The optical and UV continuum in the impulsive phase

H. S. Hudson

Space Sciences Laboratory, University of California, Berkeley, USA

Difficult messages

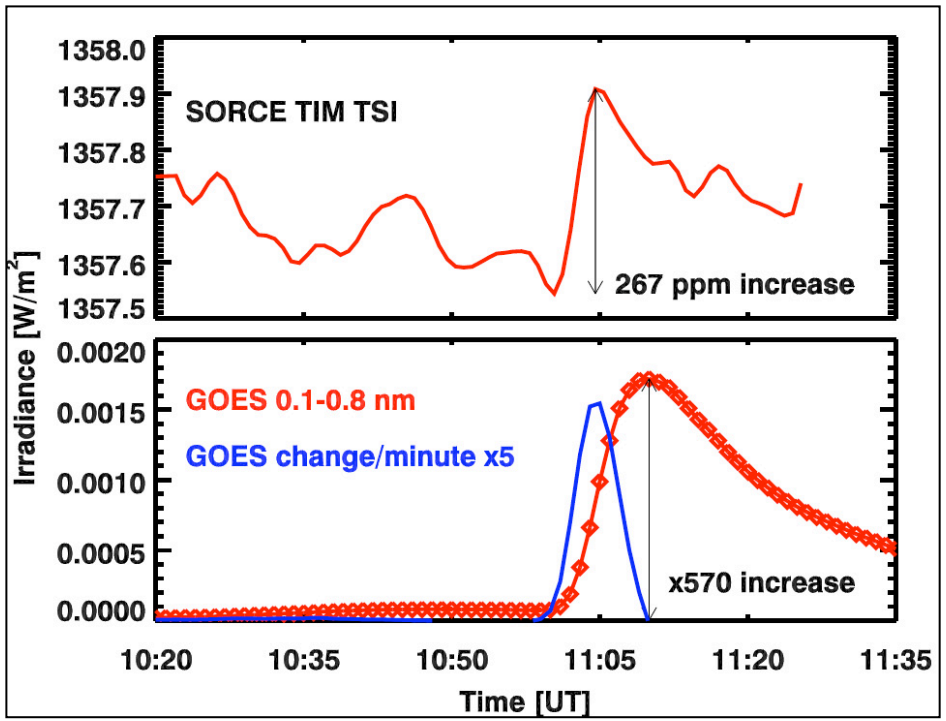
1) The continuum is the most important part of the spectrum

2) The electron distribution functions in the sources are certainly not Maxwellian

3) The stellar data are far better than the solar data

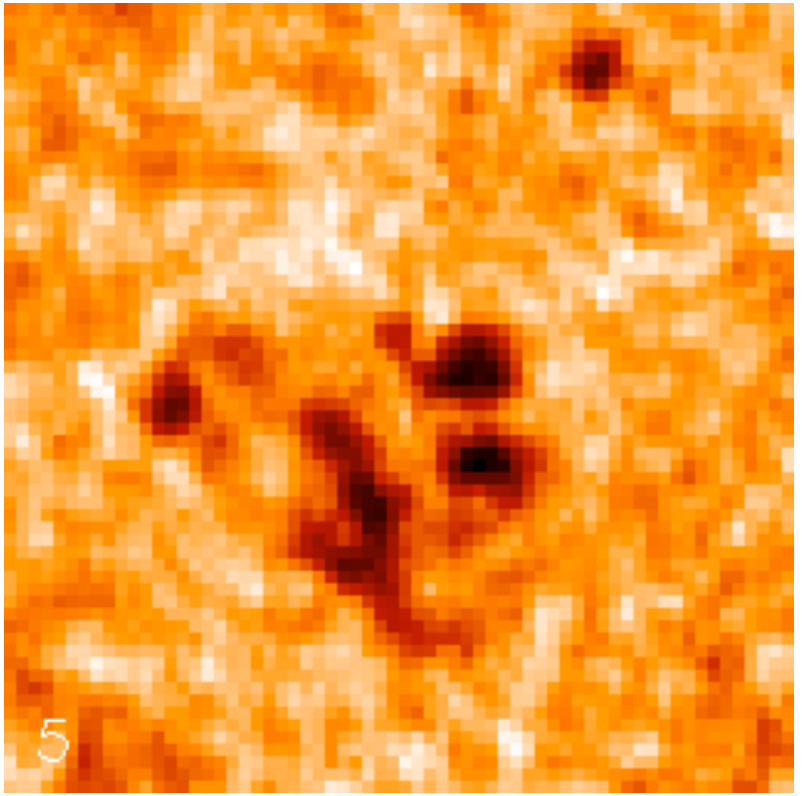
Flare energy

Short-lived[1]



Woods et al 2004

Small-scale[2]

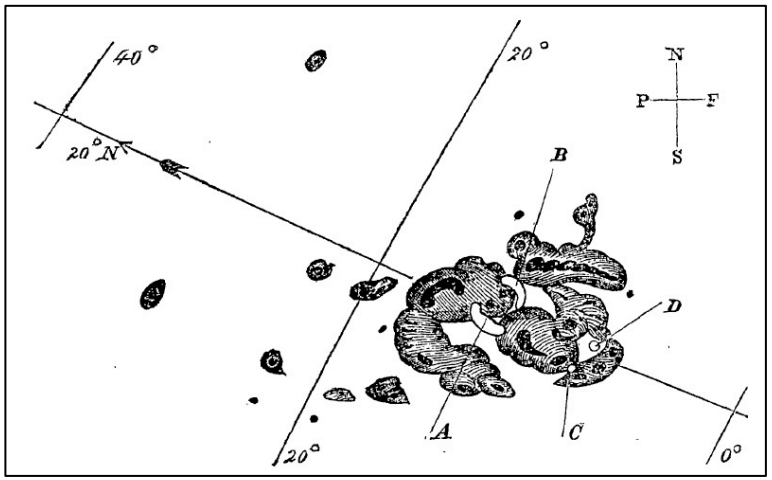


Hudson et al 2006

[2]TSI impulsive phase, flare SOL20031028T11:05

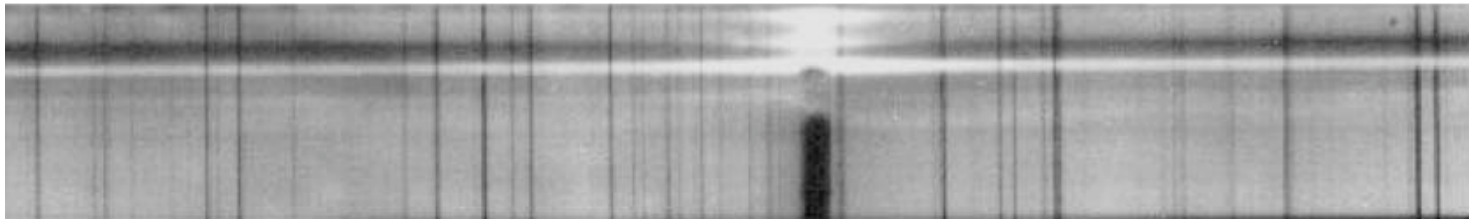
[2]TRACE 0.5" pixels, flare SOL20040722T00:30

Optical imaging and spectroscopy



Carrington 1859 original flare

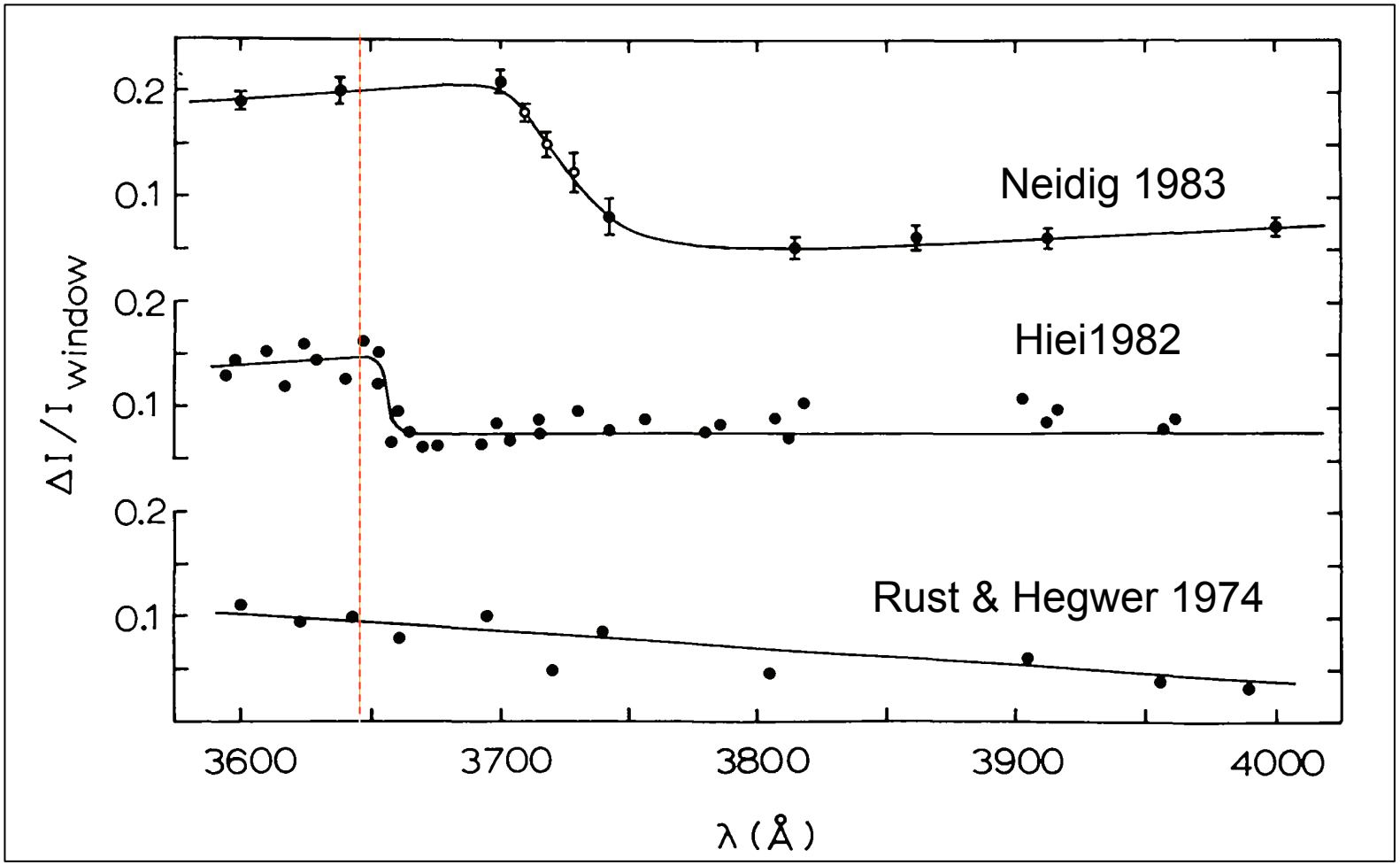
- Flare emission is intermittent
- Flare emission is energetic



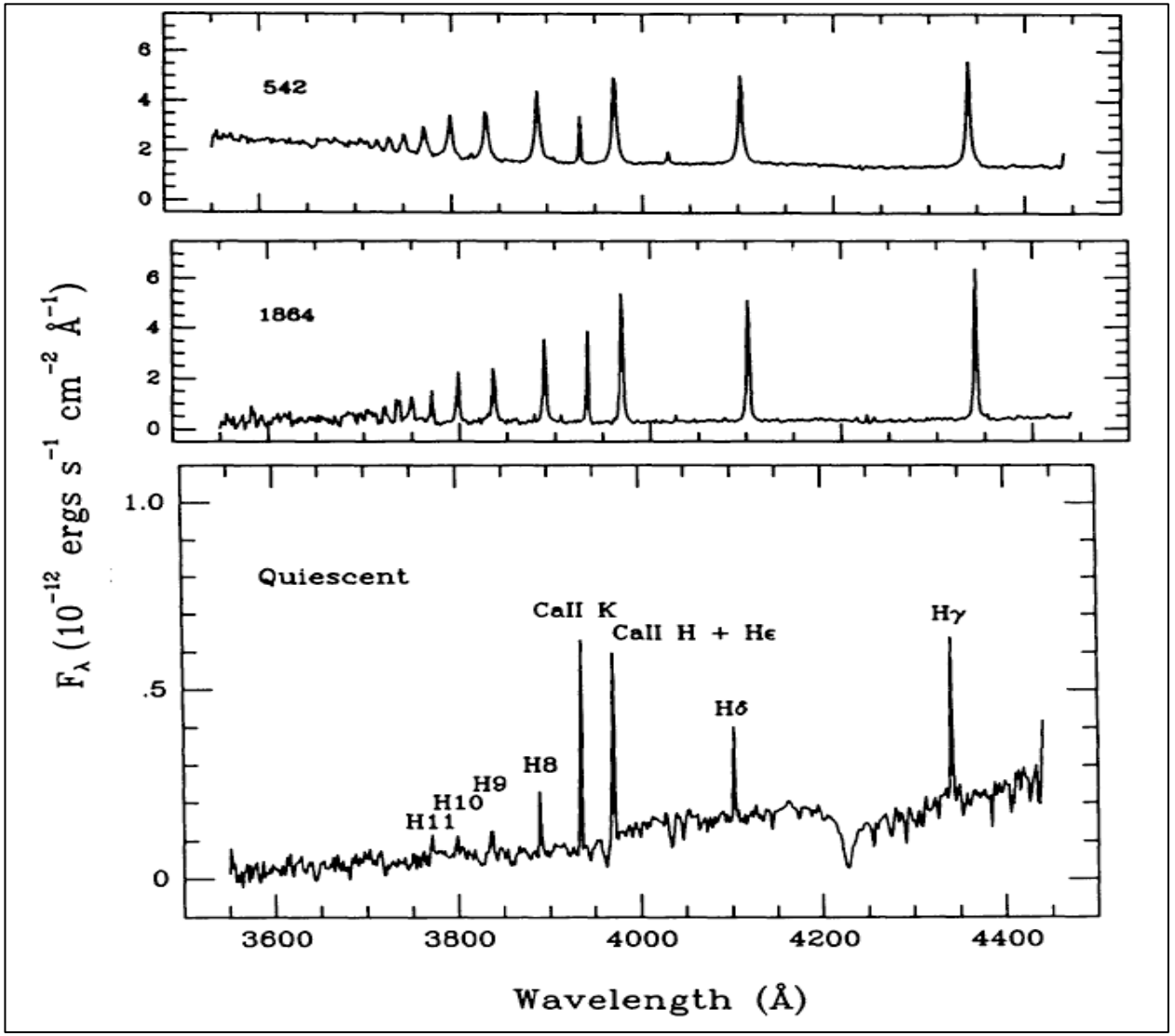
Babin & Koval 2007 (SOL1991-06-15)

- It has been difficult to put the slit on the flare at the right time and place
- Much early observational work was on film
- There is little modern CCD-based flare imaging spectroscopy

The Balmer Edge?



Stellar Flare Spectra (AD Leo)

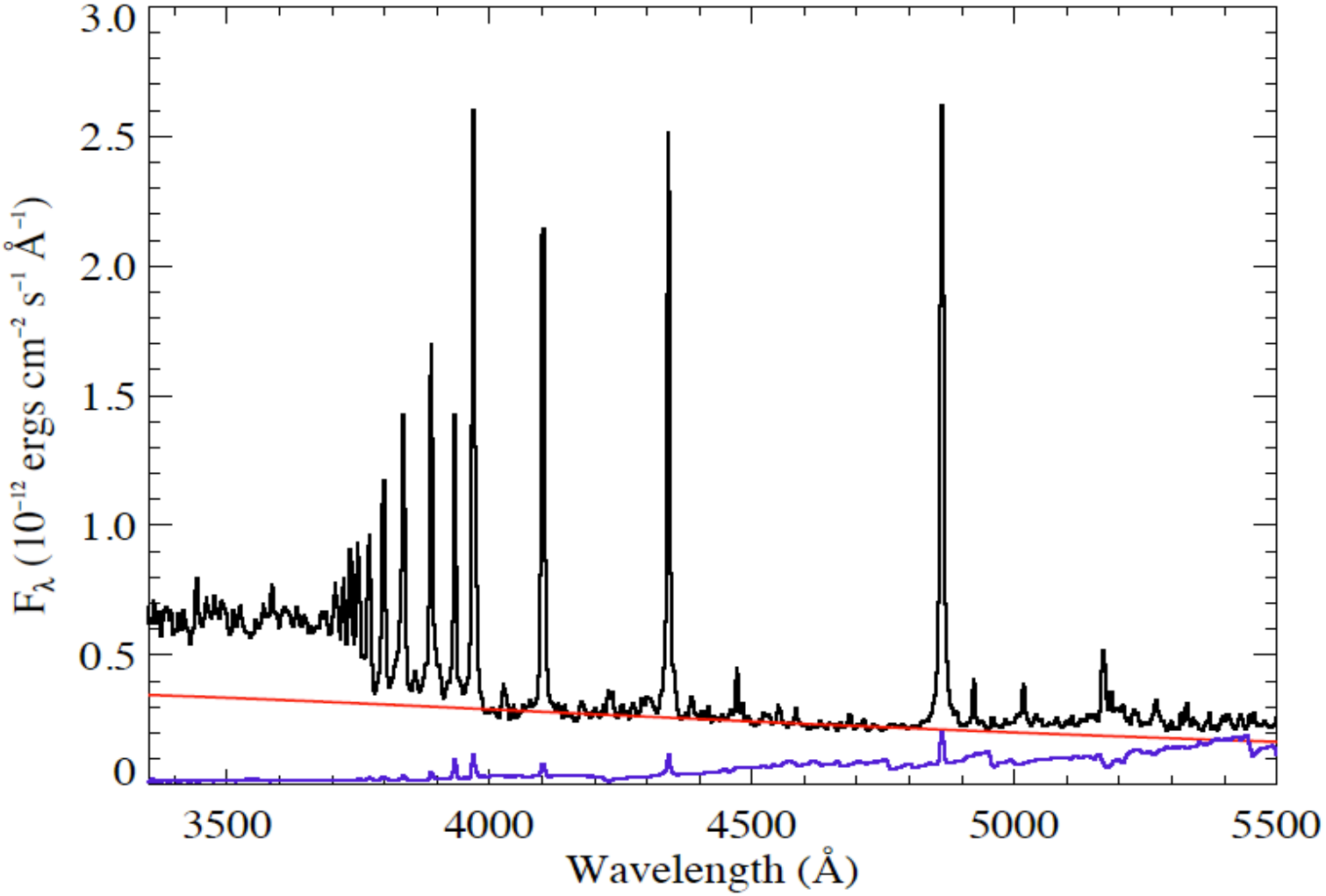


Hawley & Pettersen 1991

What do the spectra show?

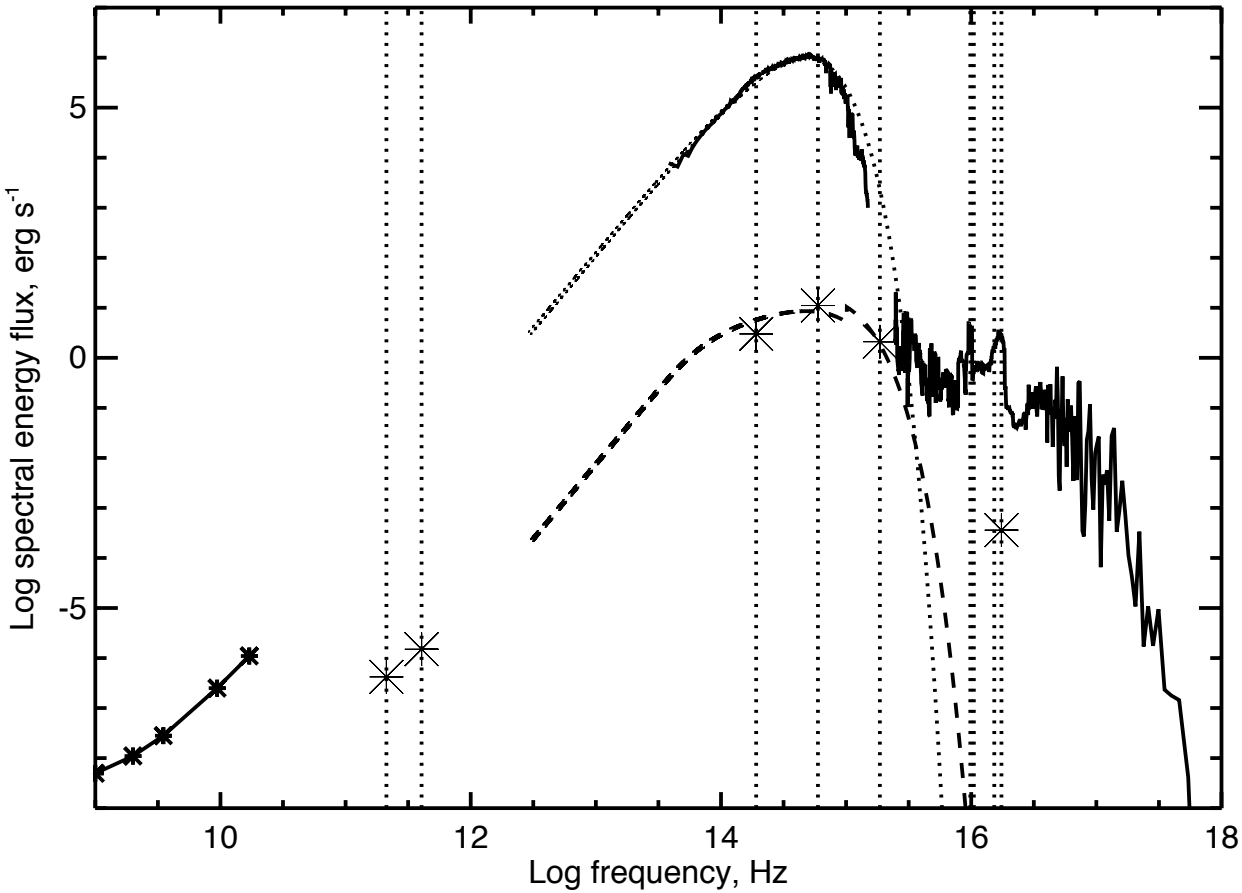
- The spectra in the impulsive phase show strong Balmer emission lines
- The Balmer jump itself is hard to see; there is an extra “blue continuum”
- The YZ CMi spectra (Kowalski et al 2010) show two components, identified respectively with chromospheric and photospheric (backwarming) sources, but the modeling is not reliable yet

A small A0 star appears in an M dwarf atmosphere (YZ CMi)



Kowalski et al. 2010

Energy distribution of the impulsive phase (generic X1 solar flare)



Hudson et al. 2010

Conclusions

1) The optical-UV continuum contains the bulk of the luminous energy of a flare

2) Probably, this continuum contains recombination radiation both from over-ionized chomospheric and photospheric backwarming sources

3) The observations still (a century and a half post-Carrington) do not resolve the sources spatially, temporally, or spectrally