LAMOST observations of flaring M Dwarfs in the Kepler field

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LAMOST,NAOC

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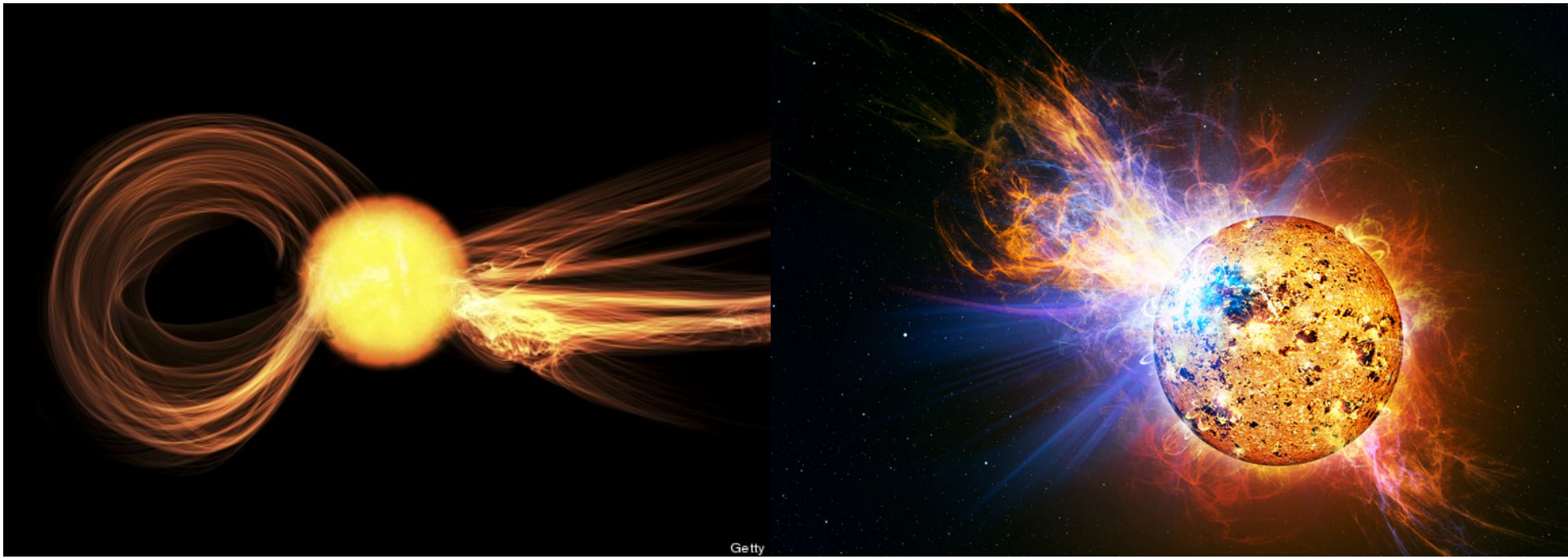
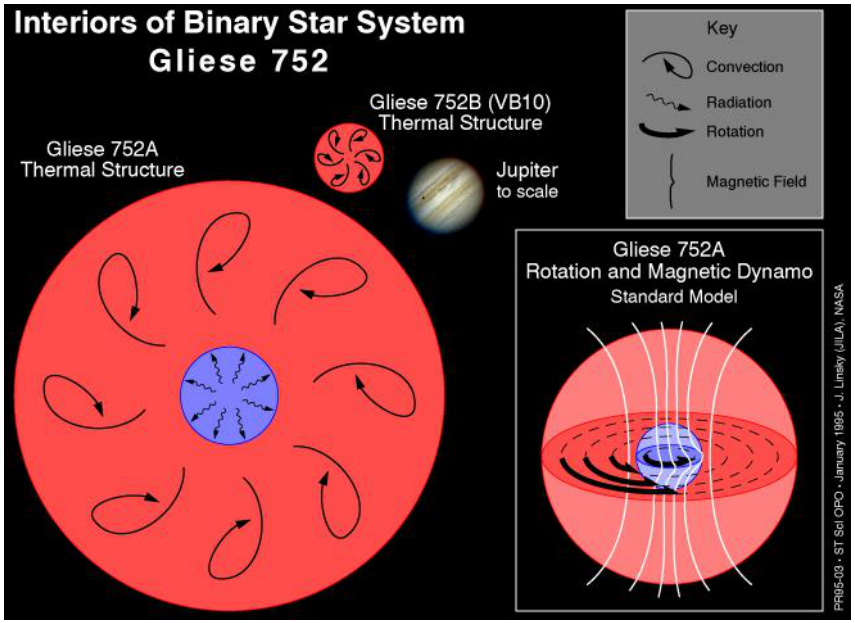
Background



- A flare star is a variable star that can undergo unpredictable dramatic increases in brightness for a few minutes.
- Most flare stars are dim red dwarfs.
- Flare is understood that these flares are induced by a companion star in a binary system.

Background

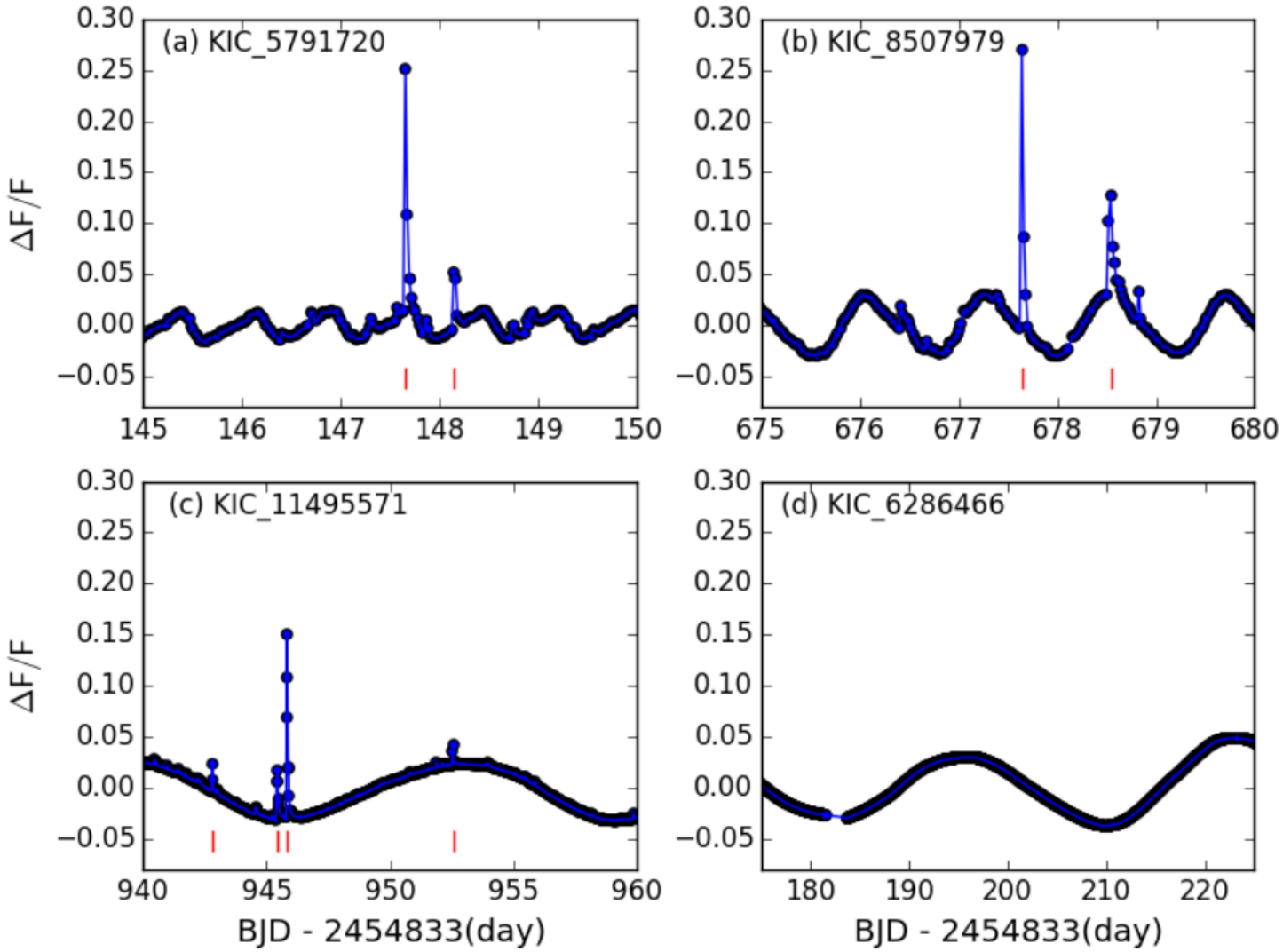


Stellar class	Mass ($M_\odot$)	Radius ($R_\odot$)	Luminosity ($L_\odot$)	Teff (K)
M0V	60%	62%	7.2%	3,800
M1V	49%	49%	3.5%	3,600
M2V	44%	44%	2.3%	3,400
M3V	36%	39%	1.5%	3,250
M4V	20%	26%	0.55%	3,100
M5V	14%	20%	0.22%	2,800
M6V	10%	15%	0.09%	2,600
M7V	9%	12%	0.05%	2,500
M8V	8%	11%	0.03%	2,400
M9V	7.5%	8%	0.015%	2,300

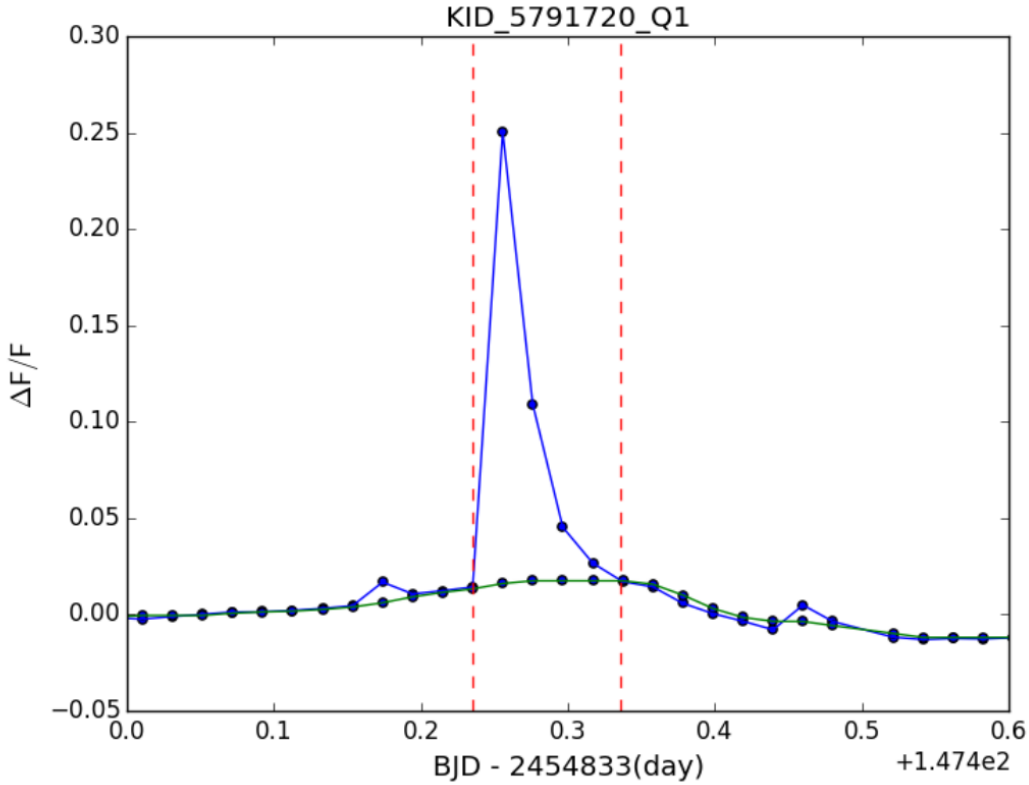
Data selection

- Since the Kepler provided 4 years continuous photometry observation, we have enough statistic to study overall M dwarfs.
- We use the data from MAST (https://archive.stsci.edu/)
- We selected 3130 M dwarfs with criteria 2500 $<$ Teff $<$ 3800 and log (g) $>$ 4 from Huber et al. 2014.
- We have matched the LAMOST M dwarf (DR3) targets with those with Kepler light curves, and identified 144 M dwarfs matches.

Kepler light curve, lc,sc



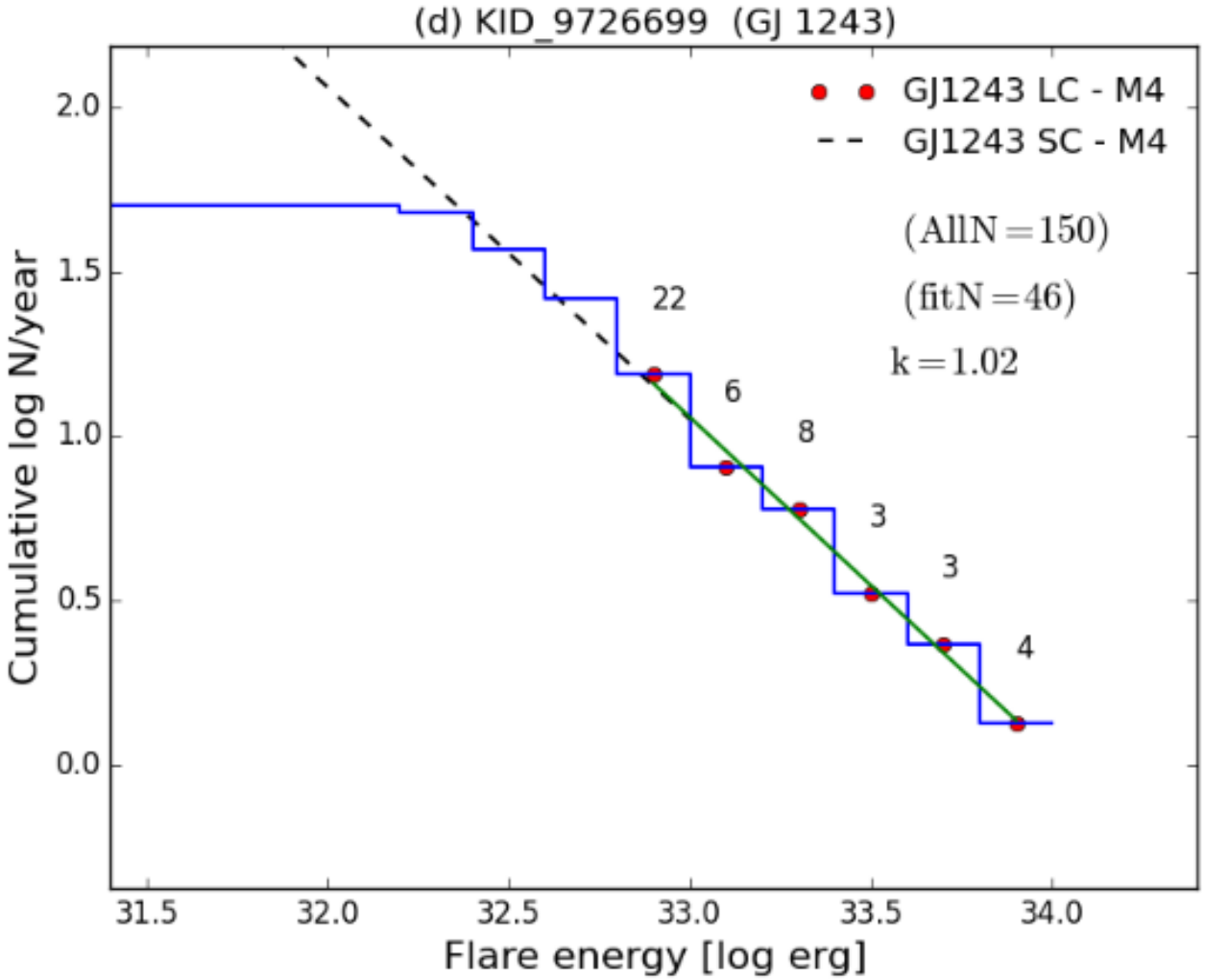
estimate energe from light curve



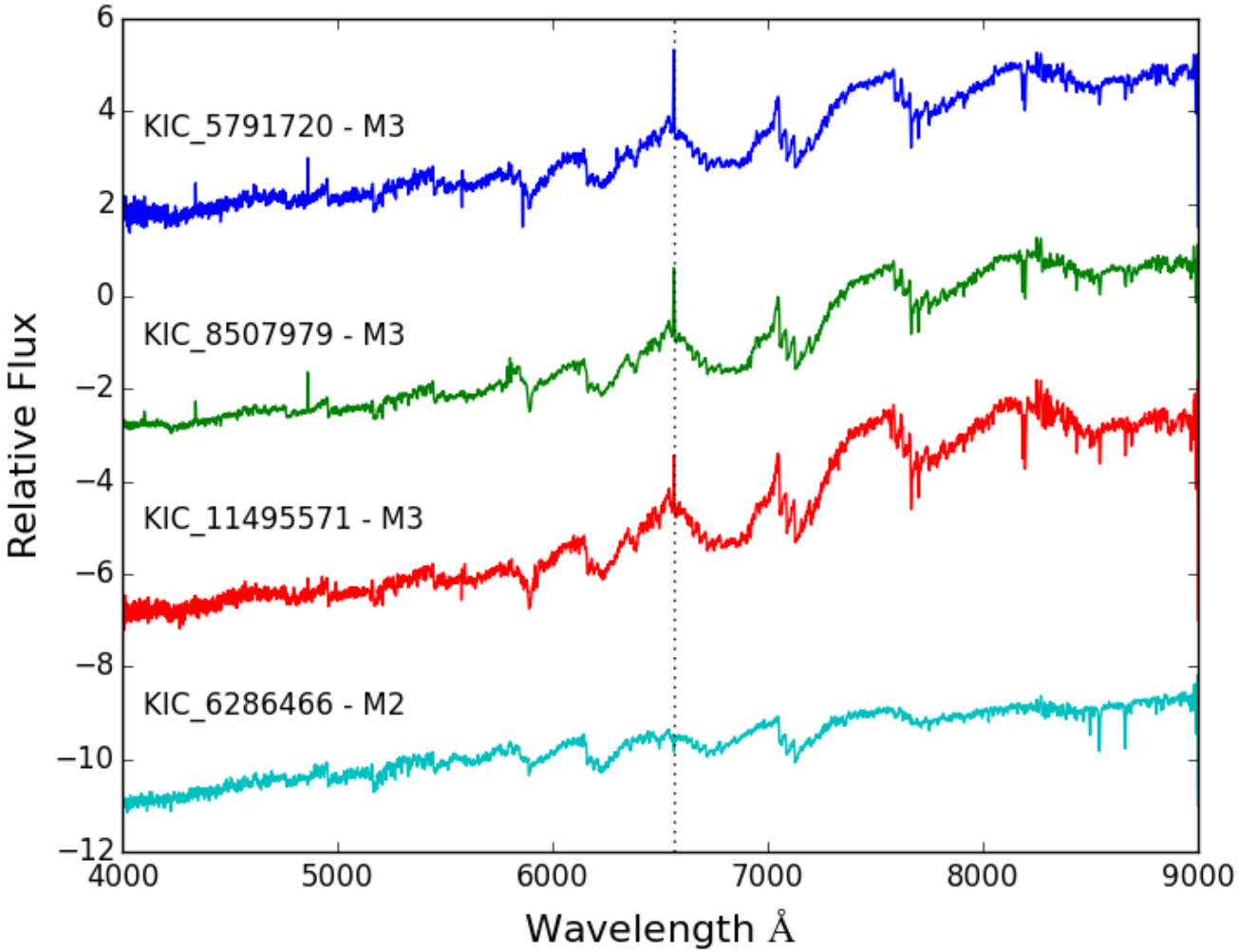
$$E = 4\pi R_*^2 \sigma_{sb} {T_{eff}}^4 \int \Delta F dt$$

σ_{sb} is the Stefan-Boltzmann constant, R_* is stellar radius from Huber et al. 2014

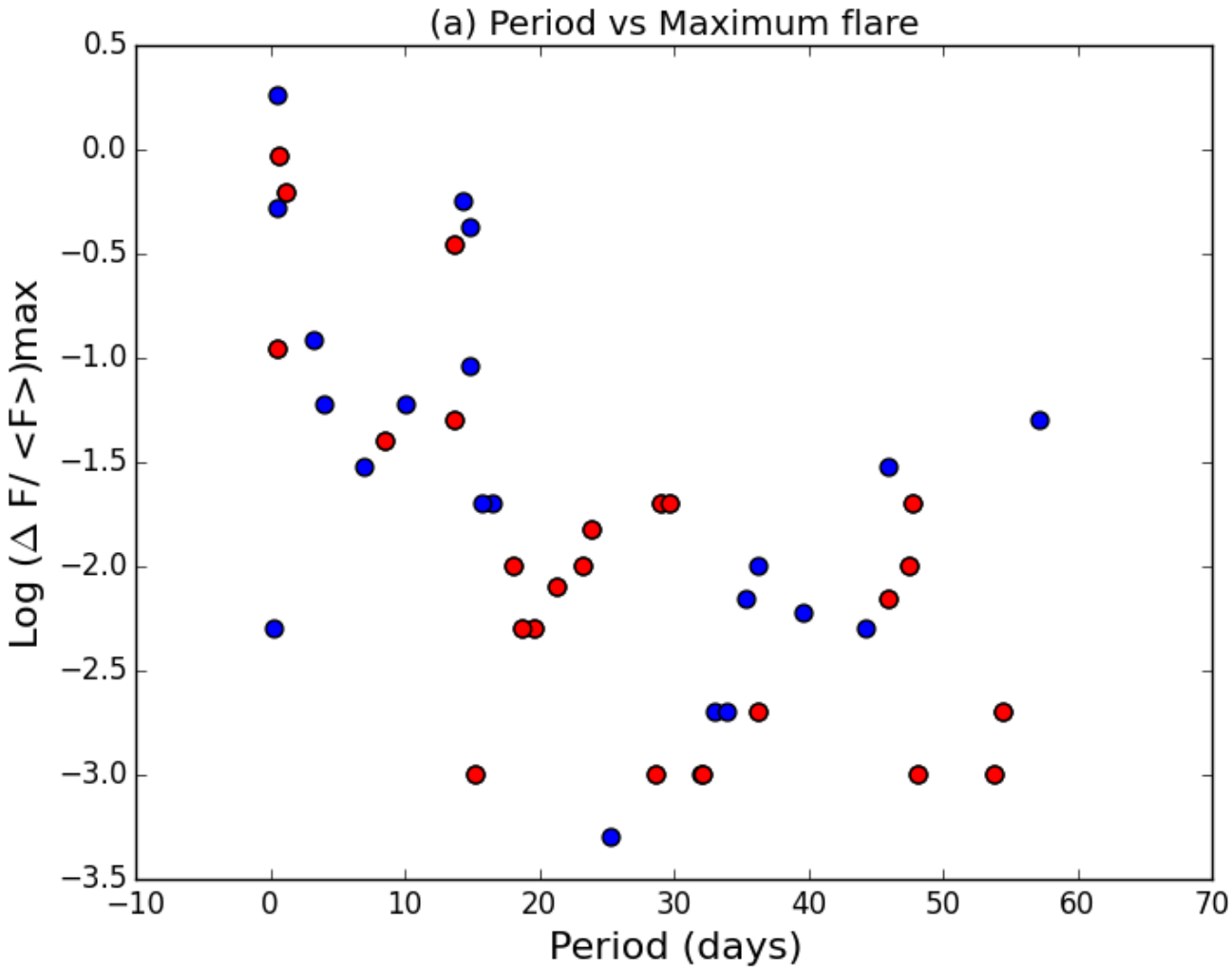
power low fitting — k value



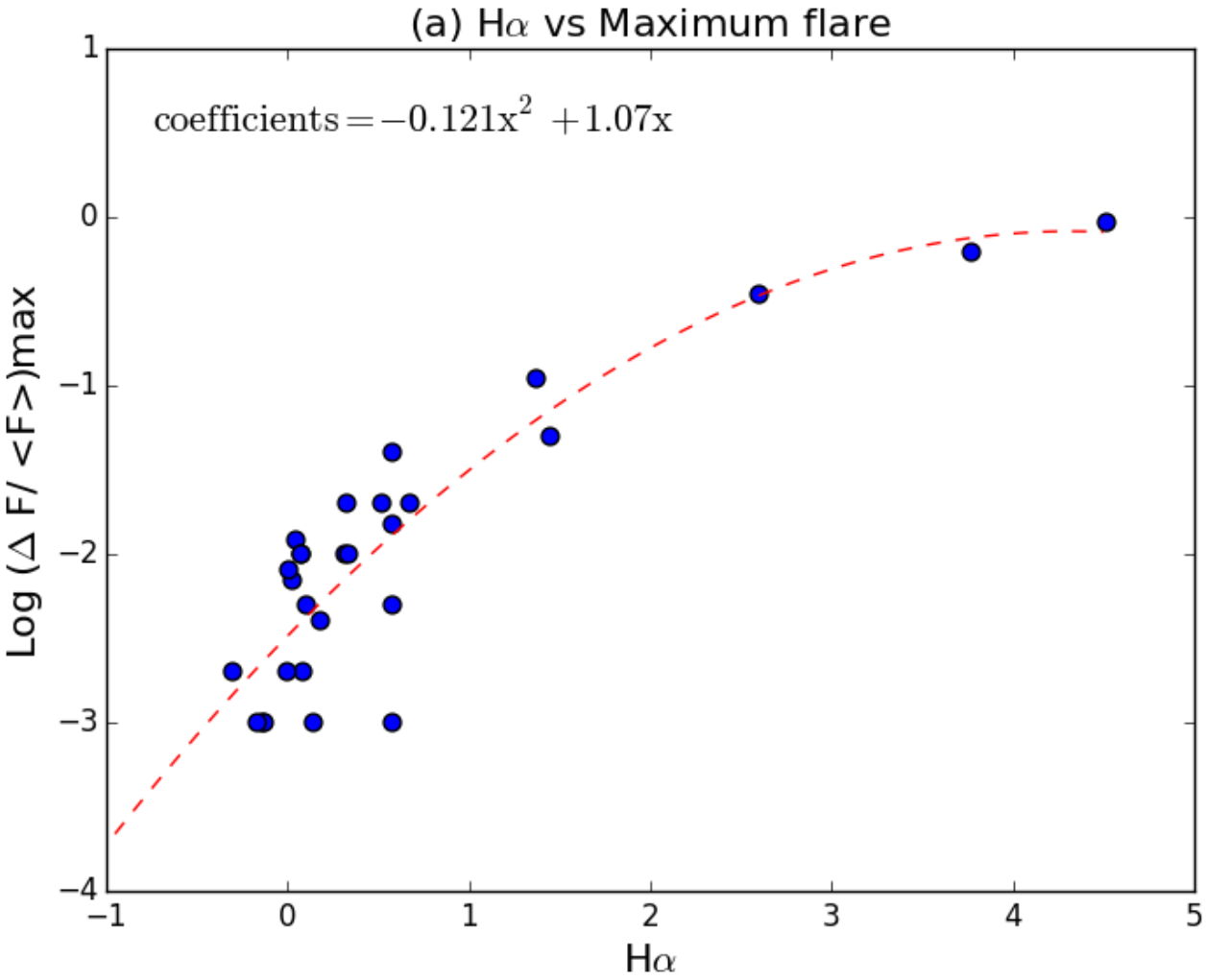
lamost spectra



halpha vs period



halpha vs ΔF



Conclusion

- From a match of the list of the M dwarfs (M0-M3) observed by Kepler and the DR3 catalog of the M dwarf spectra by LAMOST, we have identified 144 M dwarfs for intercomparision.
- Those with large EW values tend to exhibit strong flare activity with some of them possessing explosive envergy comparable to the luminosity of the central stars ("hyperflares").
- k values vary between 1.0 and 2.5.
- k value is 1.81 ± 0.34 on the average.
- For fast rotator (P $<$ 15 days), they have larger flares and higher H_α emission.

Question?

Thank you