

Hinode helps us to understand the nature of stellar flares

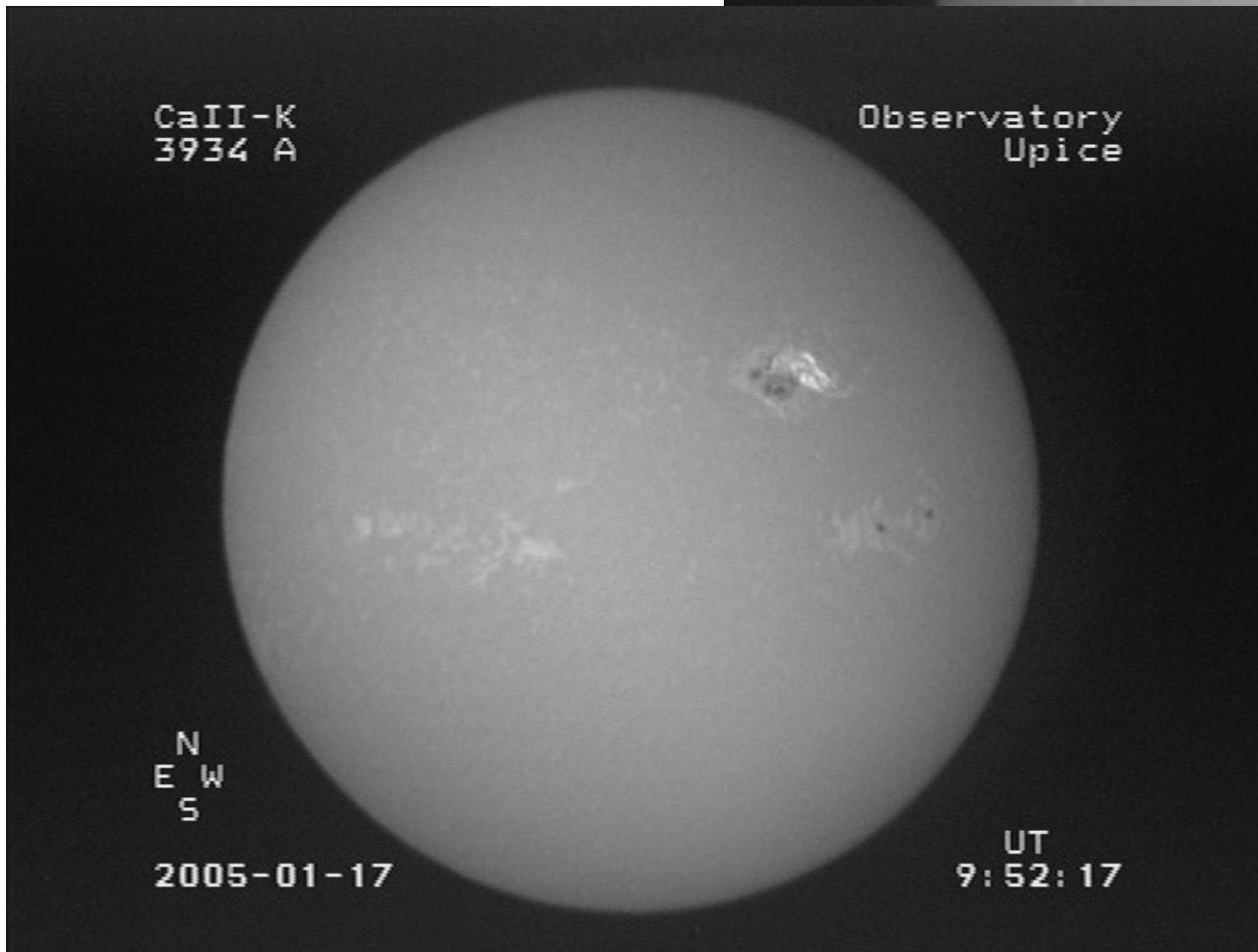
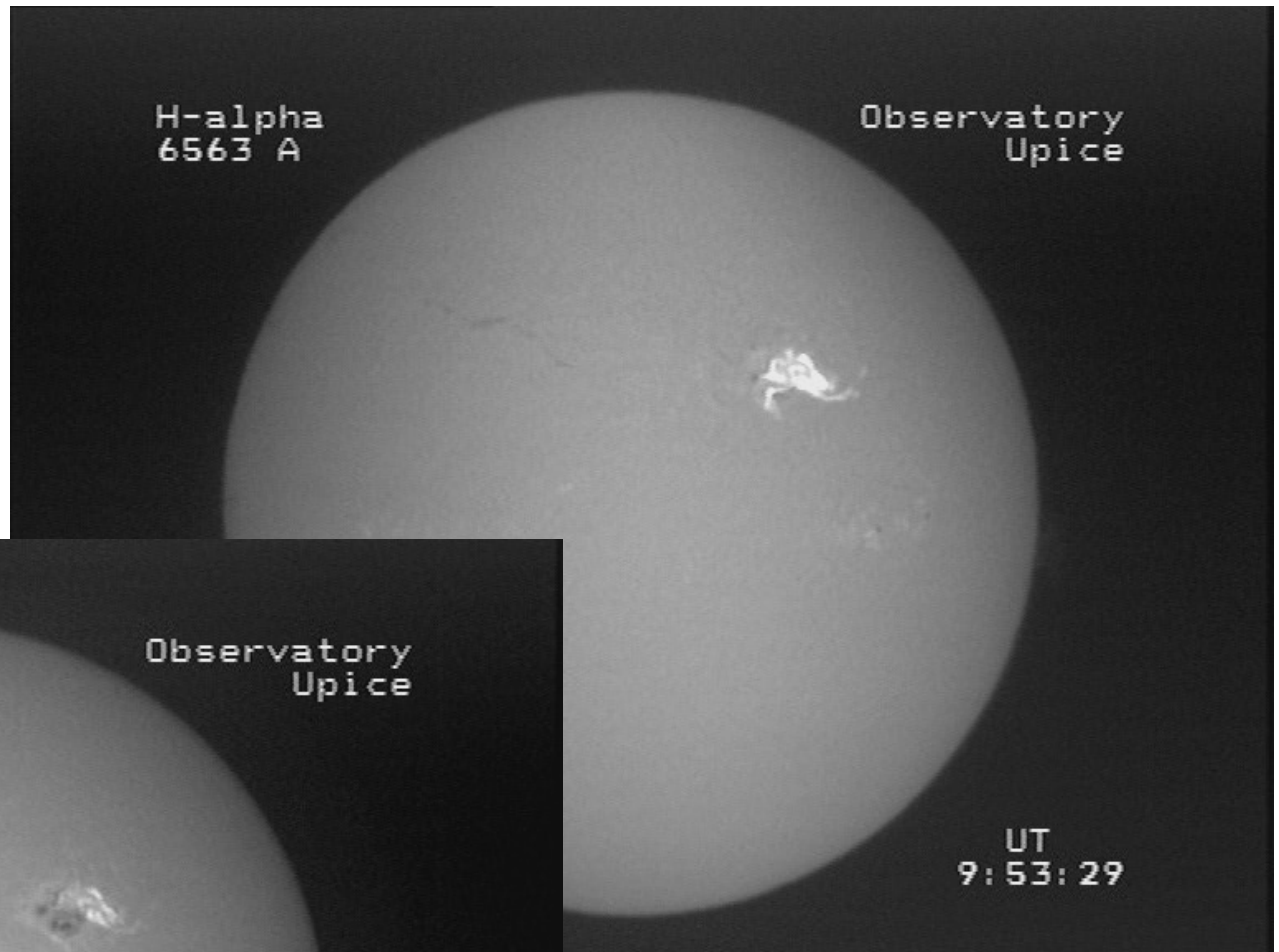
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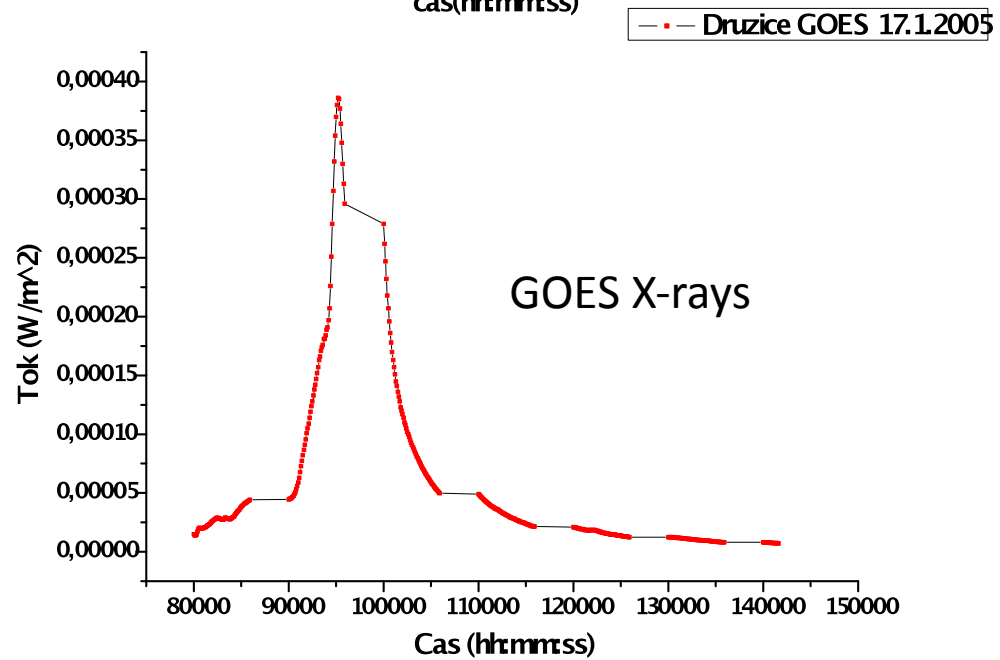
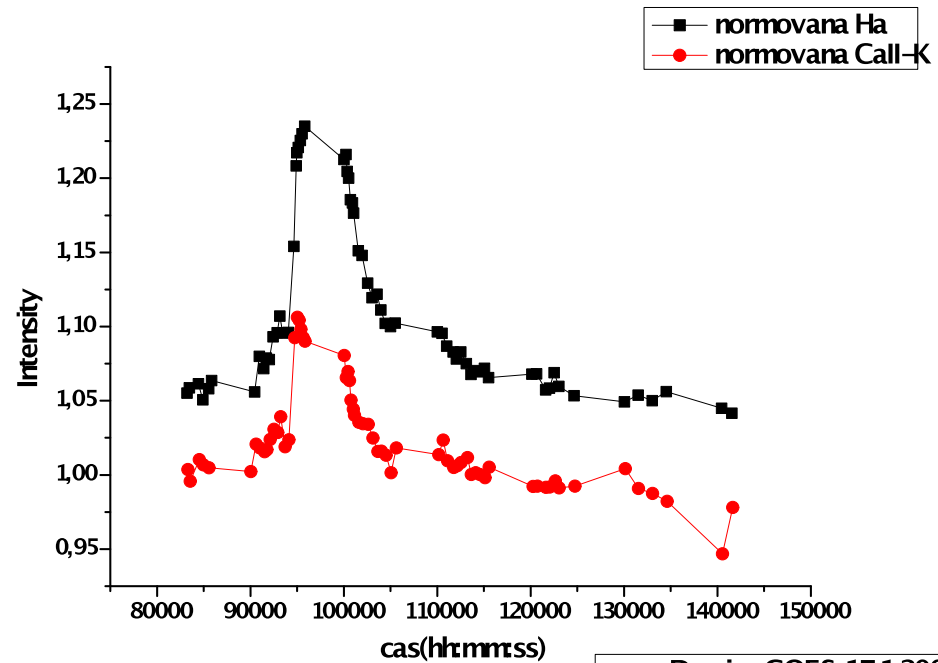
2 Astronomical Institute, Wroclaw University, Poland

3 GSFC NASA, Greenbelt, MD, USA

Medium-class two-ribbon flare



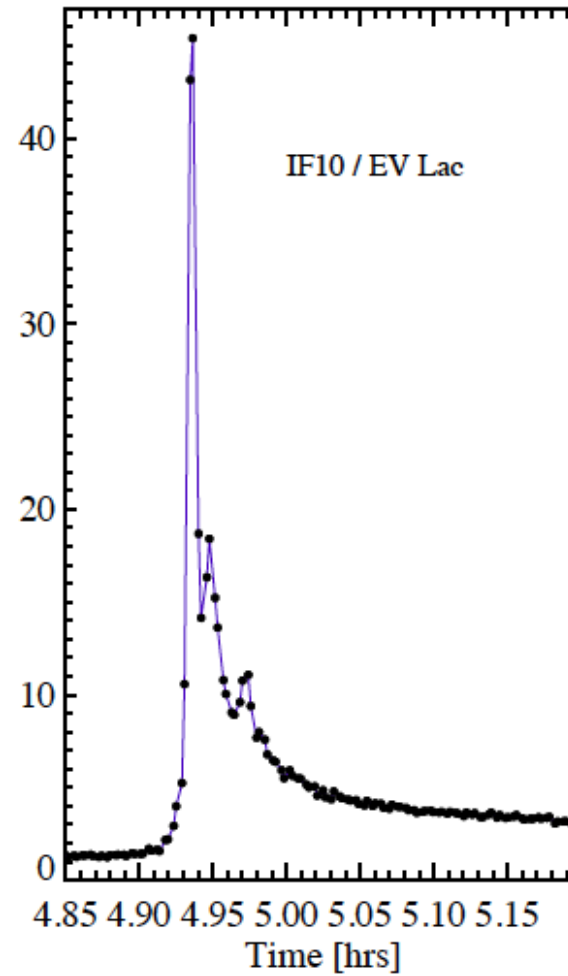
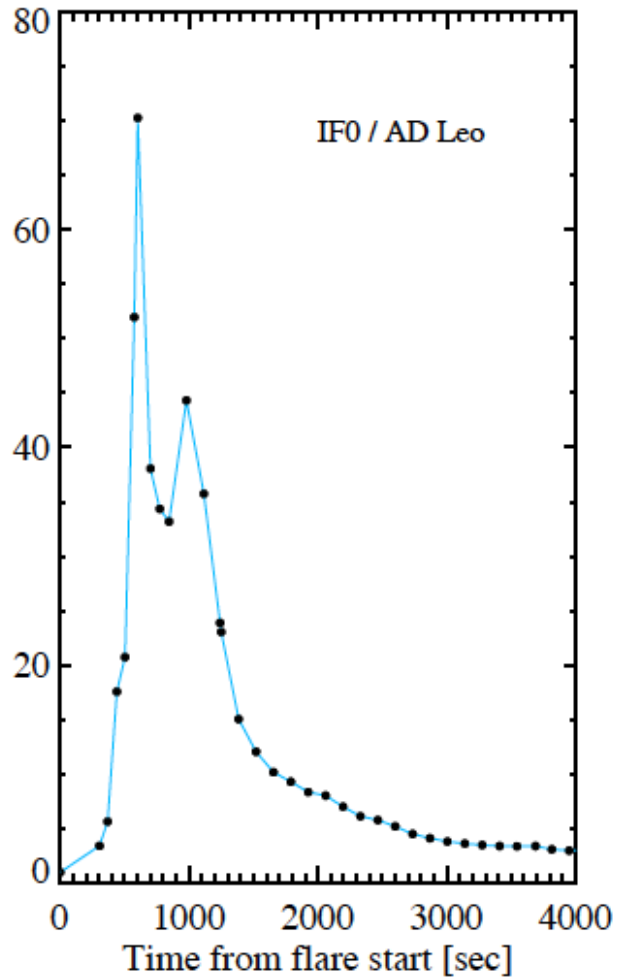
courtesy of
Upice Observatory
(Czech Republic)



dMe flare stars

Name	Spectral type	Position (ep=J2000)	Fluxes (mag)
EV Lac	M4.5Ve	Ra = 22 46 49.7317 Dec = +44 20 02.3569	U = 13,000 B = 11,450 V = 10,090
YZ CMi	M4.5Ve	Ra = 07 44 40.17401 Dec = +03 33 08.8350	U = 13,761 B = 12,831 V = 11,225
AD Leo	M4.5Ve	Ra = 10 19 36.277 Dec = +19 52 12.06	U = 12,000 B = 10,970 V = 9,430
V711 Tau		Ra = 03 36 47,3 Dec = +00 35 15,9	B = 6,800 V = 5,905
V773 Tau (HD 283447)		Ra = 04 14 12.92168 Dec = +28 12 12.2960	U = 13,160 B = 11,800 V = 10,700

Continuum flux during stellar flares



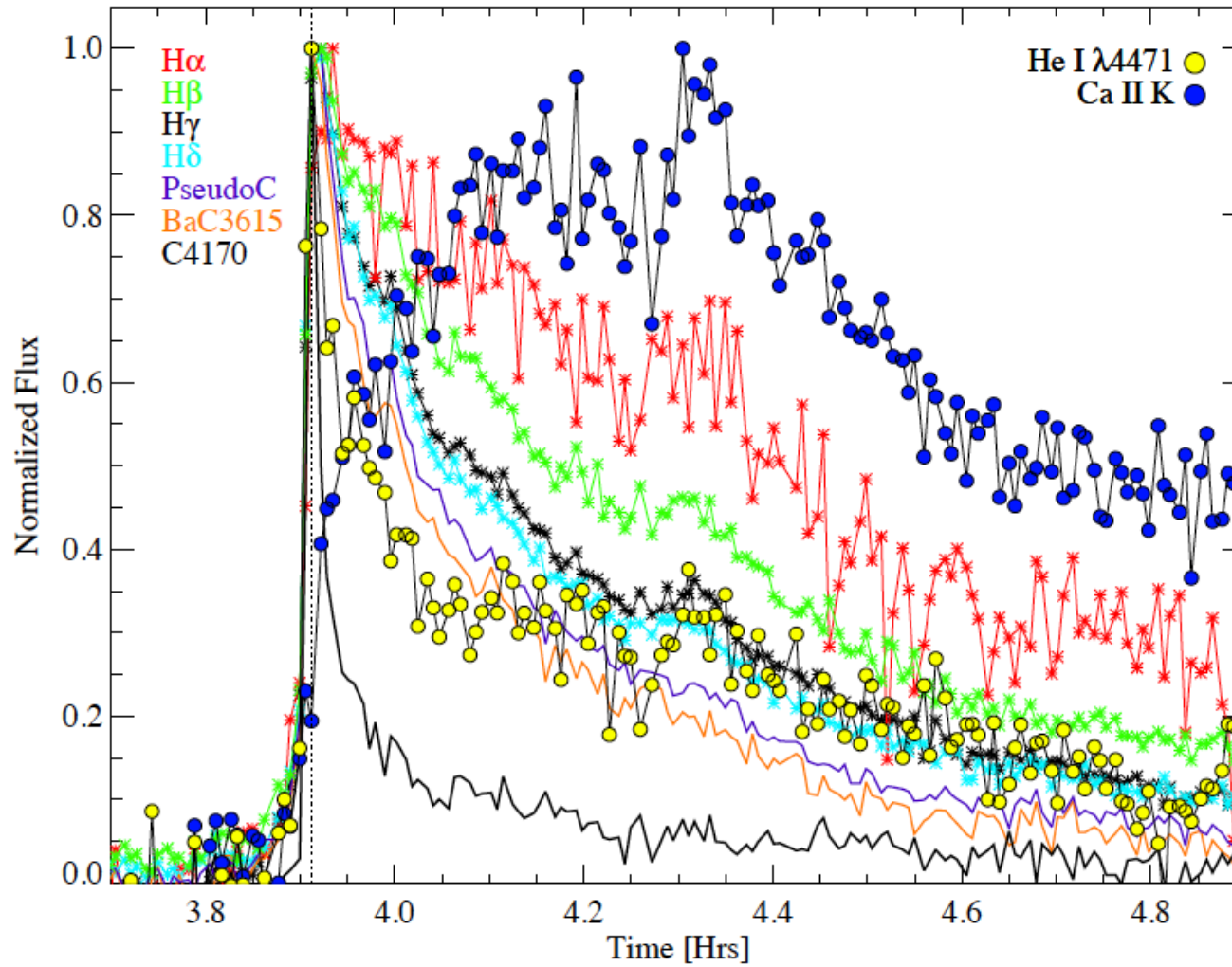
Kowalski et al. (2013)

Apache Point Observatory 3.5m telescope



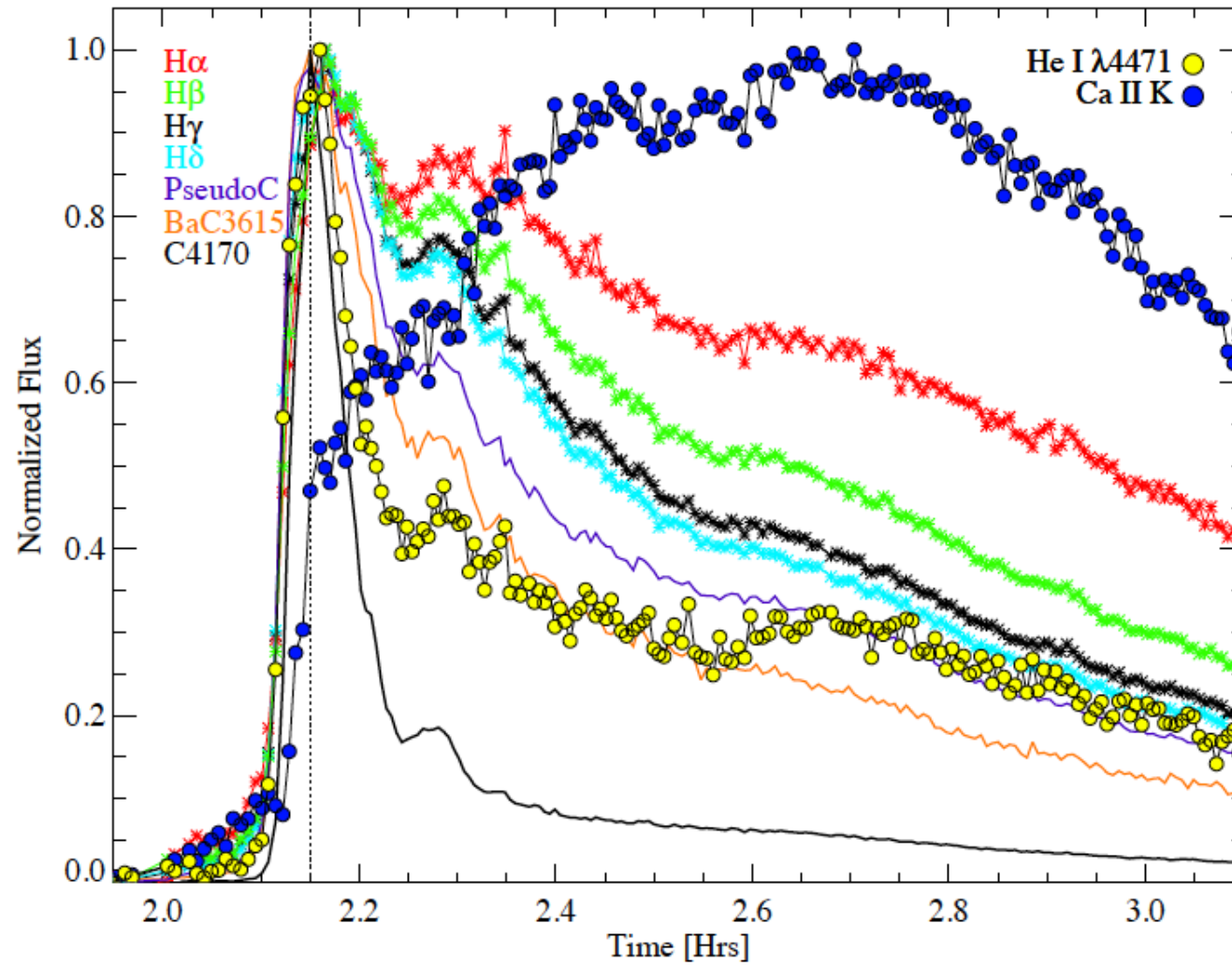
follow-up broad-band spectroscopy

AD Leo



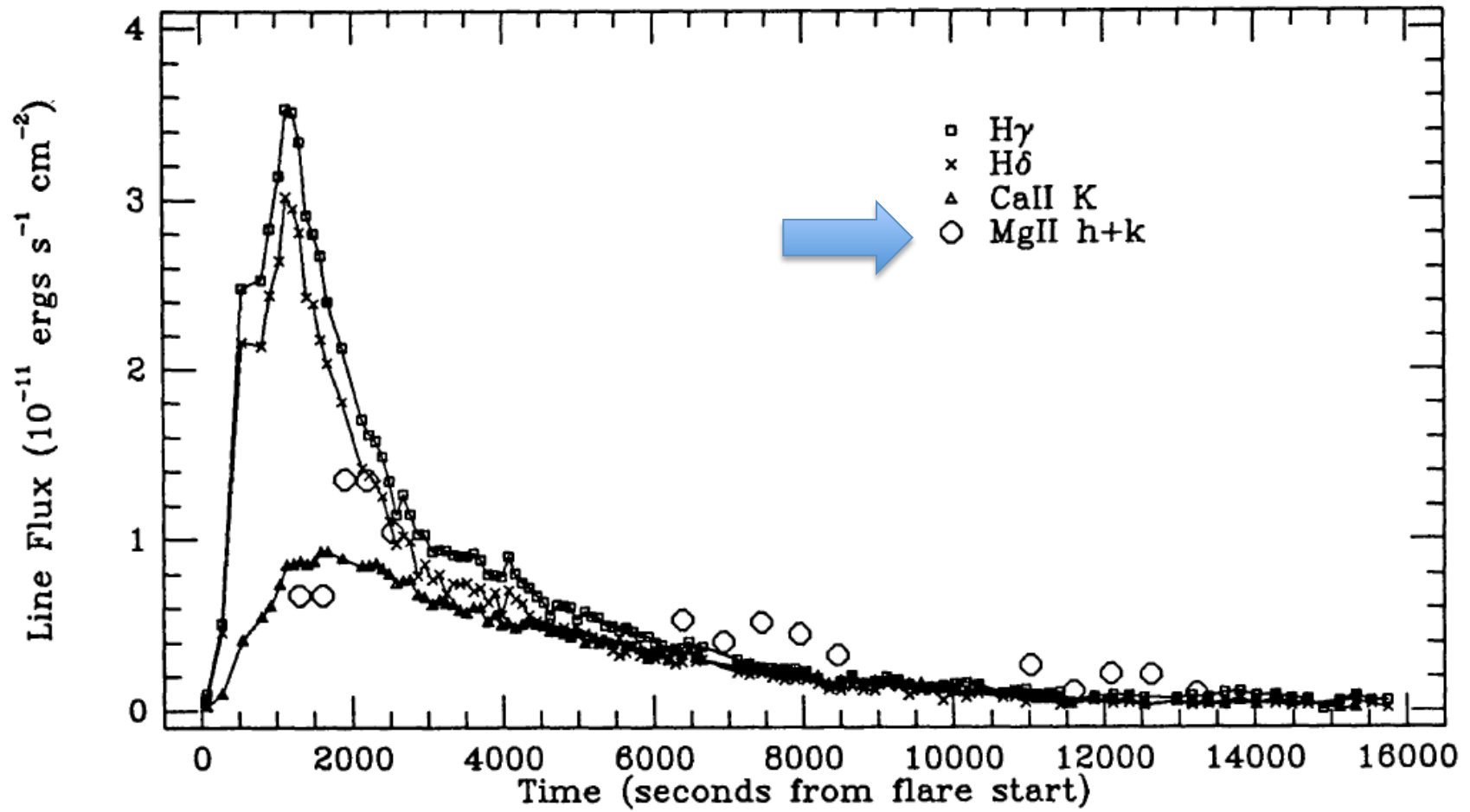
Kowalski et al. (2013)

YZ CMi



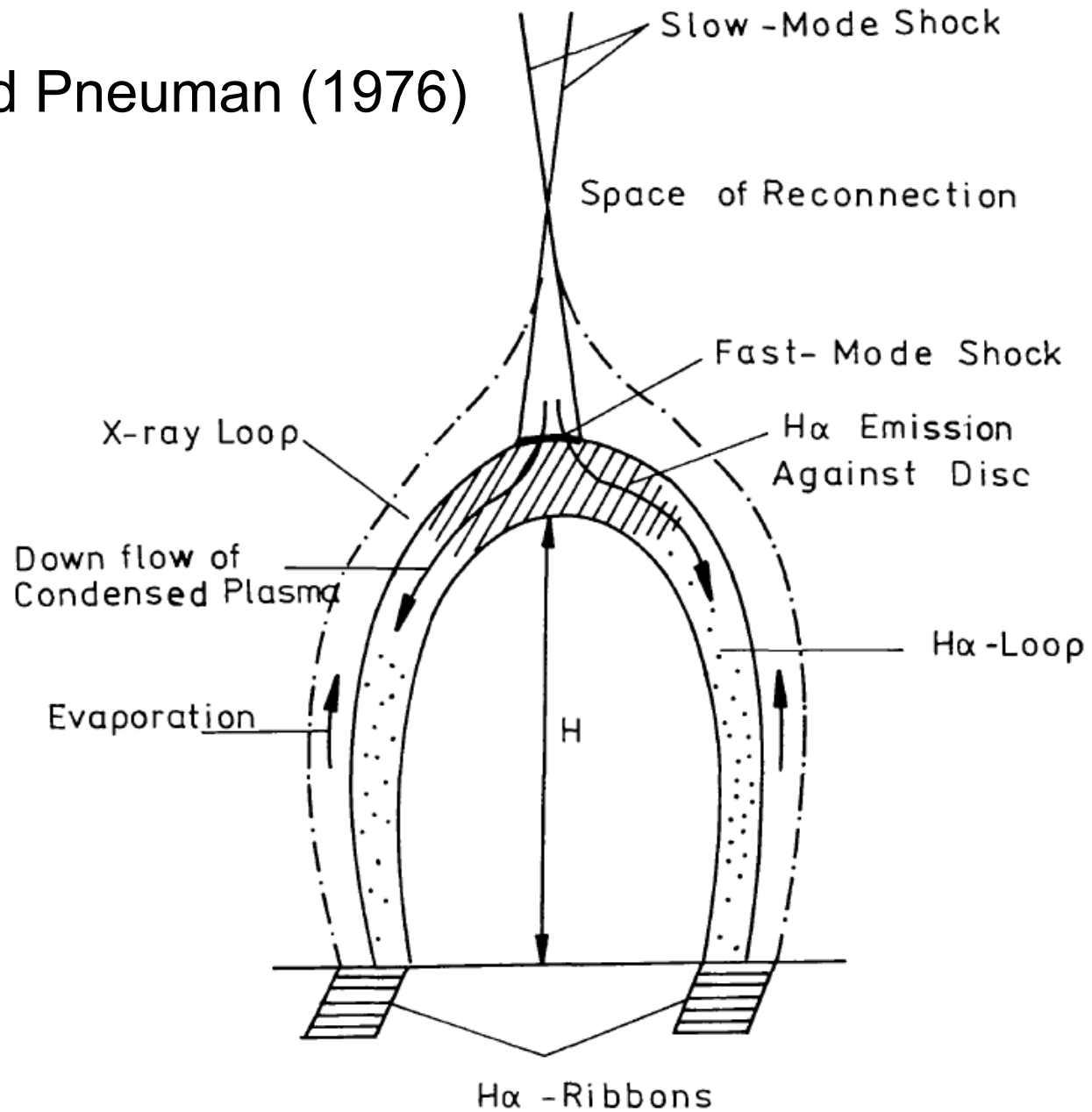
Kowalski et al. (2013)

AD Leo

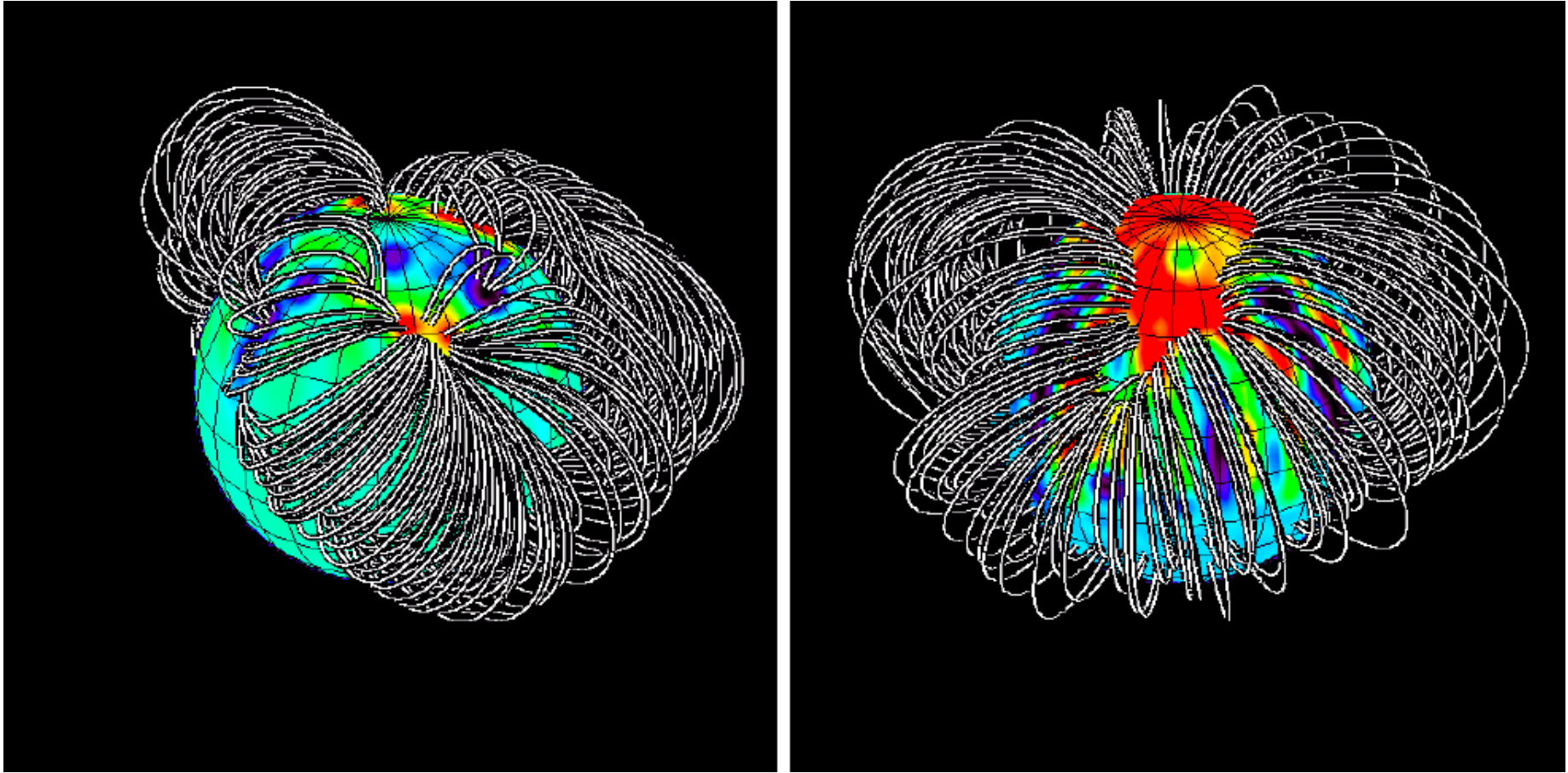


Hawley (1991)

Kopp and Pneuman (1976)

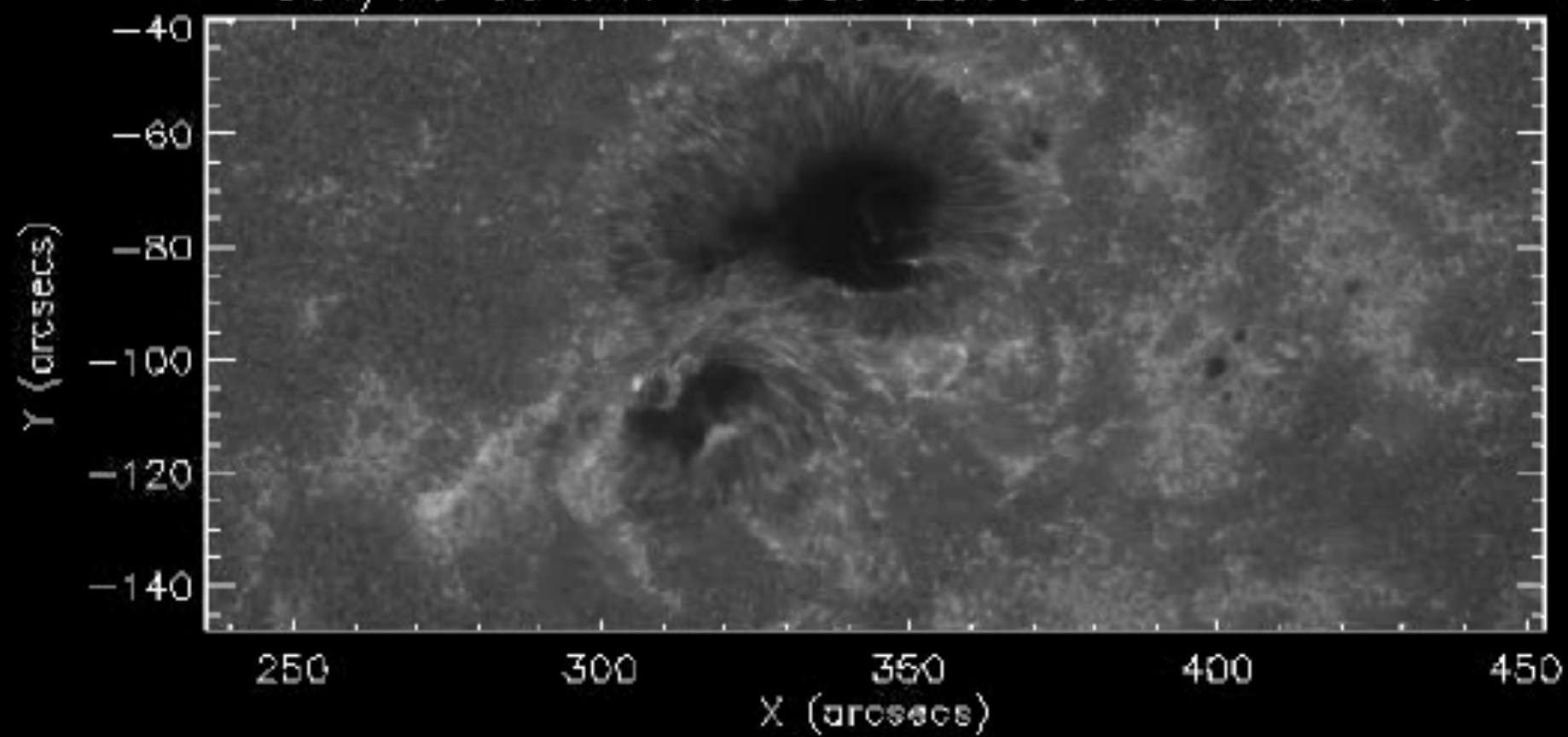


Red Dwarfs

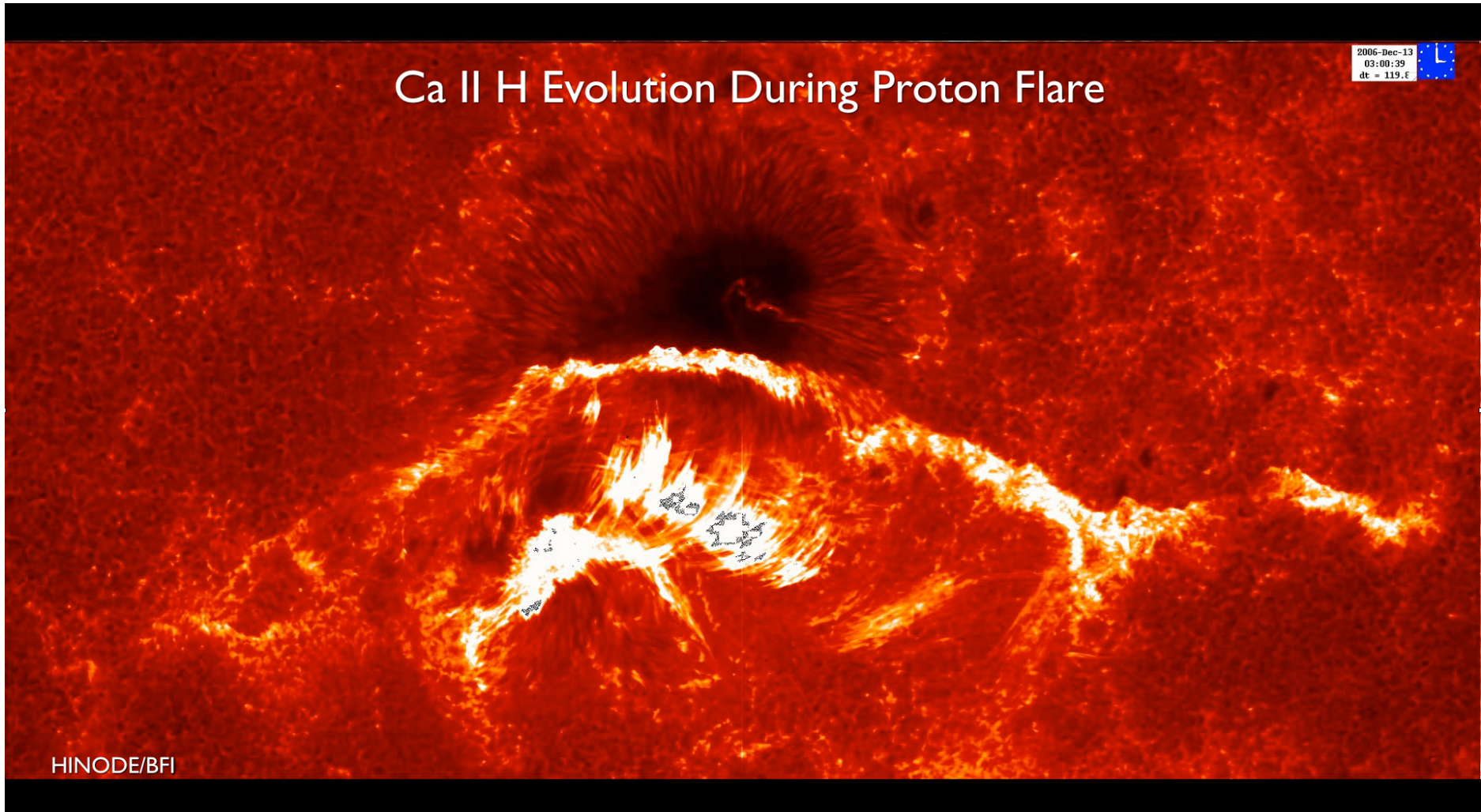


Extended coronal loops on cool stars

SOT/FG Ca II H 13-Dec-2006 00:00:21.534 UT

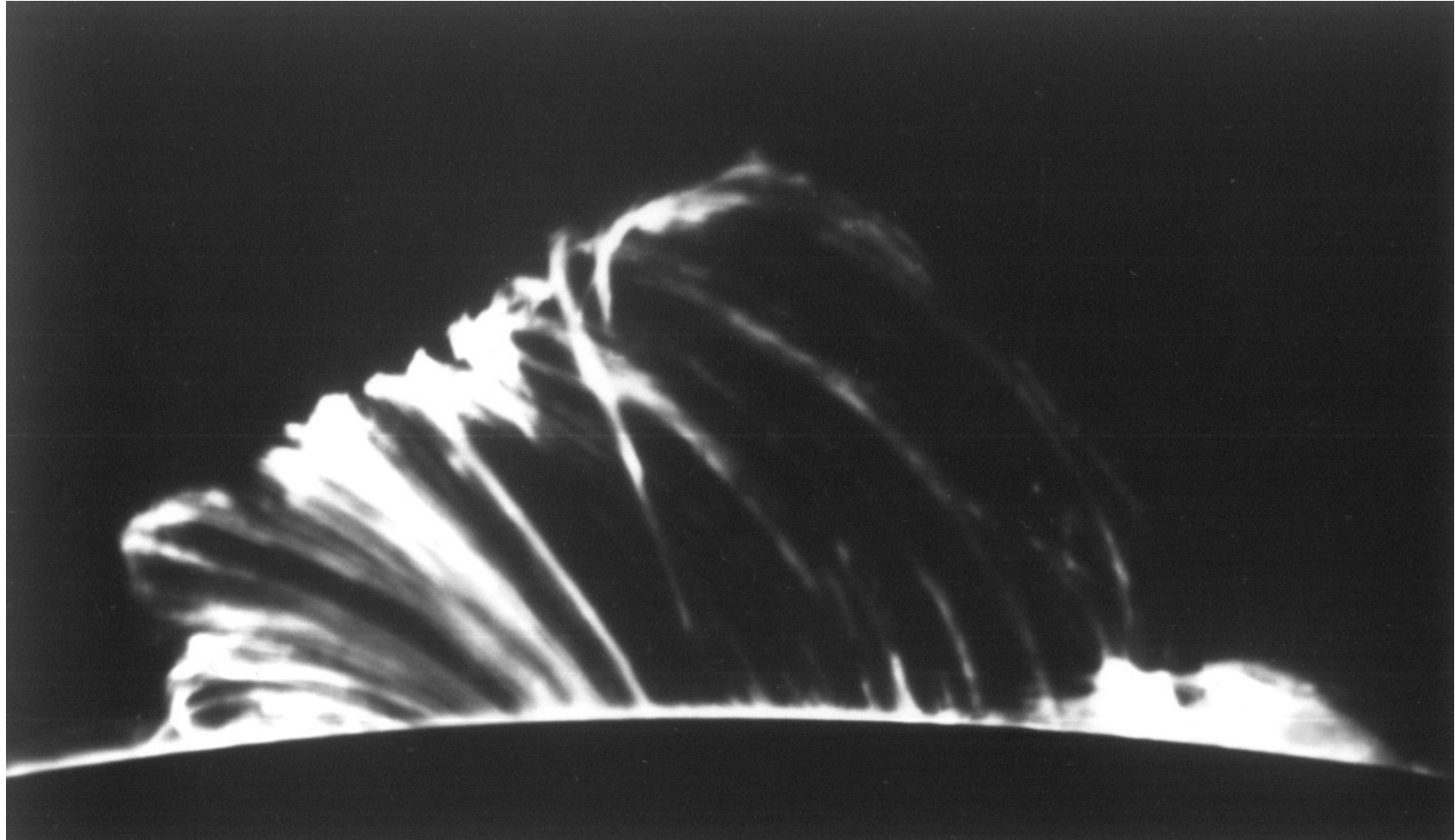


Hinode SOT



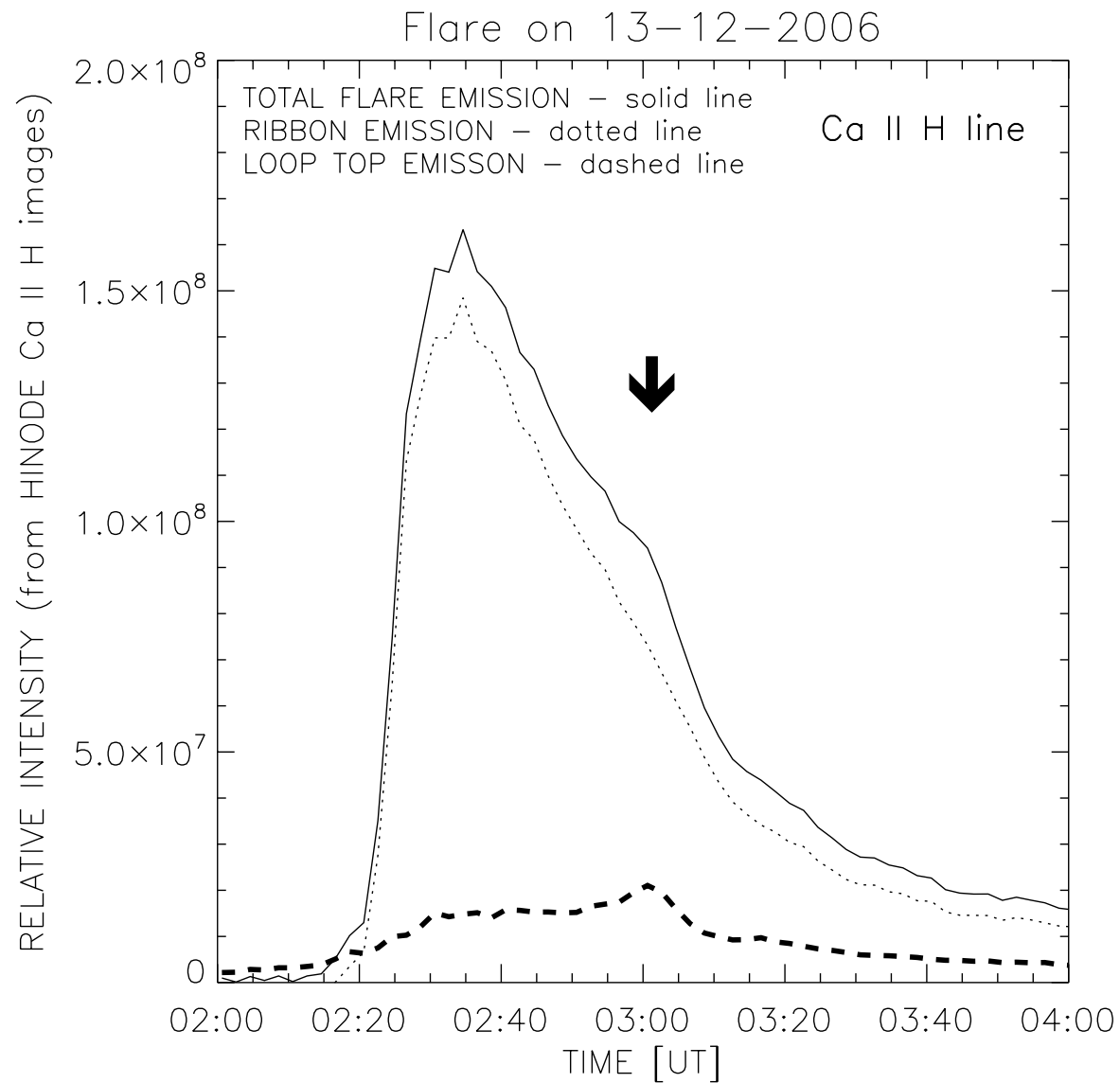
BFI (FWHM=0.3 nm)

H α loops (Wroclaw-Bialkow observatory)

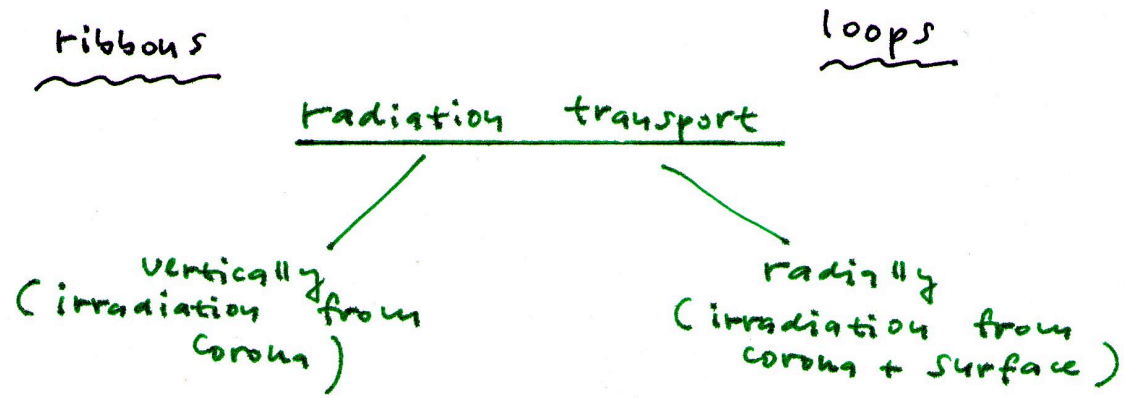
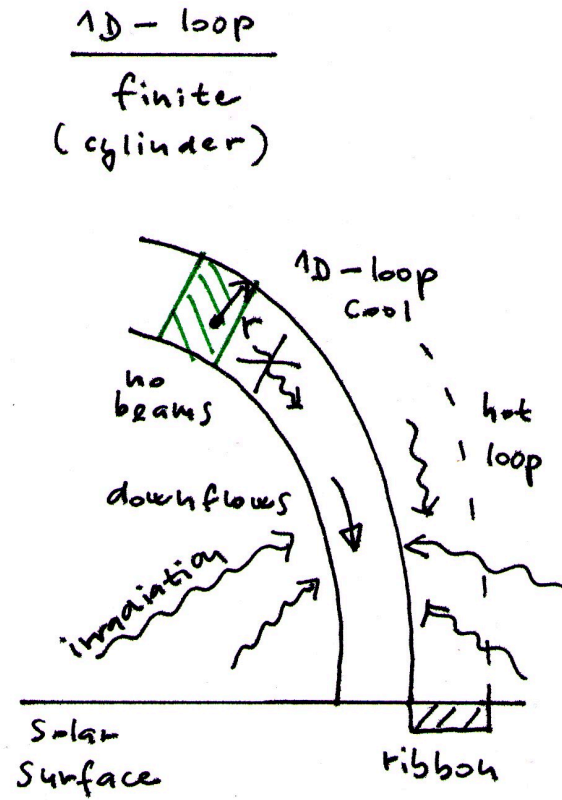
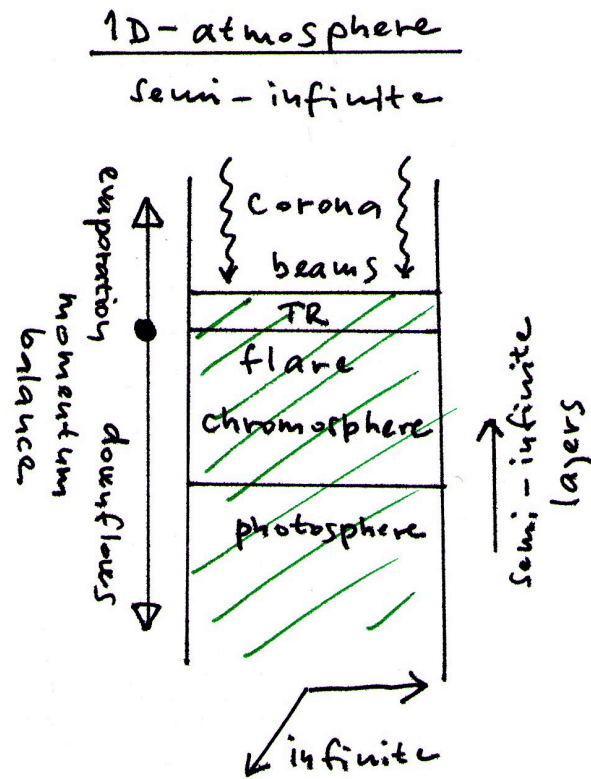


Courtesy of B. Rompolt

Integrated emission of ribbons and cool loops



Cooling time-scale for loops of the order of tens of min.



Cartoon shows 1D plane-parallel vs. cool loop model

Conclusions

UV-optical emission from stellar flares comes from a mixture of ribbons and loops (integrated flux)

On cool stars loops can be dominant

Current RHD models are based on a ribbon geometry (1D plane-parallel atmosphere)

Conceptually different geometry and physics of cool loops may be a clue to significant differences between solar and stellar flare spectra behavior



Solar & Stellar Flares: **Observations, simulations & synergies**

**Conference in honor of
Zdenek Svestka**

23 – 27 June 2014, Prague

SOC

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