Multi-wavelength Studies of stars and compact objects in light of LAMOST+

A progress report

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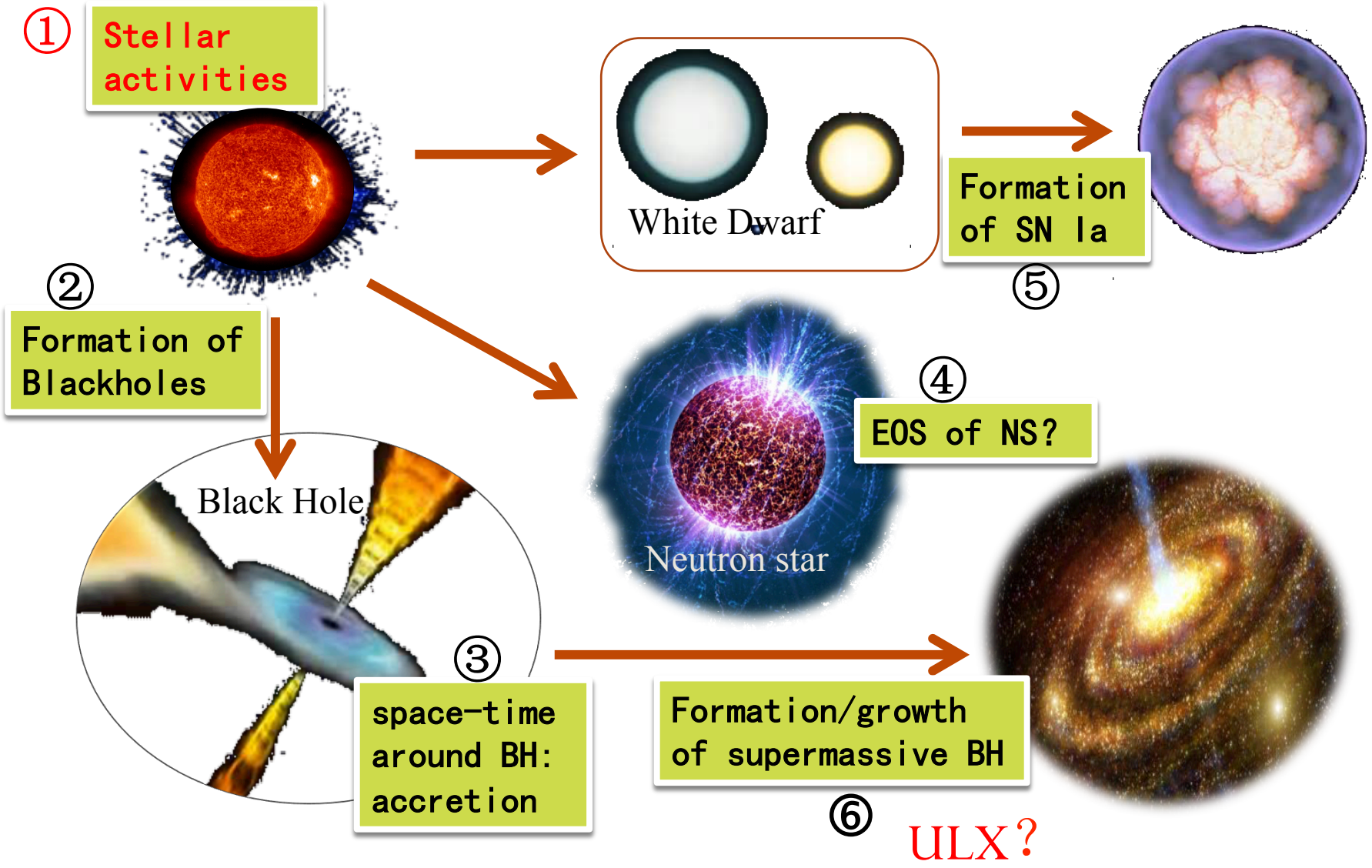
Huiqin Yang、Lin He

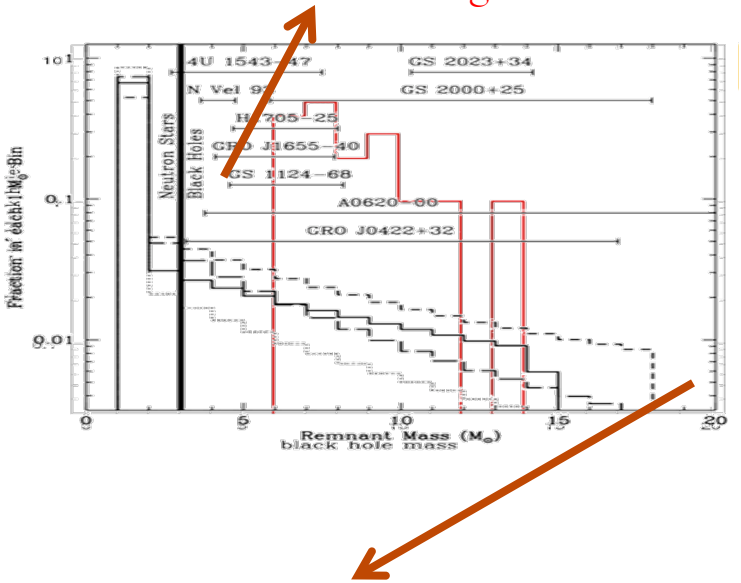
EAYAM2017 – 2017/11/17

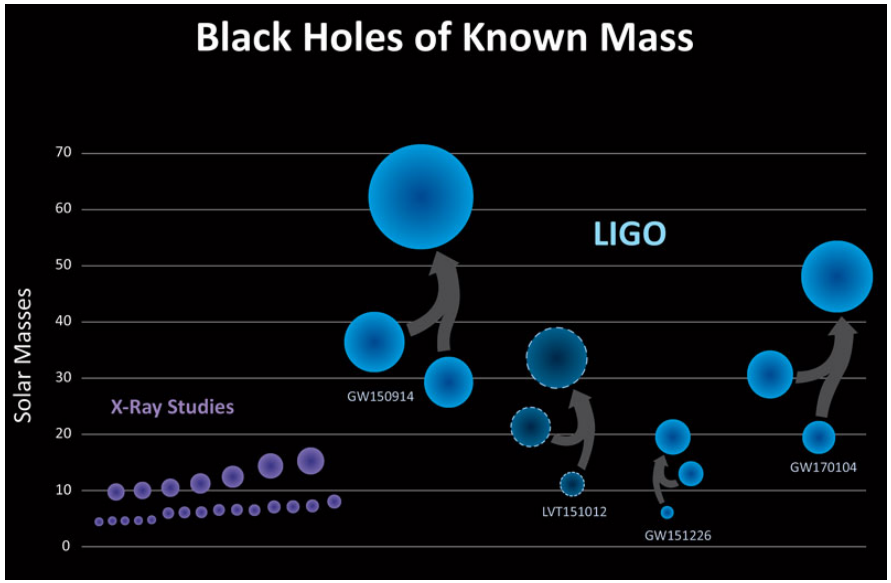
Stars and compact objects: Questions



Stars to black holes: Challenges!

Observations Miss light black holes?

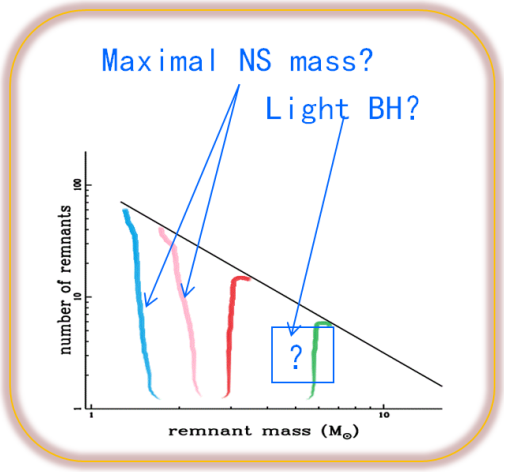




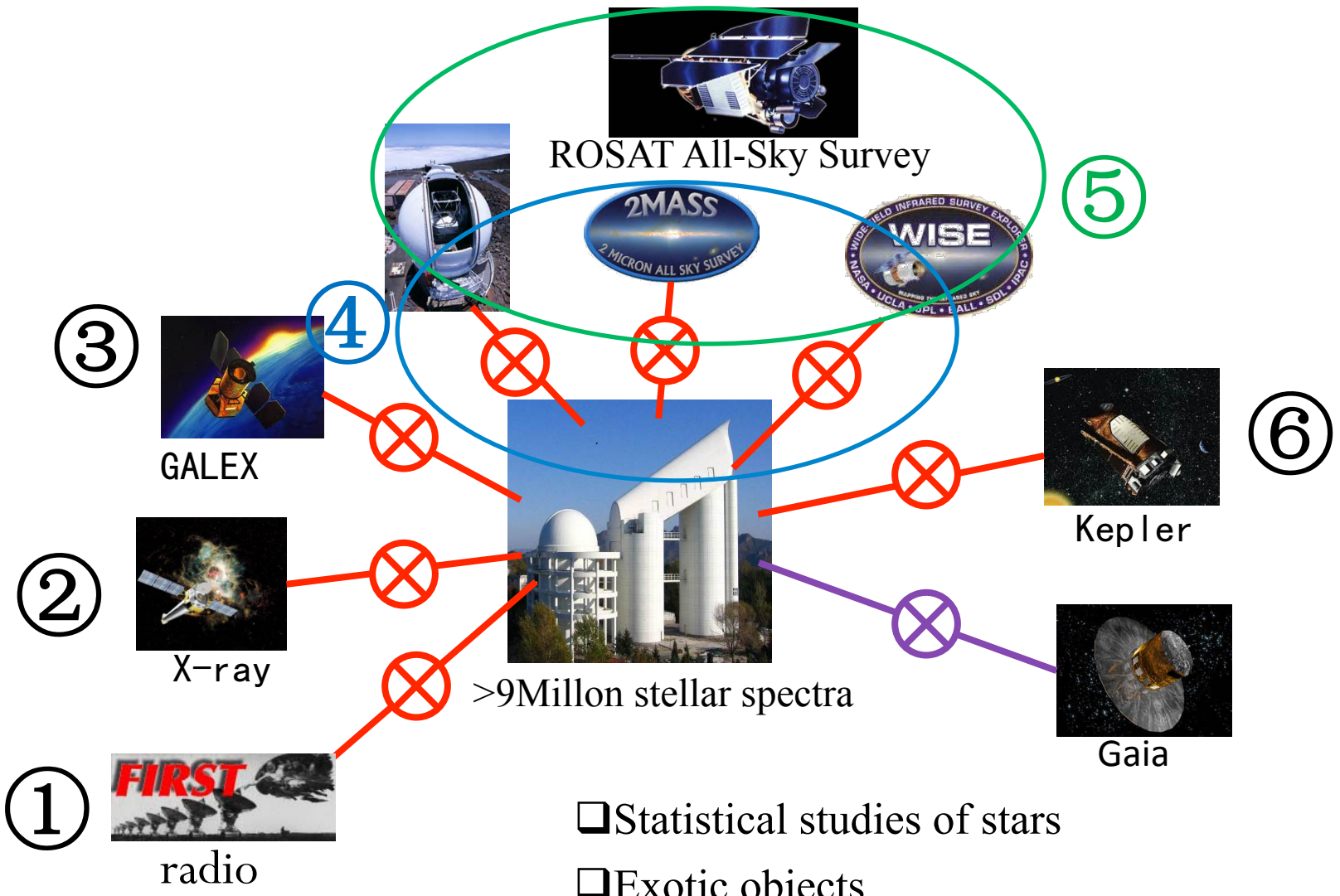
Theory Misses heavy black holes?

Urgently needed: Black hole mass distribution with statistical significance!

- Select a large sample of black hole binary candidates
- Measure the dynamical masses via monitoring campaign



Our approach: Big Data w/ LAMOST



- Statistical studies of stars
- Exotic objects
- Identification of compact objects

I: UV radiation from stars

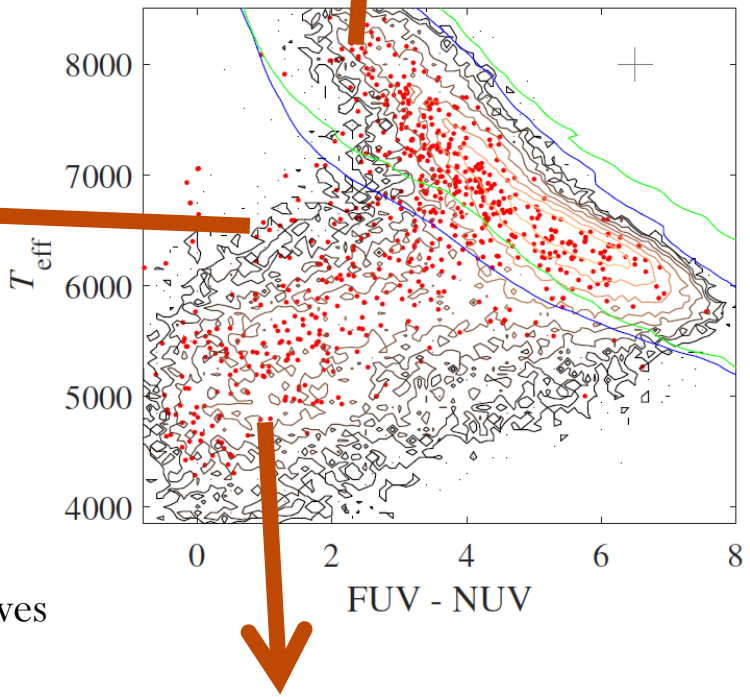
A catalog of 3millon stars

- LAMOST+GALEX+WISE
- Extinction estimates: RJCE

(Bai, Liu et al, 2017 ApJS in revision)

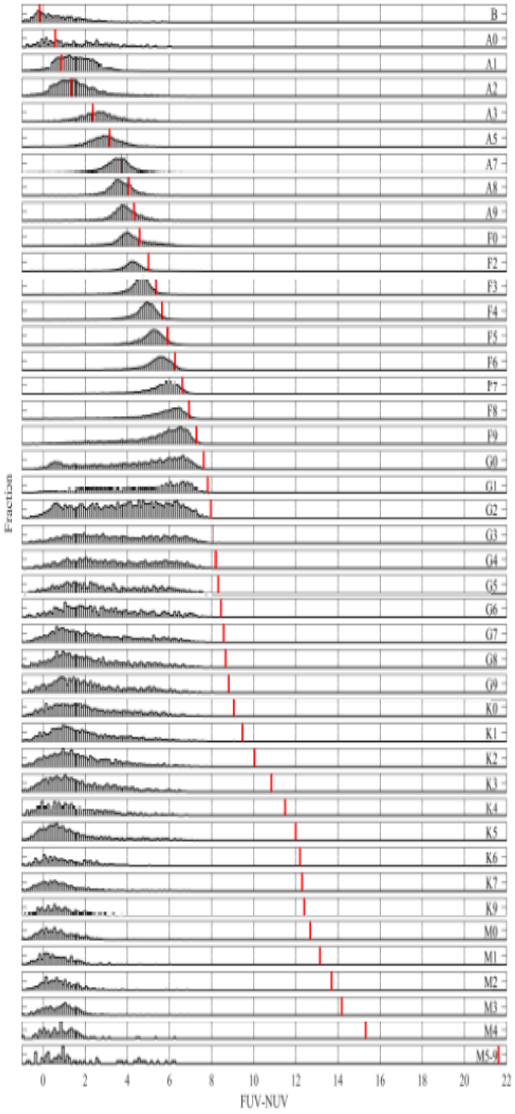
UV dominated by photosphere

Young F/G stars?
Or Binaries?



UV dominated by chromosphere

Red dots: spectra from SDSS



Future work:

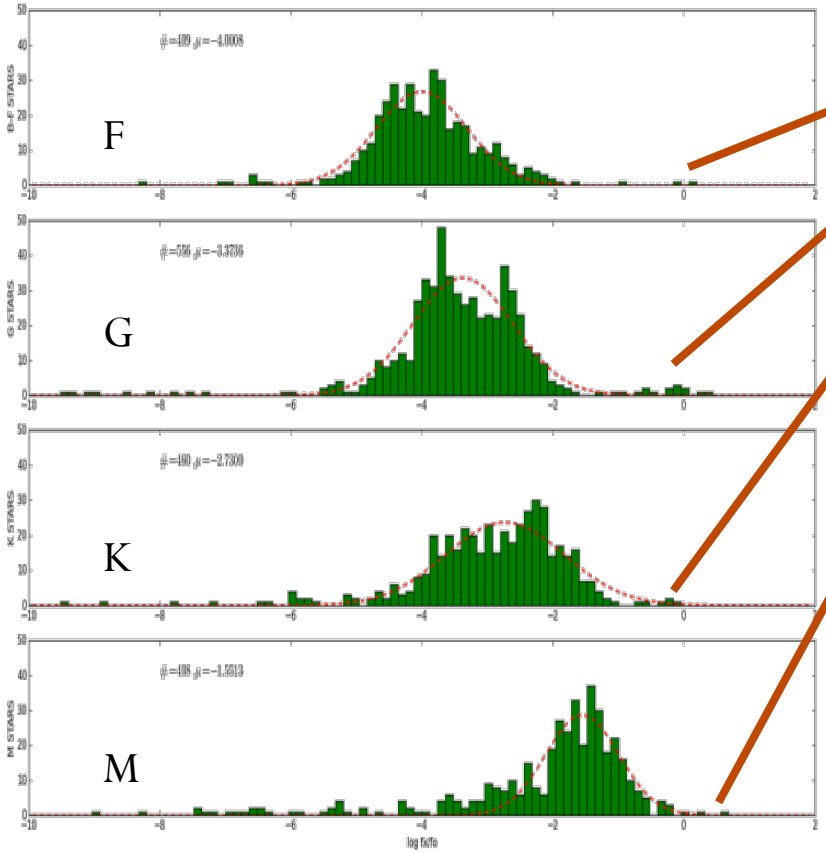
Stellar variability:

multiple observation
photon-counting light curves

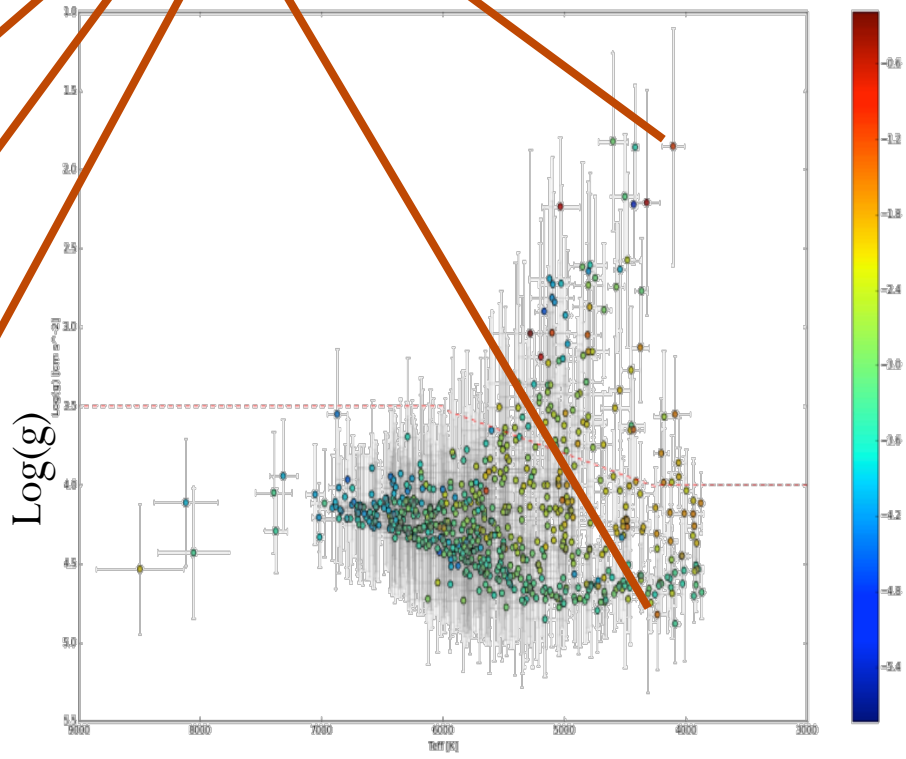
Origin of UV-upturn?

UV excess of late-type stars?
Helium stars?

II: X-ray radiation from stars



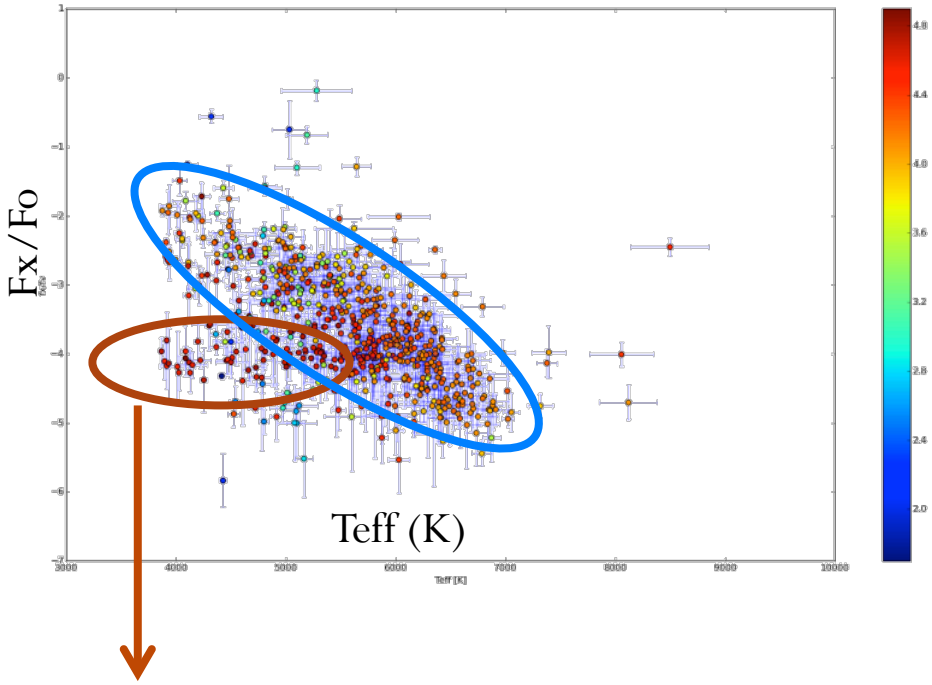
X-ray binaries?



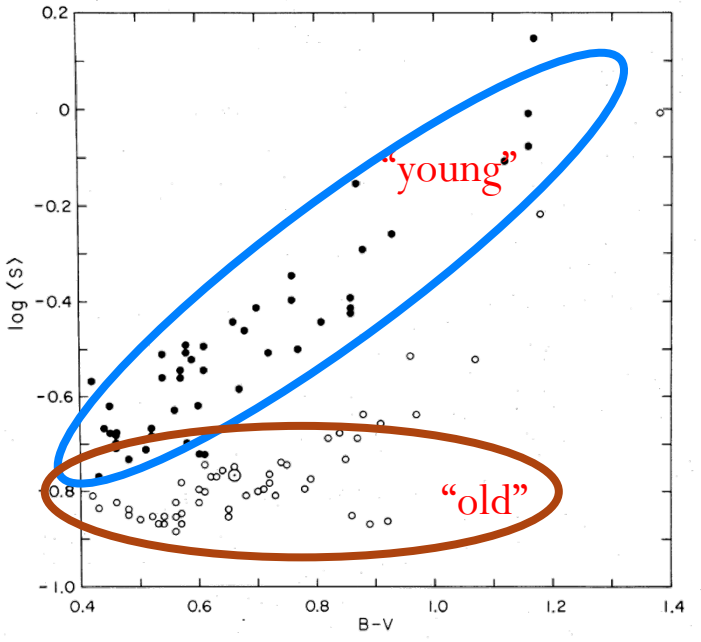
LAMOST+XMM-Newton

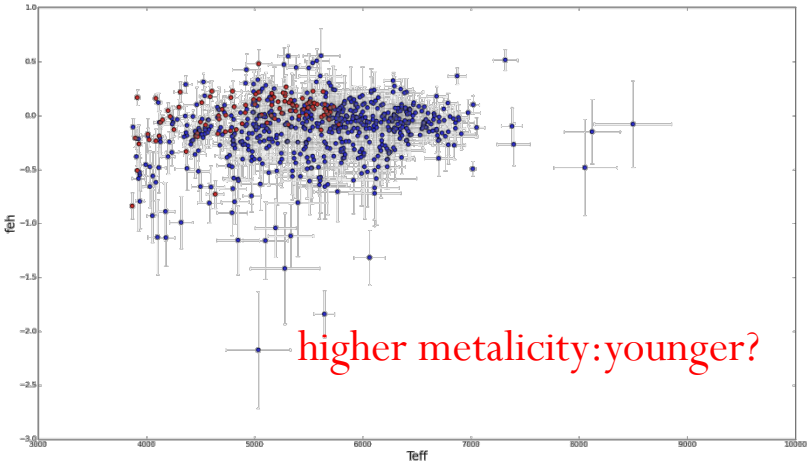
(He, Liu et al. in preparation)

II: X-ray radiation from stars



Less active subpopulation

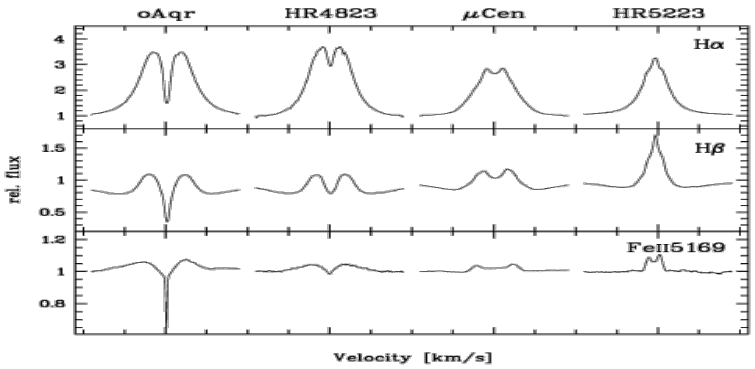


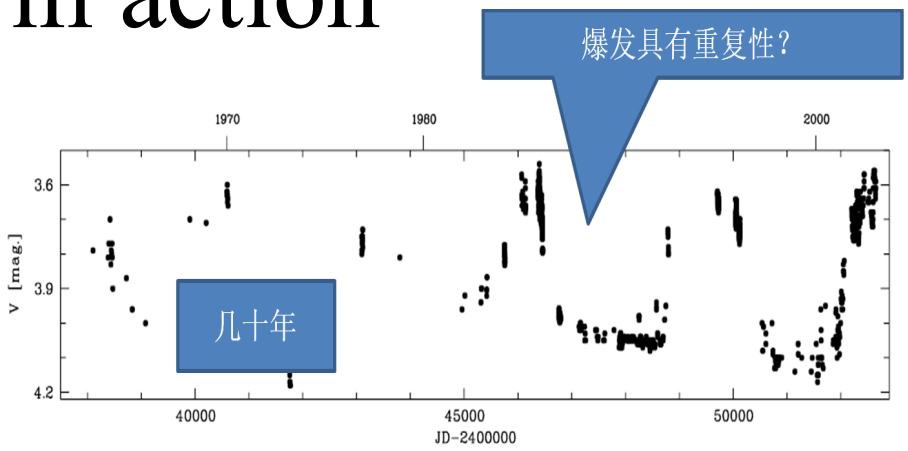


LAMOST+XMM-Newton

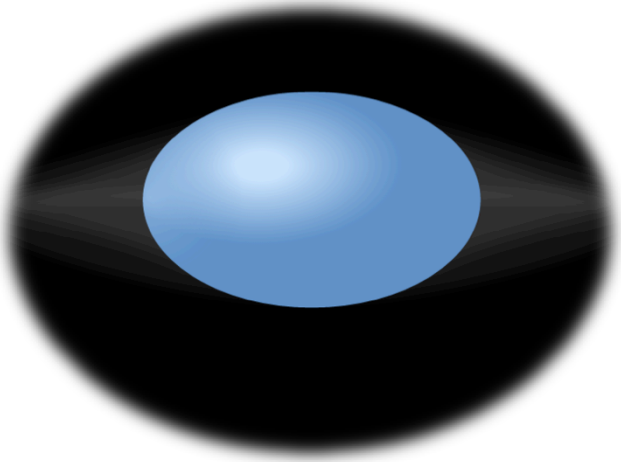
(He, Liu et al. in preparation)

III: Be stars caught in action

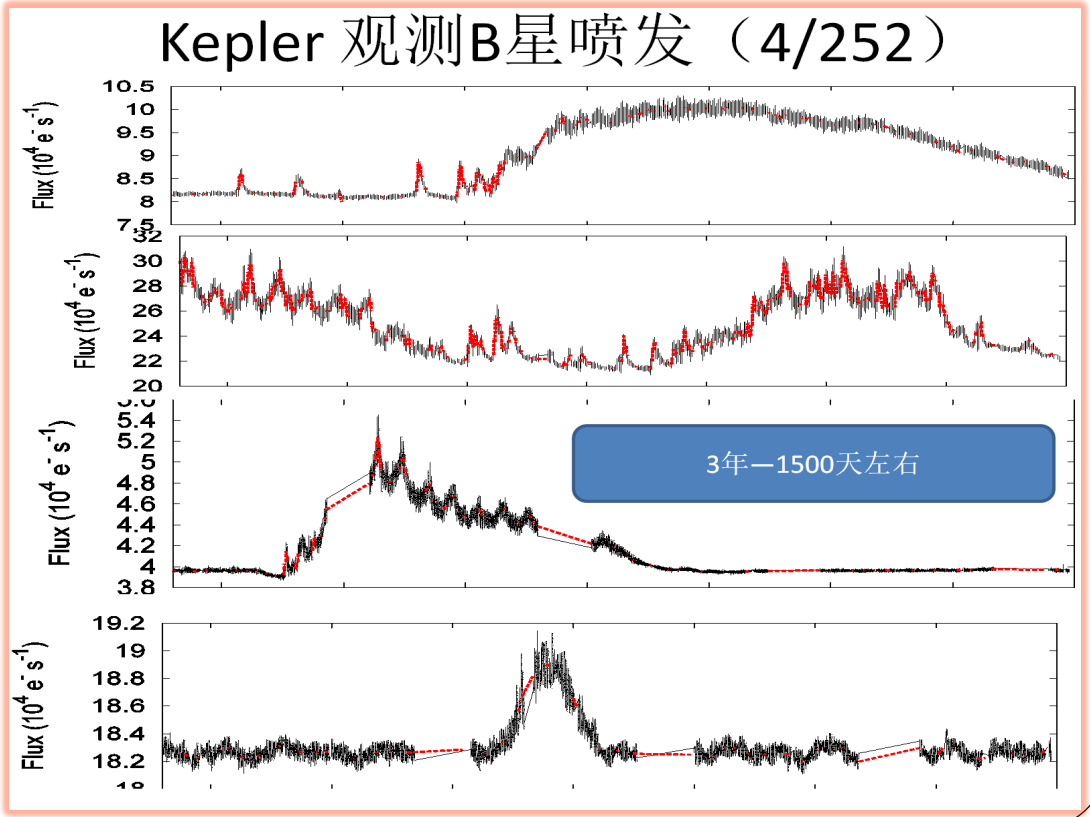




Be: B stars with emission lines
→gaseous disk around B stars

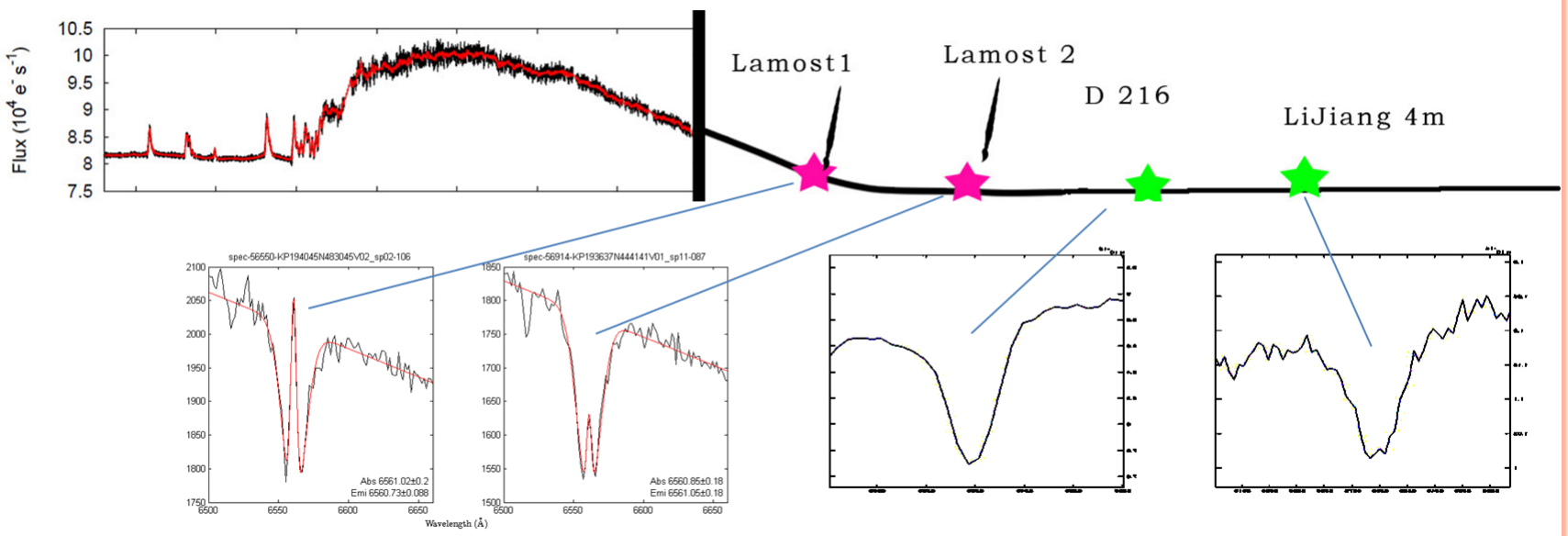


But how does the disk form?

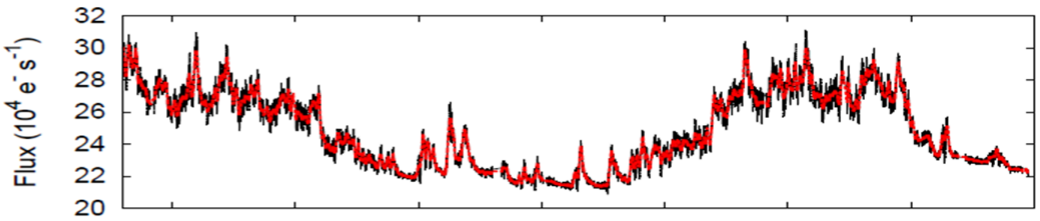


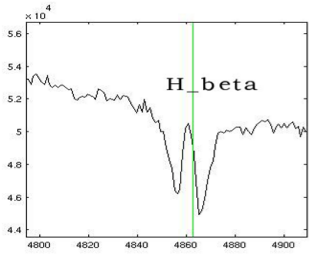
III: Be stars caught in action

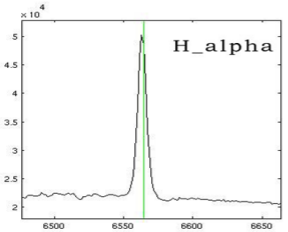
- KIC 9715425

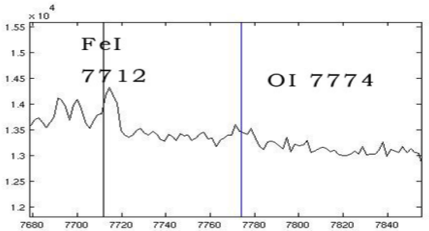


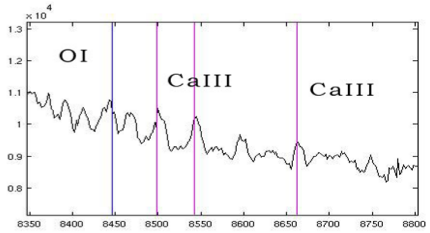
- KIC 6954726
- 发射线
  - Hα 6563 Hβ 4861
  - CaII 三重线
  - OI 线： 7774 8446
  - FeII 7712











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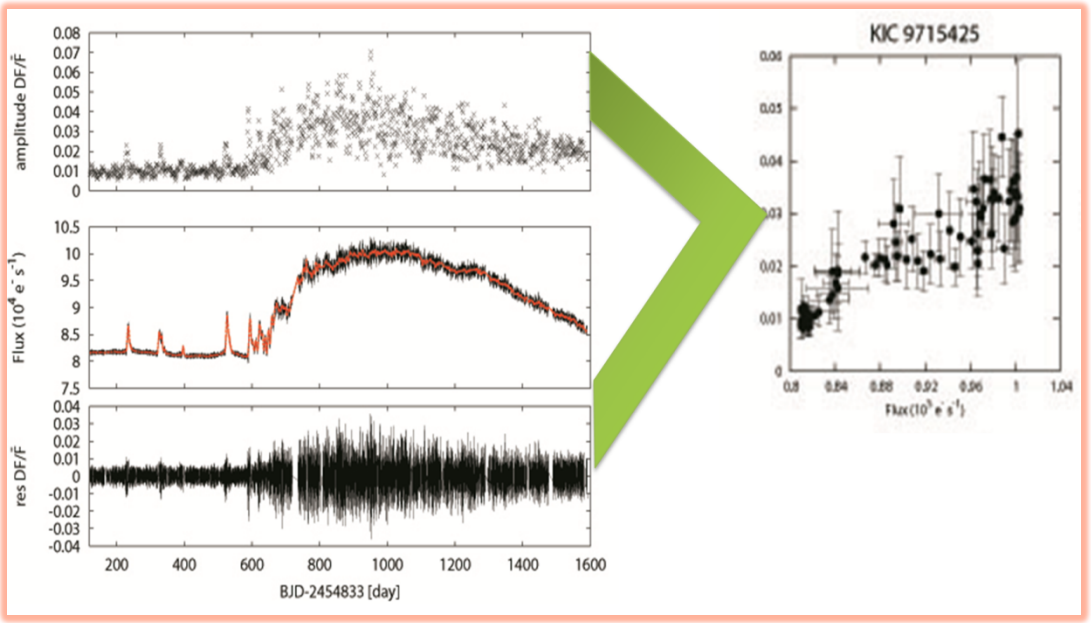
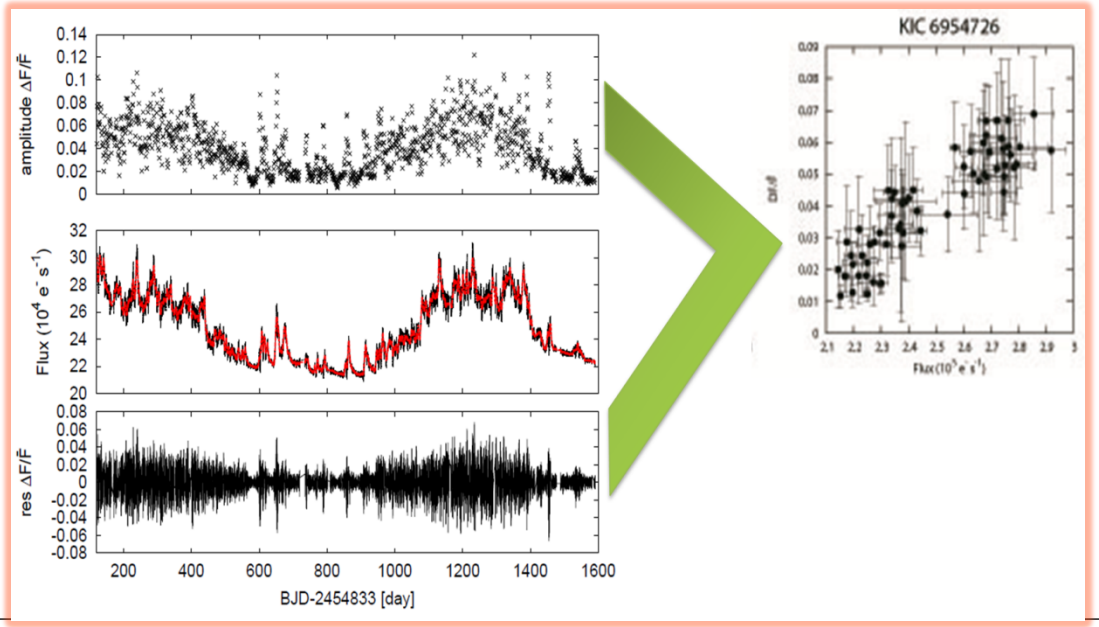
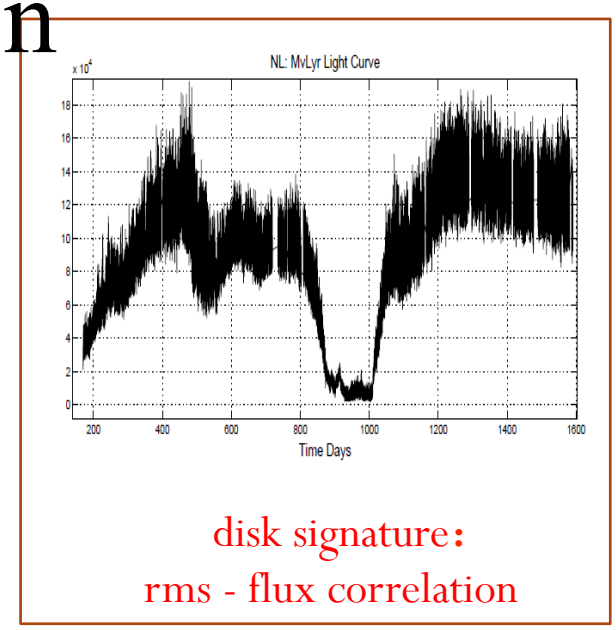
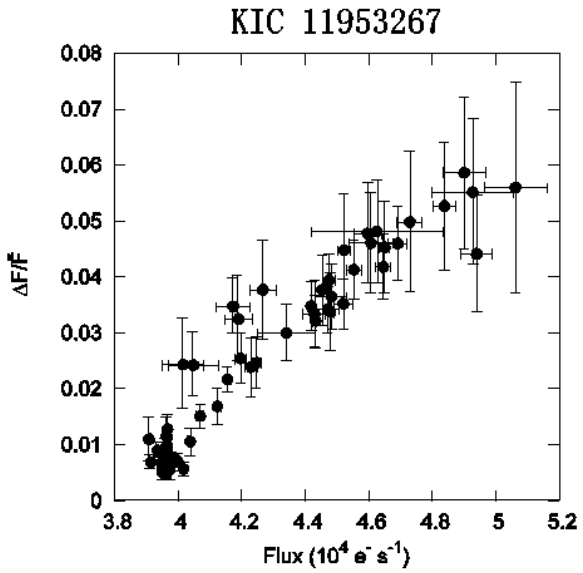






disk signature:
rms - flux correlation



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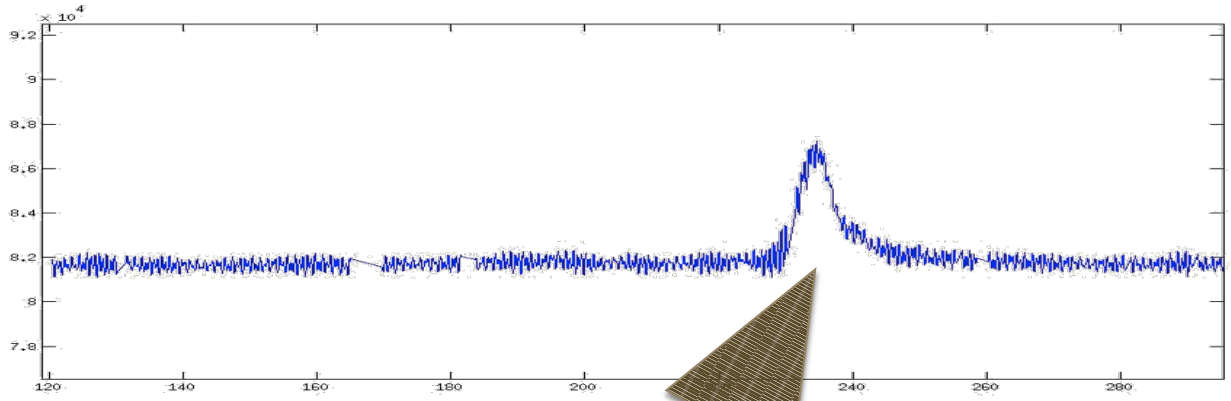
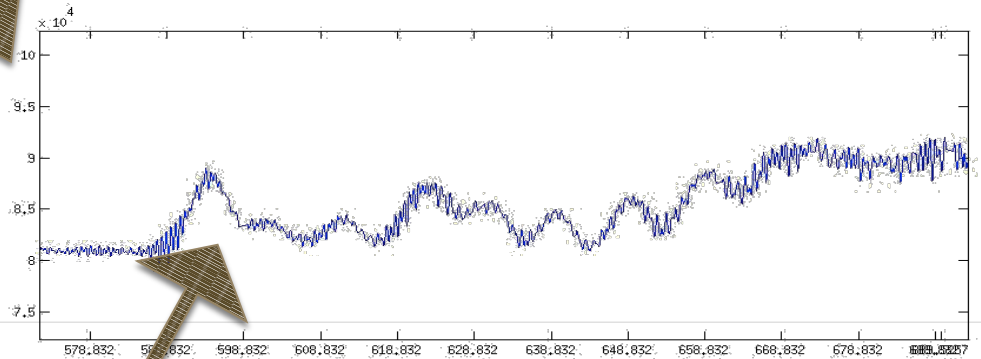
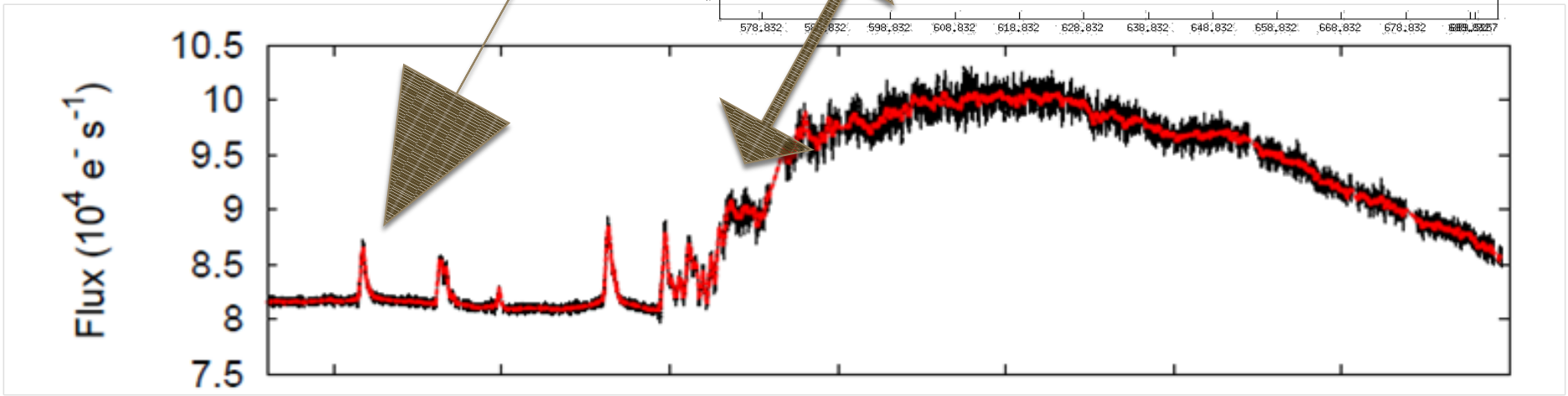
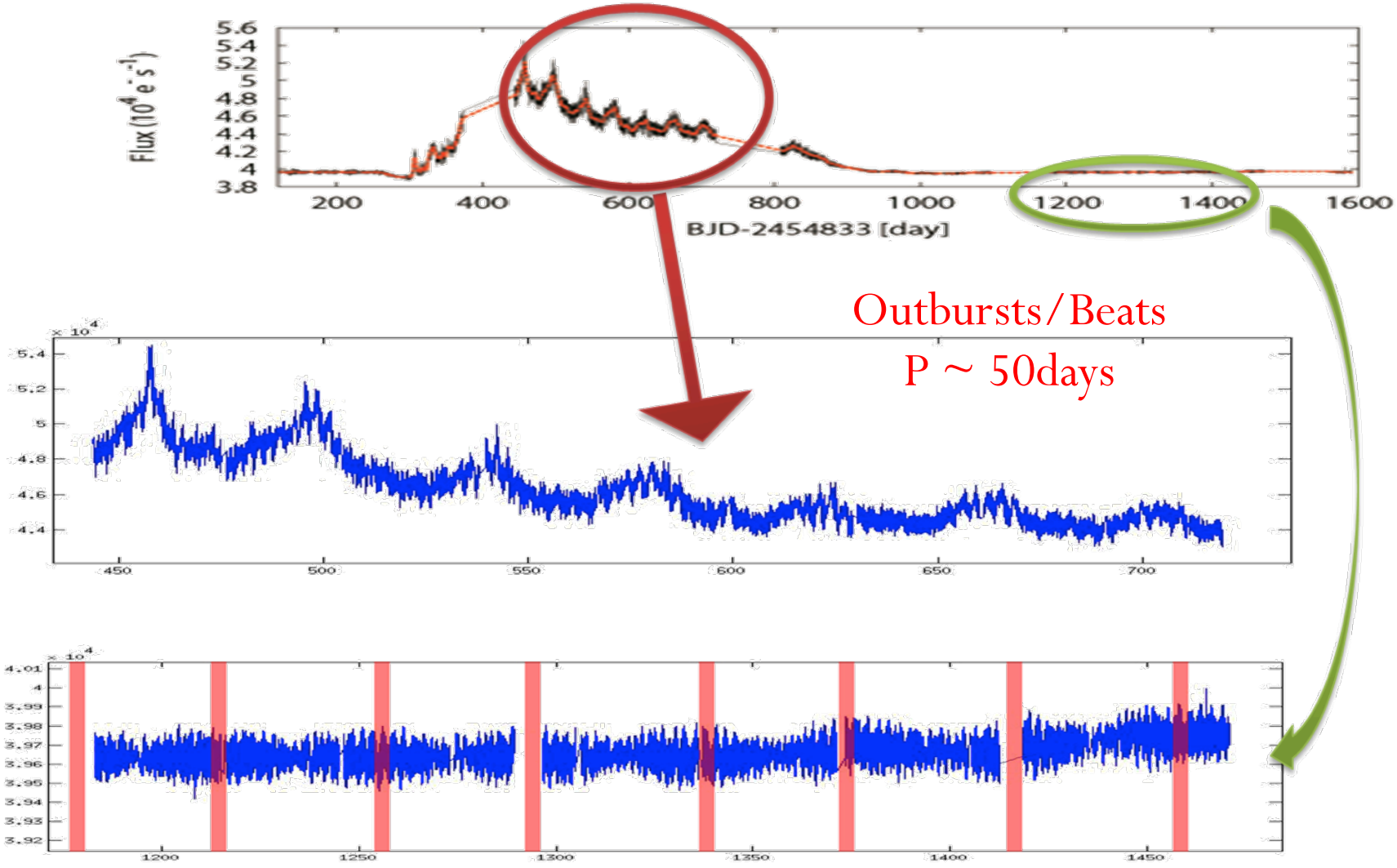






Outbursts
driven by beating

III: Be stars caught in action



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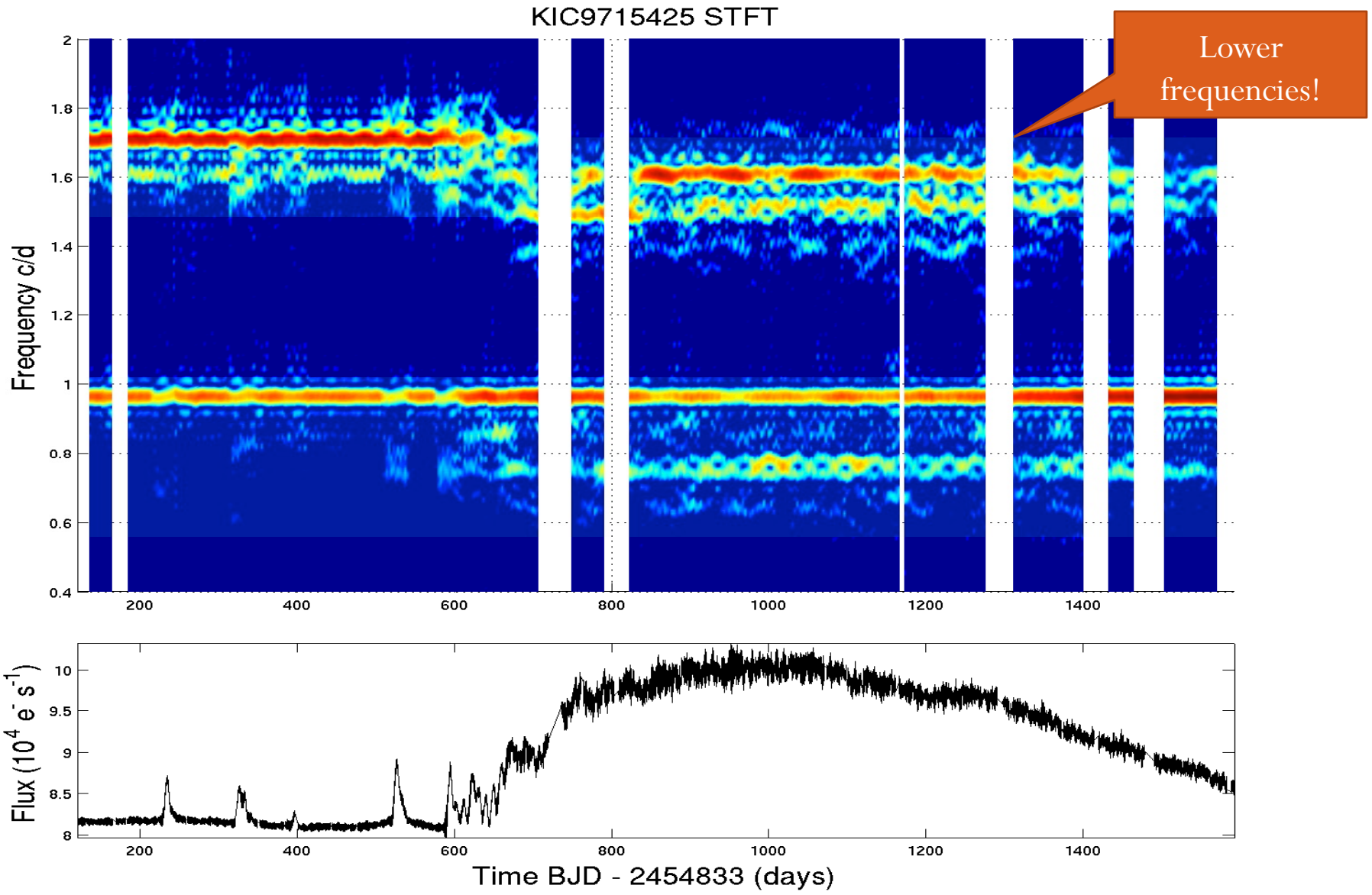

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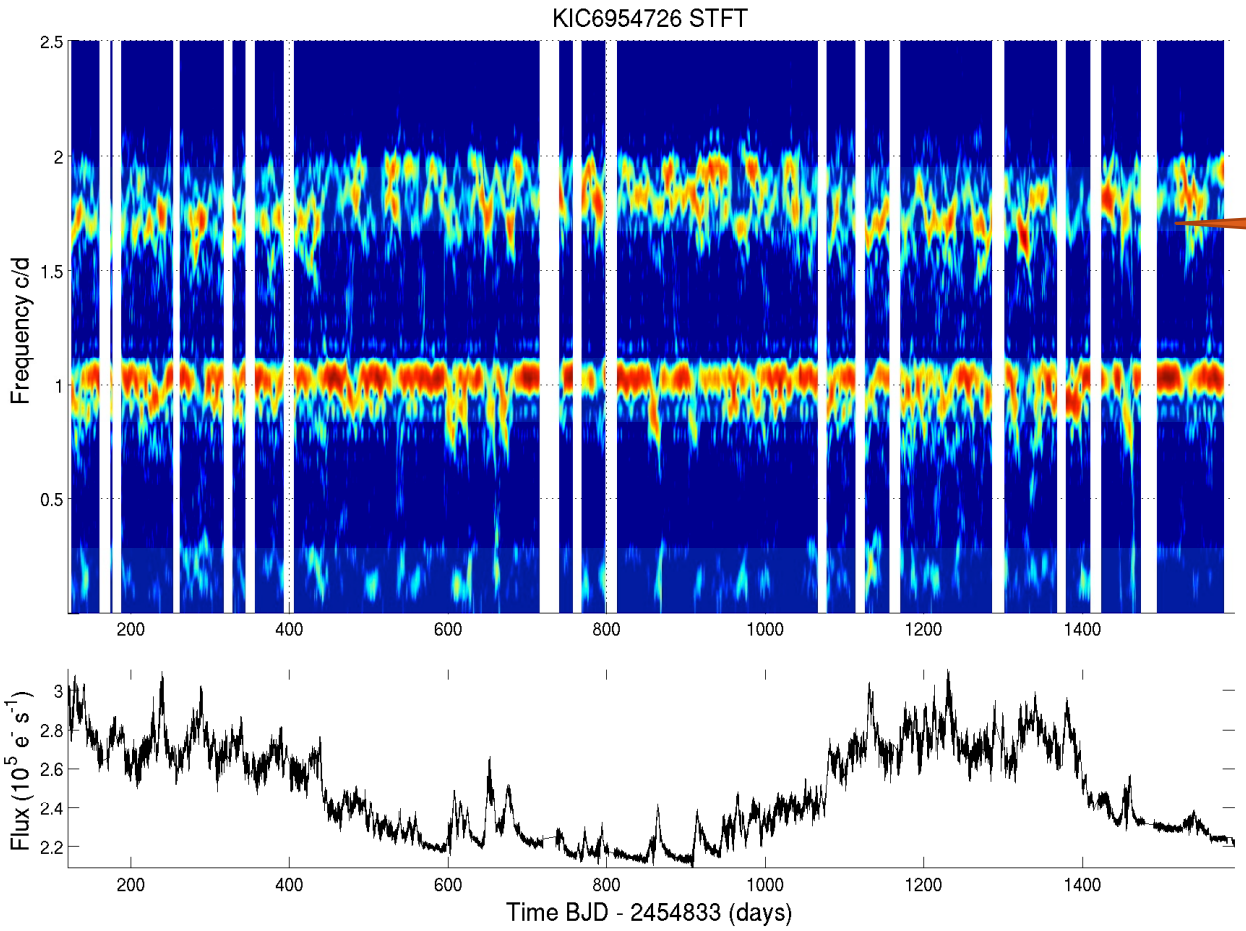
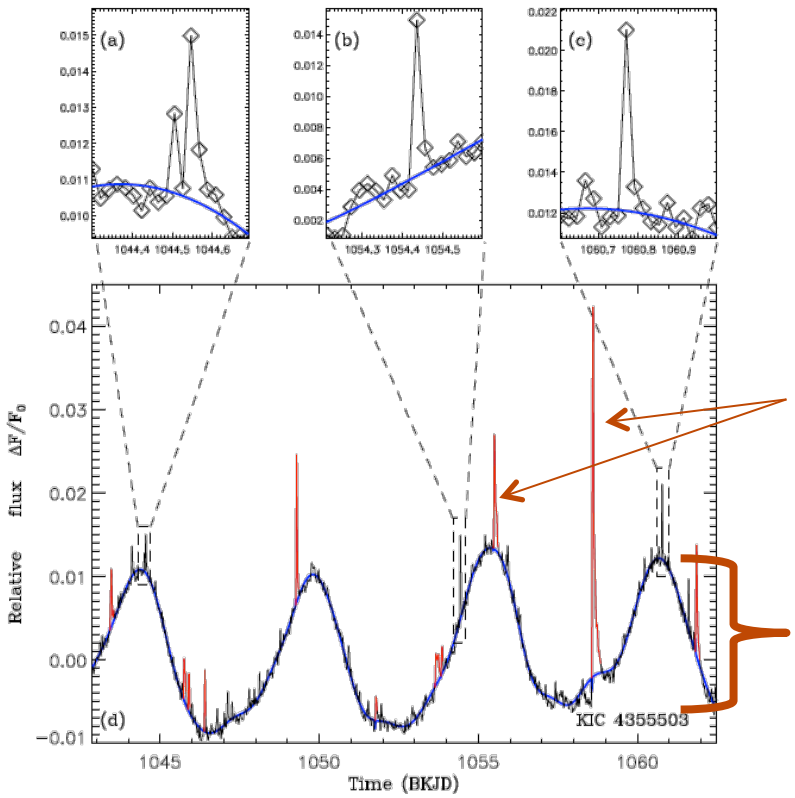


Lower frequencies !

（高清+2017）

What does this frequency change tell us?

IV: stellar activity of M dwarfs



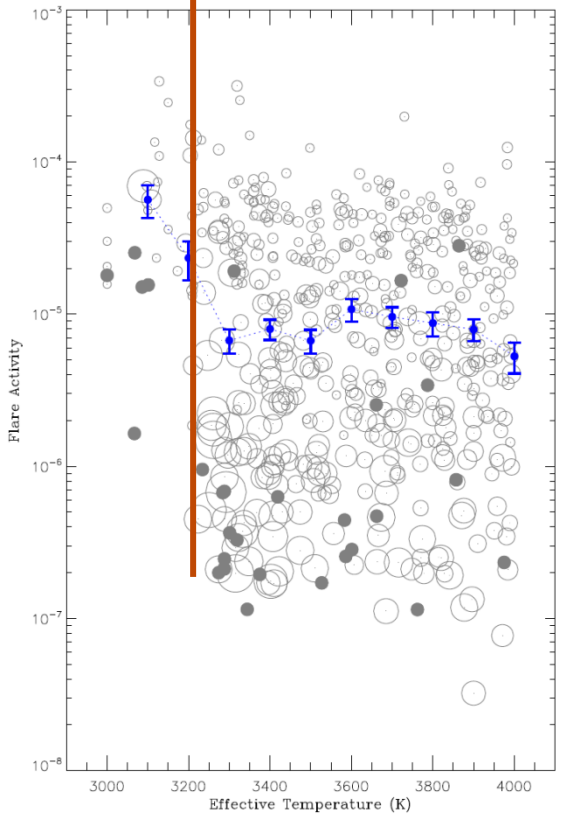
Kepler data

Flares: magnetic reconnection

Stellar spots (magnetic field) +Rotation

Yang, Liu et al. 2017, submitted to ApJS

Turbulent dynamo

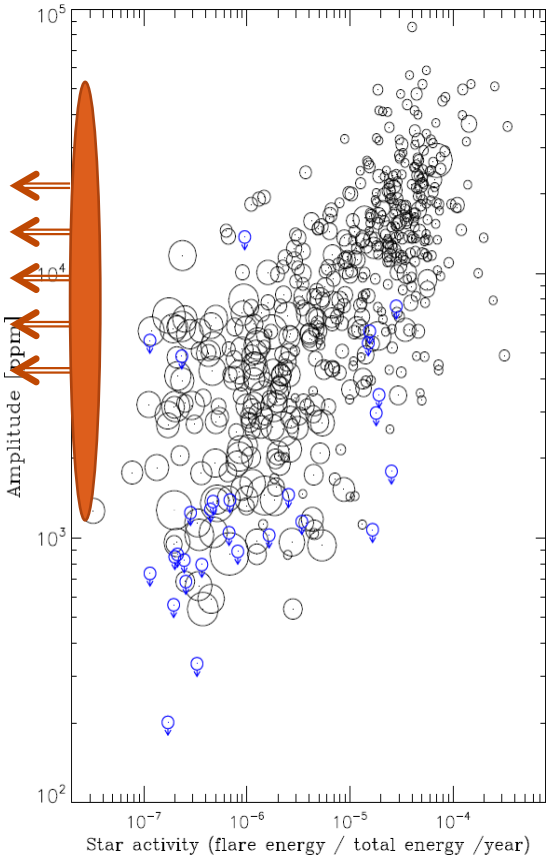


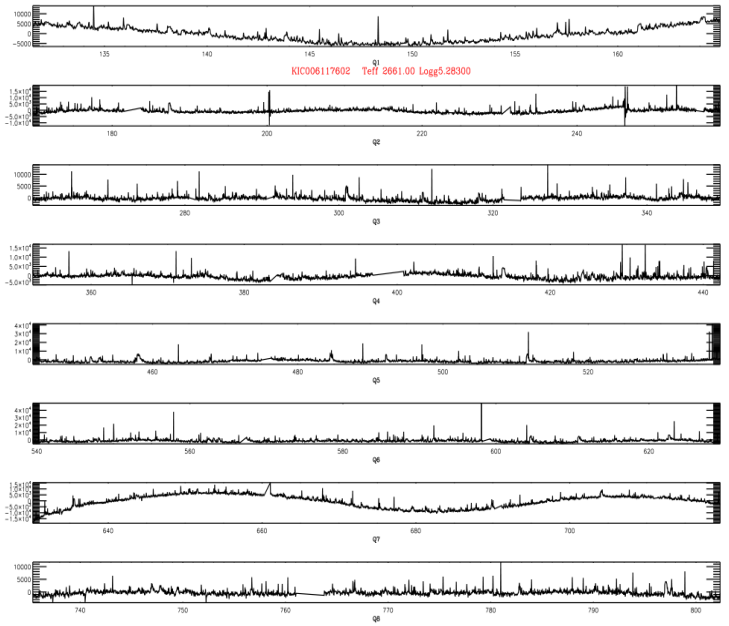
100K flares from 540/4664M dwarfs

IV: stellar activity of M dwarfs

Why

most stars with the same Logg, Teff, period, spot amplitude do not have flares?





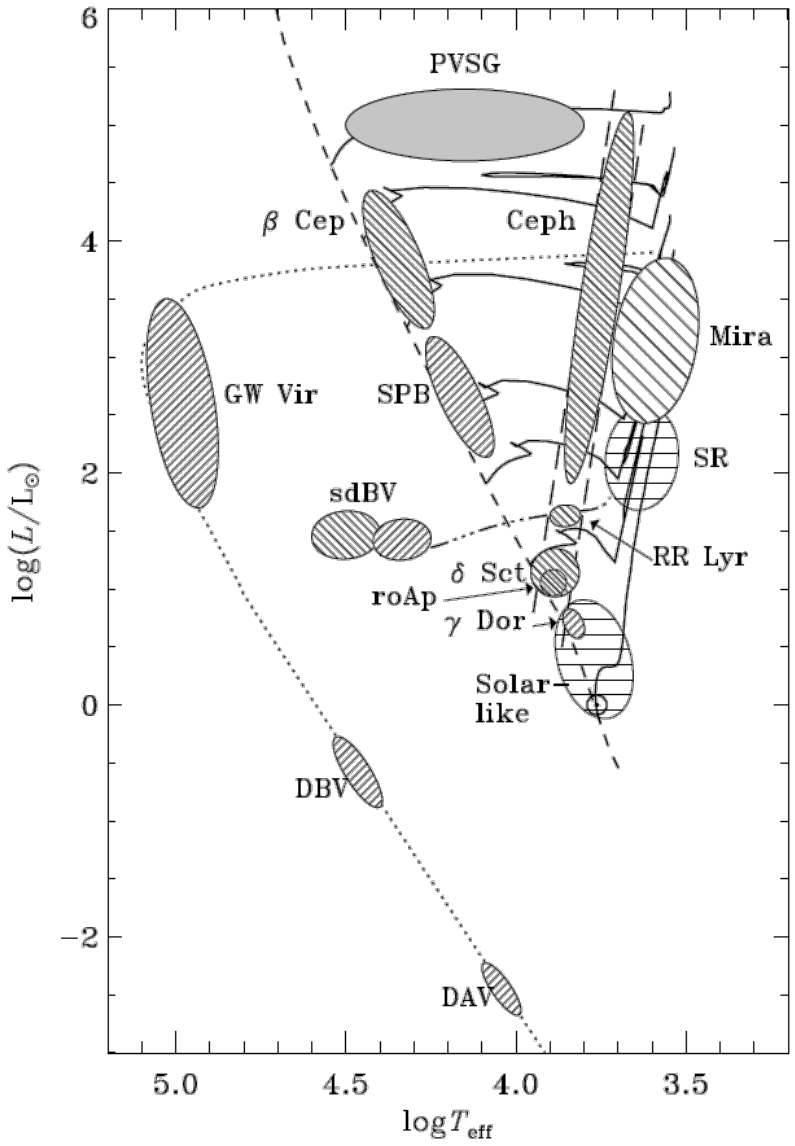
Energetic flares, but no period detected!

shorter period, larger stellar spots, stronger flares

Puzzles!

Future work

stellar activities across HR diagram



Variety of activities

- Pulsation
- Non-radial pulsation
- Rotation w/ spots
- Binarity
- Flares

a uniformly processed database @ AliCloud
200K Kepler targets +LAMOST etc

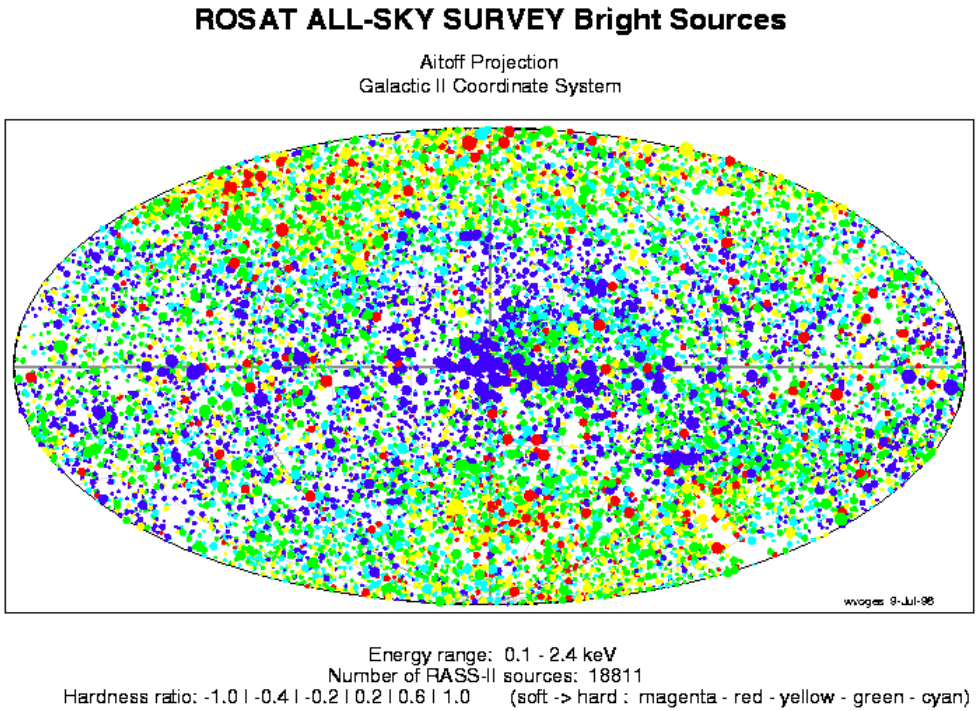
Physical parameters

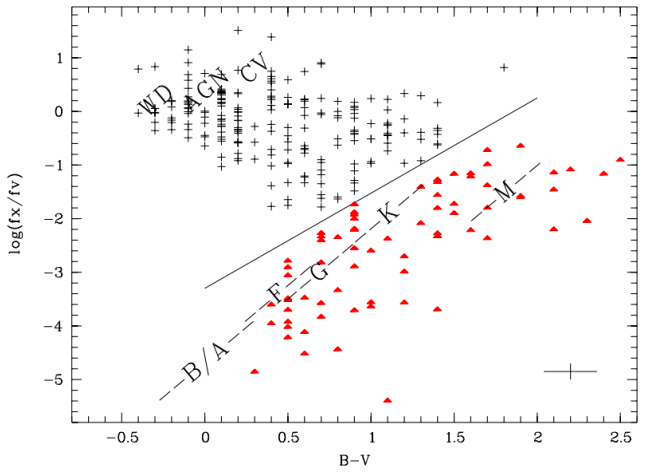
- Periods and harmonics → shapes
- Sigma8 → gravity etc
- Period deriatives → stellar cycles
- Beating frequencies

→ Activity versus Inactivity

Future work

X-ray binaries from RASS

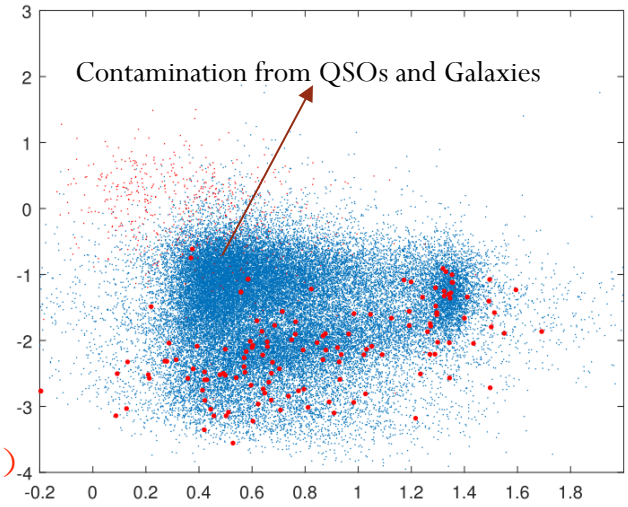




AGN/QSO： ~half

Stars： ~half

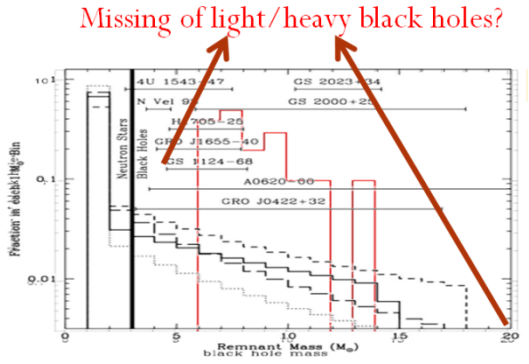
X-ray binaries: a few percent → 10^2~10^4

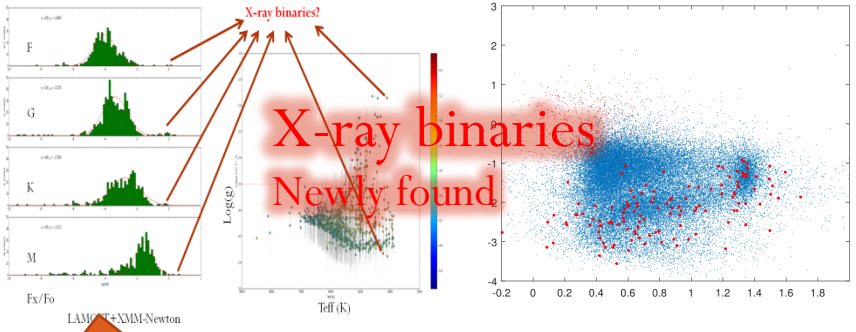


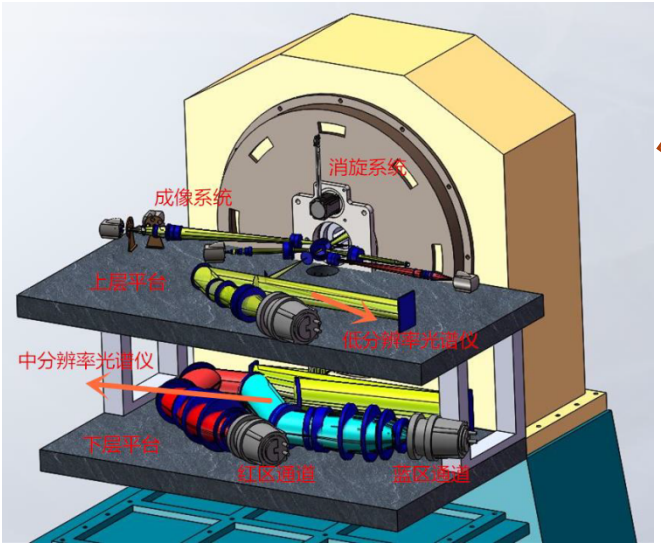
（董一泽、白宇+）

Future work

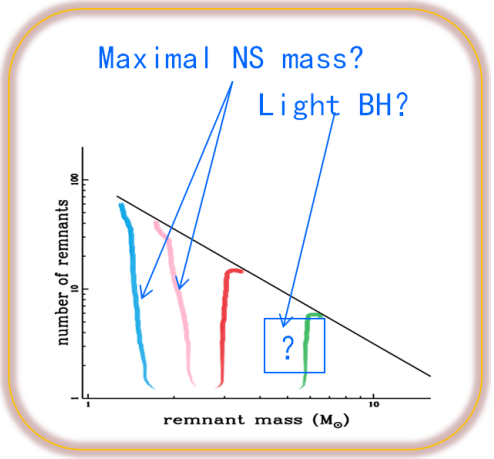
Mass function for BH/NSs







A dedicated integrated imaging spectrograph
To be mounted on a 4m telescope by 2019



Stay tuned …

Welcome to join

Prof Stephen Justham

Prof. Roberto Soria

Prof Jifeng Liu

Tenure-track faculty at NAOC/UCAS
Staff researcher in our group
Postdoc: PIFI fellowships etc
Long-term or short-term visitors