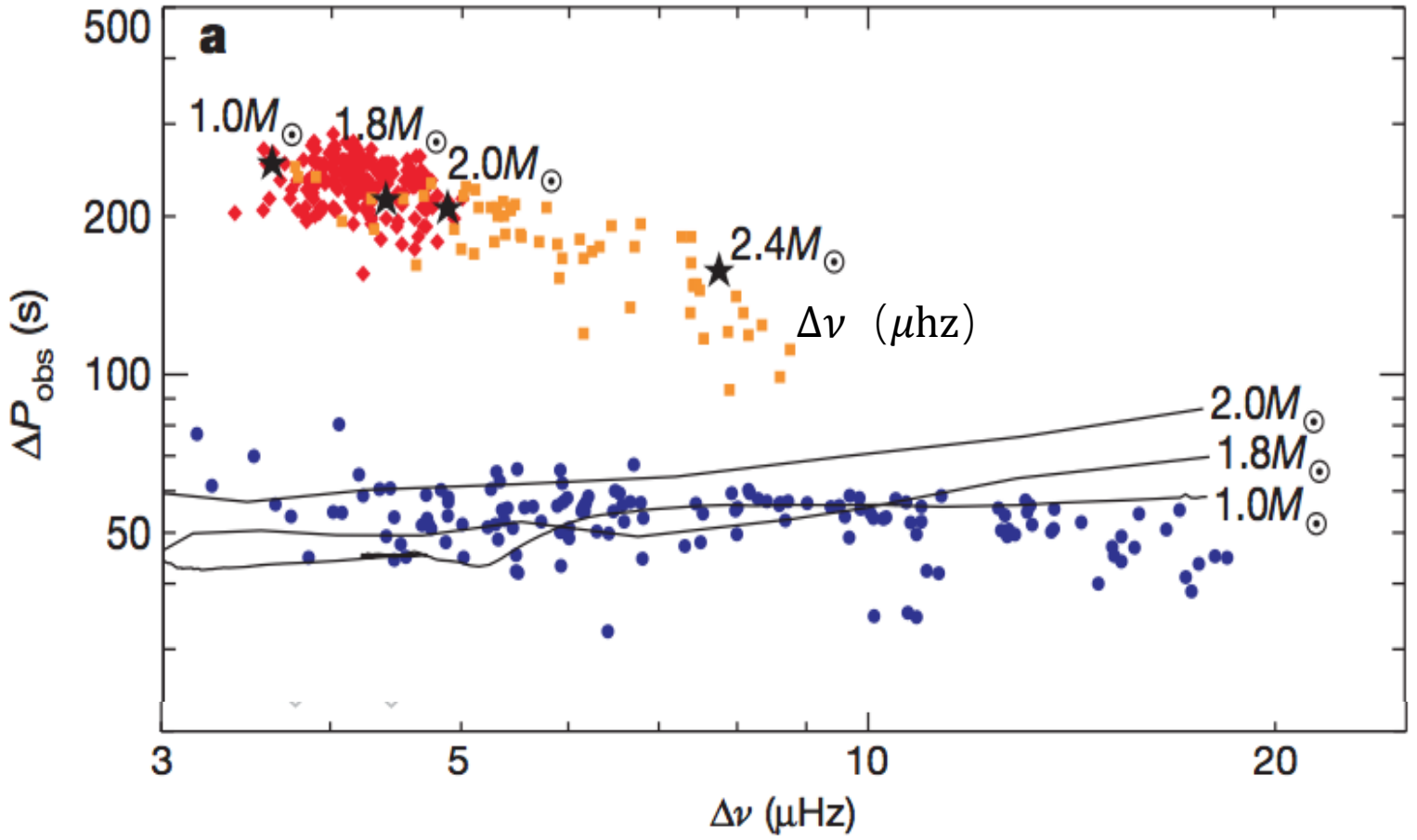



Li-rich giants from LAMOST and Kepler

- X-Match LAMOST and Kepler
- Light curve analysis
  - Binary
  - Companion
  - Variable star
- Frequency analysis
  - Base on two articles
    - Bedding et al 2011
    - Silva Aguirre et al 2014



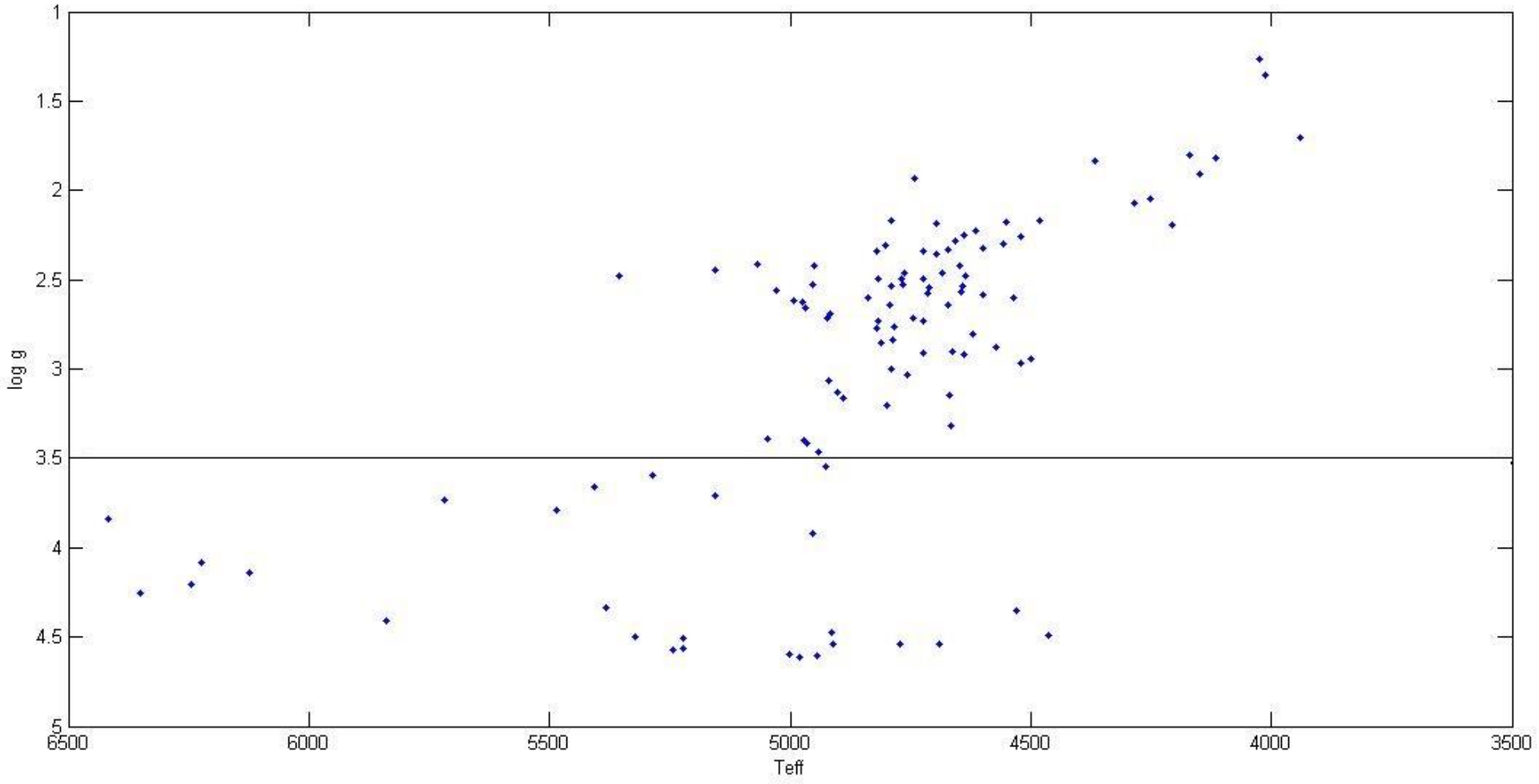
Li-rich giants from LAMOST and Kepler



Bedding et al 2011

Some latest results

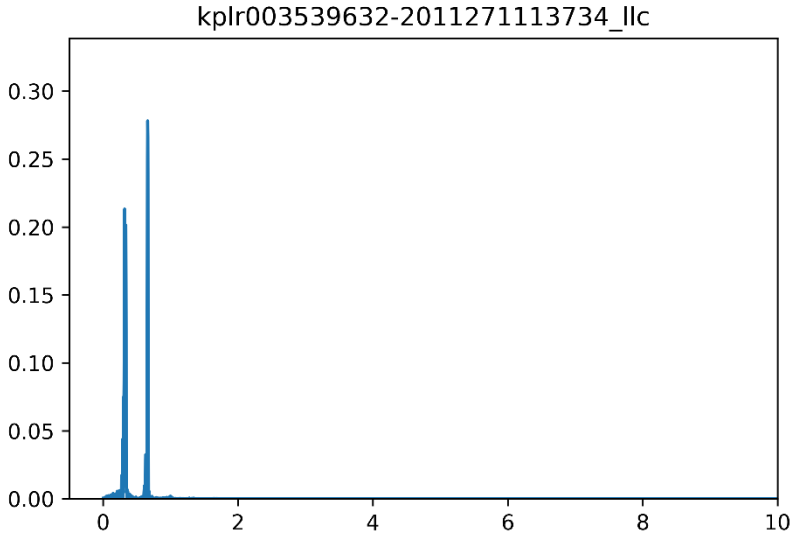
- 291 Li-rich candidates, 136 variable stars, 89 red giant

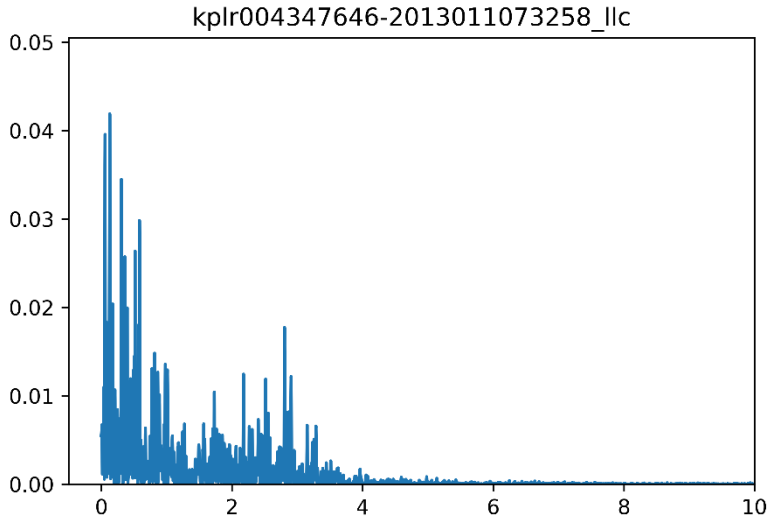


Some latest results

- Not found binary yet

- Two types:





Summary

- LAMOST has unique advantage of studying Li-rich candidates, while Kepler data are of great importance for Li-rich giants.
- 291 candidates 136 variable stars 89 RG
- 100+Li-rich candidates have be observed with high-resolution spectra, including ~50 Kepler Li-rich objects

- Follow research
  - Kepler field Li-rich candidates
  - Accurate stellar parameters
  - Asteroseismic parameters
  - Model building

Summary

Thanks