# Superflares on Solar-Type Stars: The Curious Case of EK Draconis

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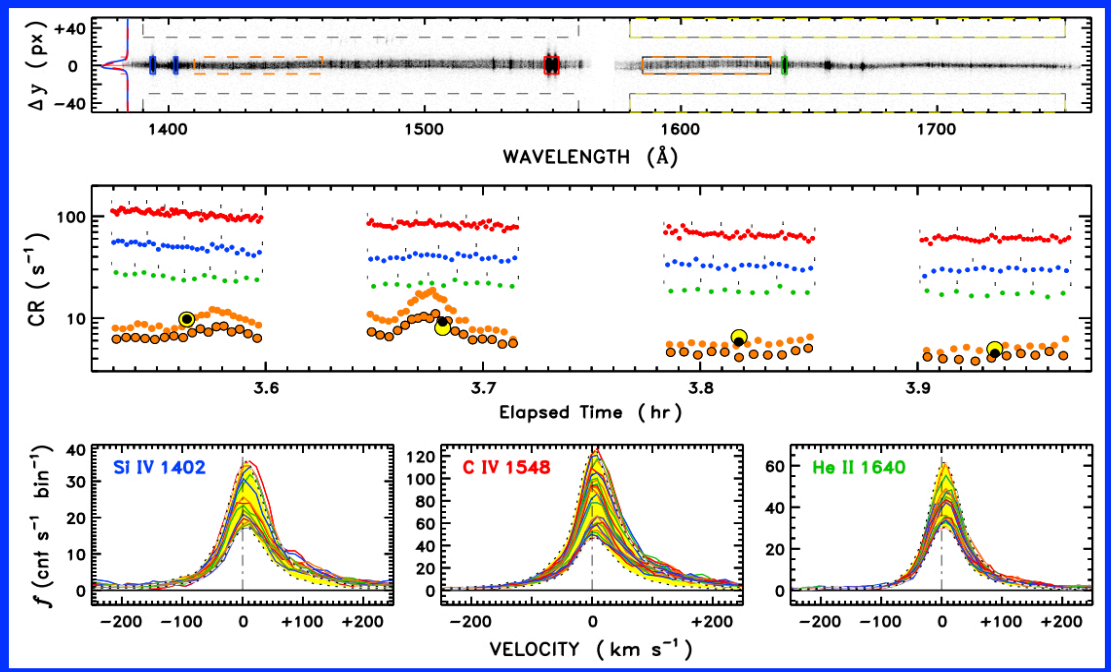
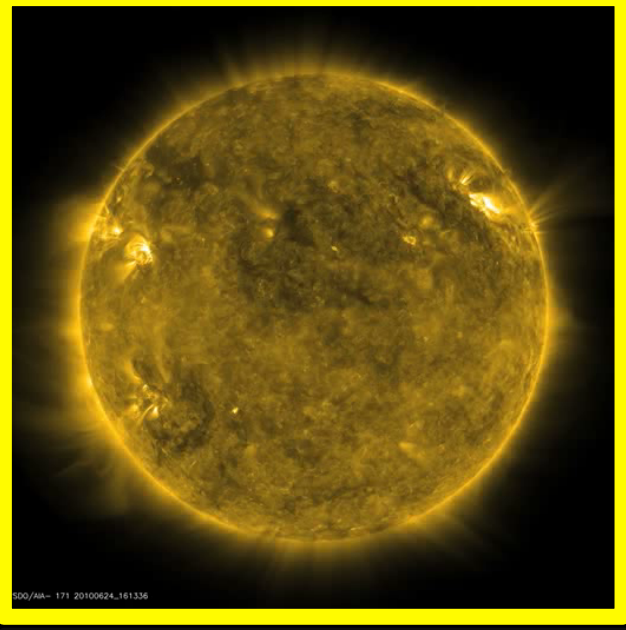
TS*12
Oct '15




Time-resolved *HST/COS G160M*

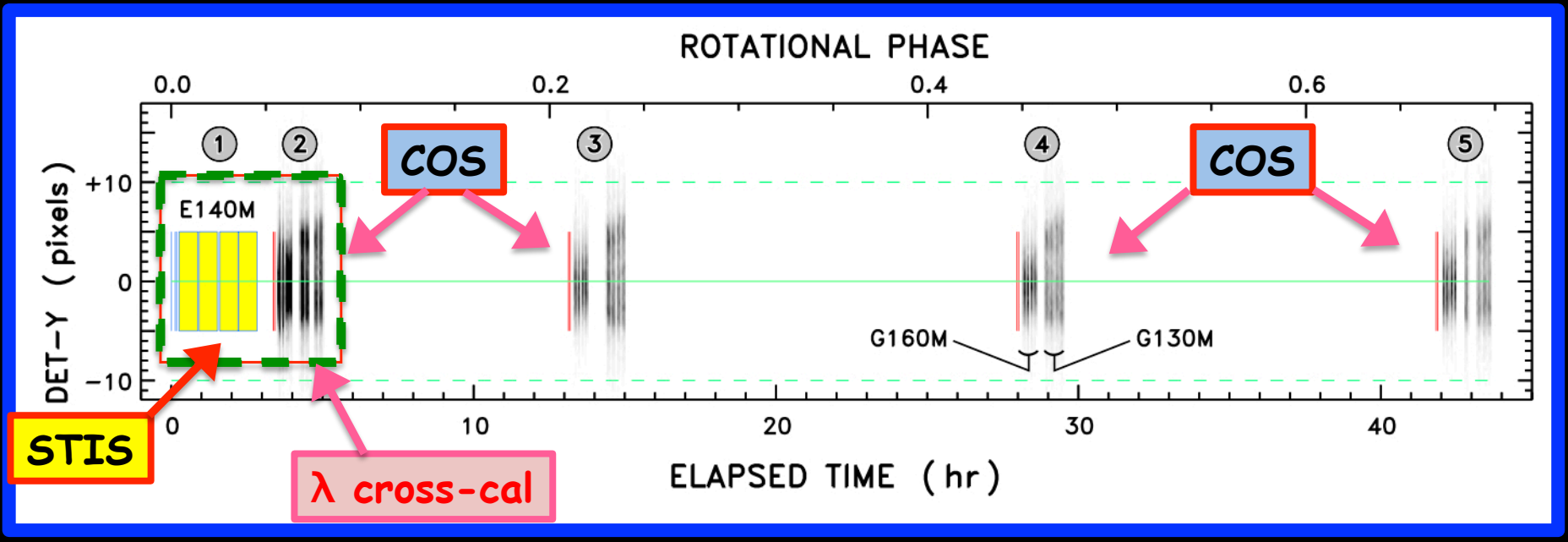


SDO photosphere to corona

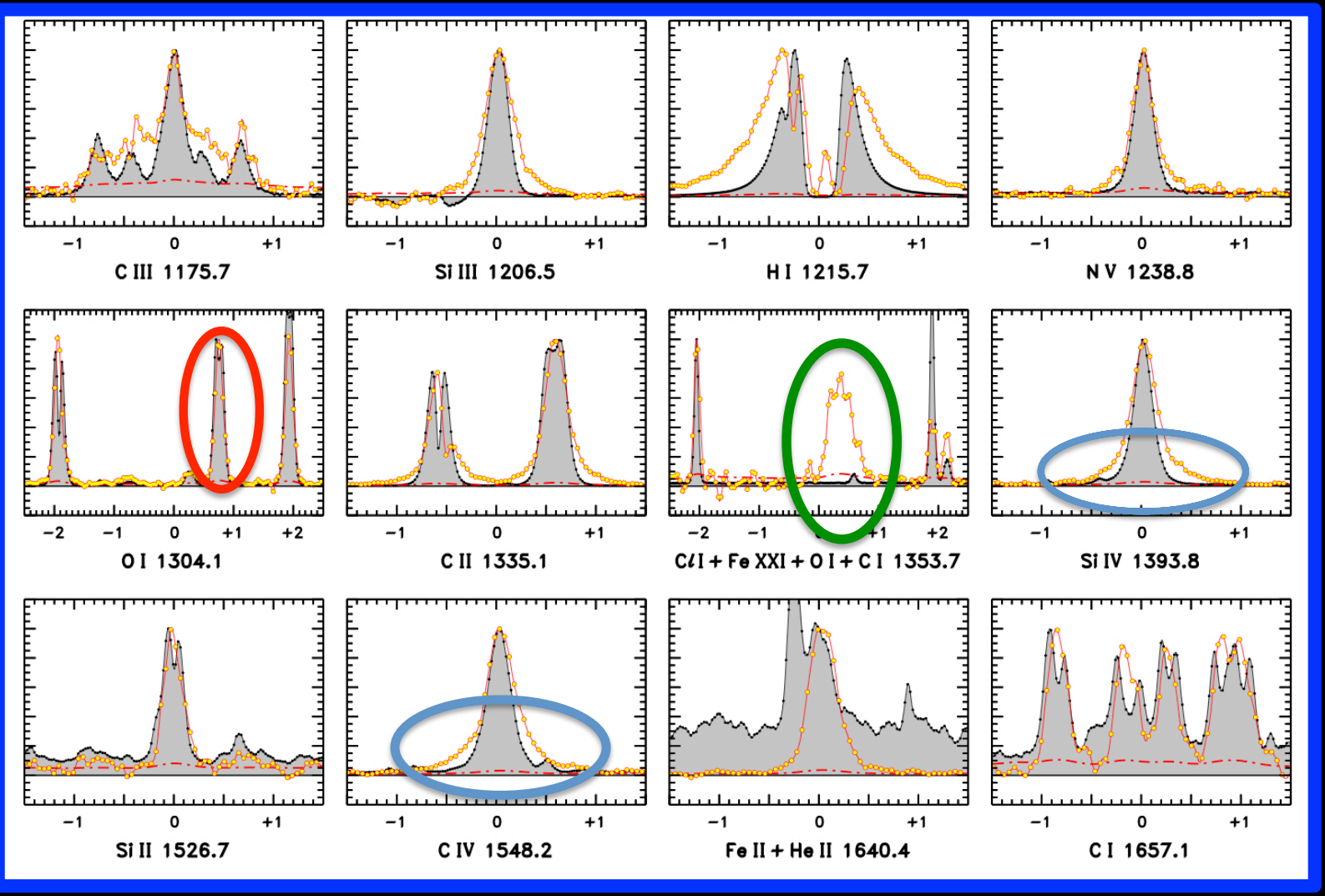
# BACKGROUND

- 2010 *HST/COS* SNAPshot FUV spectrum of 50 Myr solar analog EK Draconis found *redshifted* Si IV (*T*~ 80,000 K) and *impulsive behavior* uncorrelated with cooler C II or hotter Fe XXI
- Complex atmospheric dynamics, related to elusive coronal heating mechanism?
- Rotational "Doppler imaging" effects?
- Instrumental wavelength scale errors?

# 2012 Observing Plan

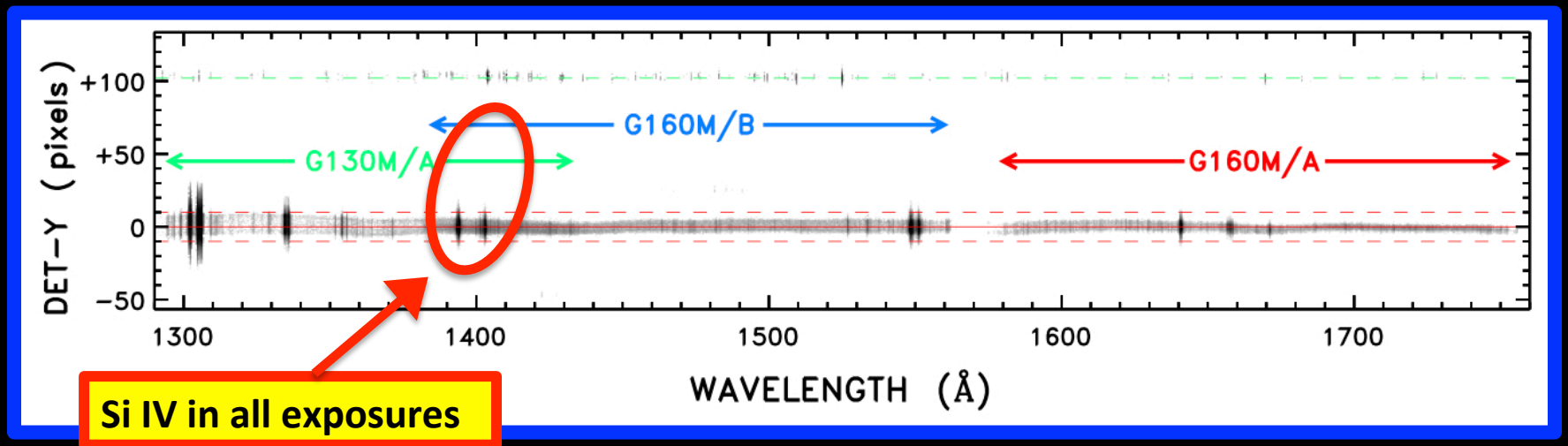



*HST/STIS E140M spectrum in 2012* Visit 1;
follow with *COS* in Visit 2 for λ cross-cal;
repeat *COS* at ½-day intervals (Visits 3-5)
to cover several rotational phases (P~2.4 d)

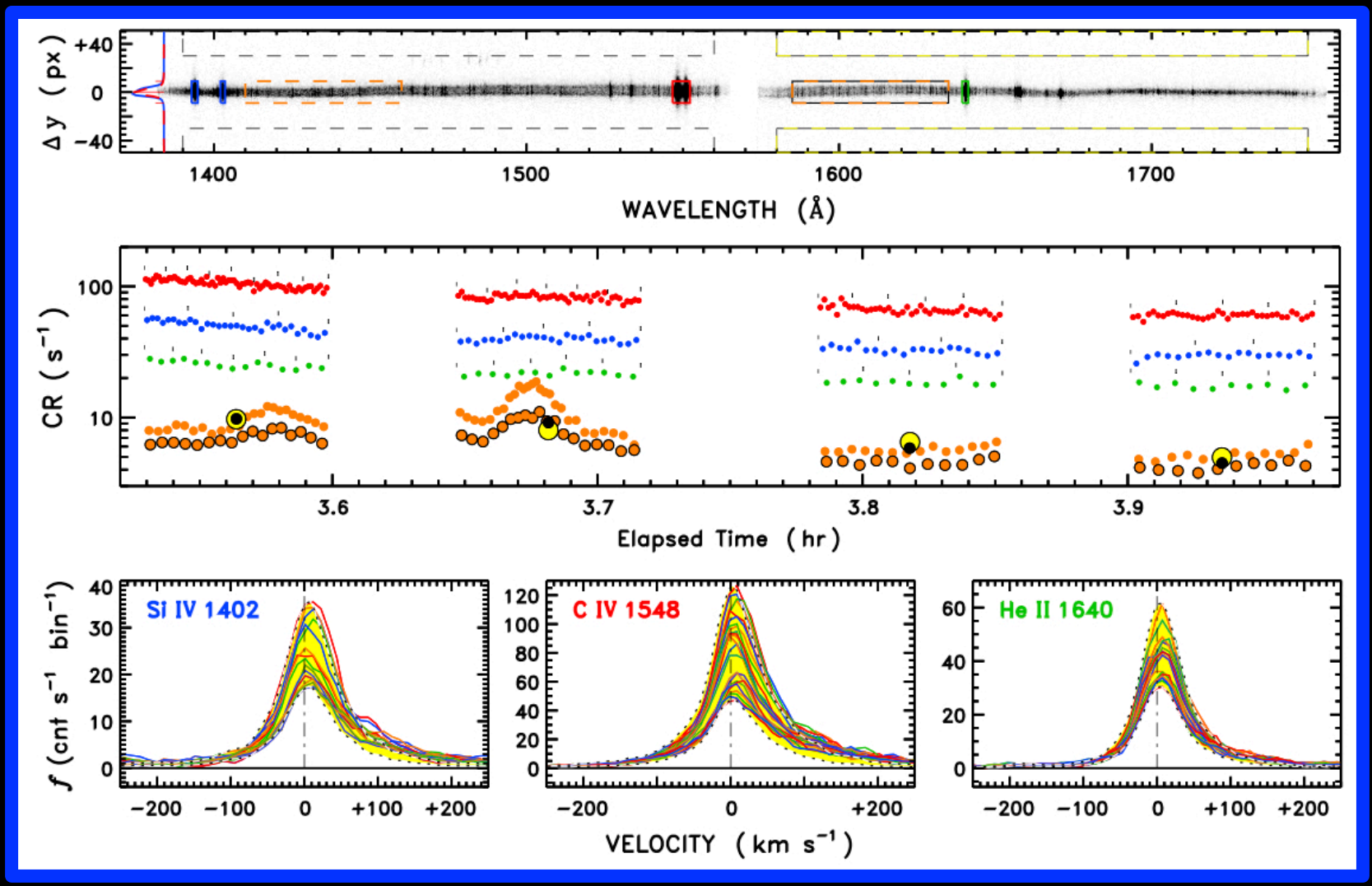



STIS FUV spectra- shaded is sunlike a Cen A; dots are EK Dra: chromosph lines similar; but subcoronal broad wings; & strong FeXXI (T~10 MK), absent in a Cen A

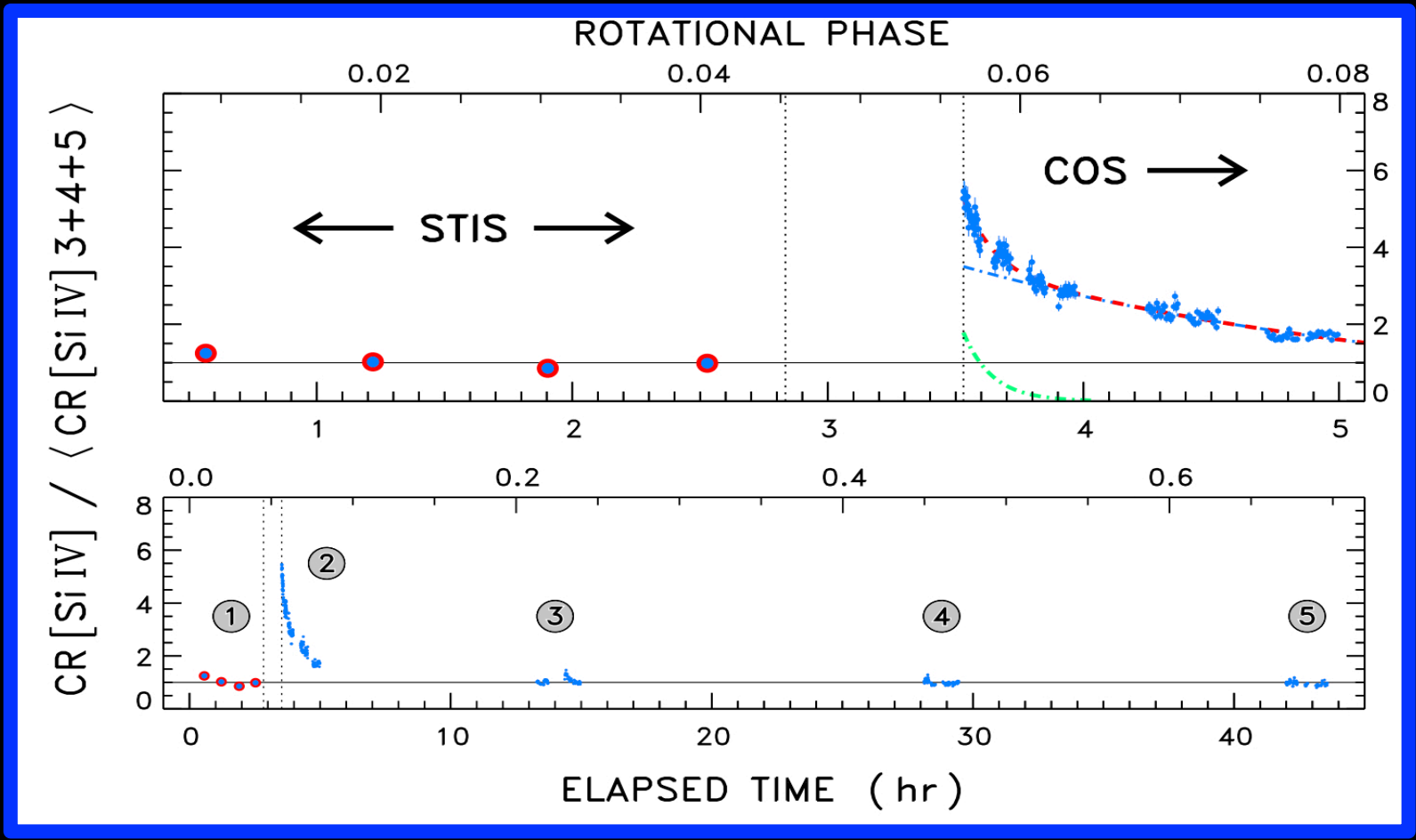
*HST/COS* TIME-TAG spectra cover same spectral territory as STIS, but at much higher (~20x) sensitivity with only minor loss of resolution, although of uncertain wavelength accuracy



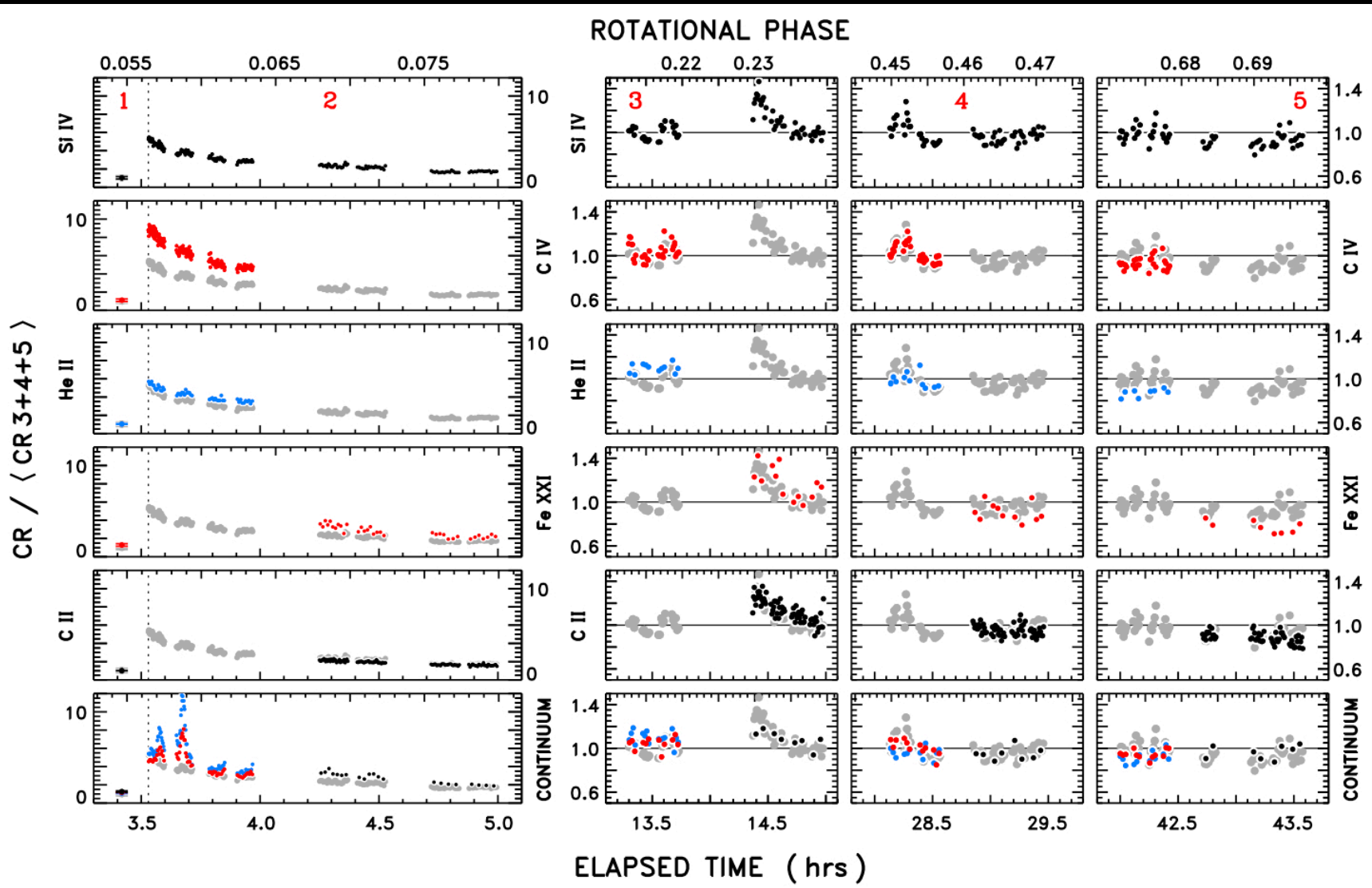
# Time-resolved COS fluxes & profiles in Visit 2, immediately following STIS Visit 1

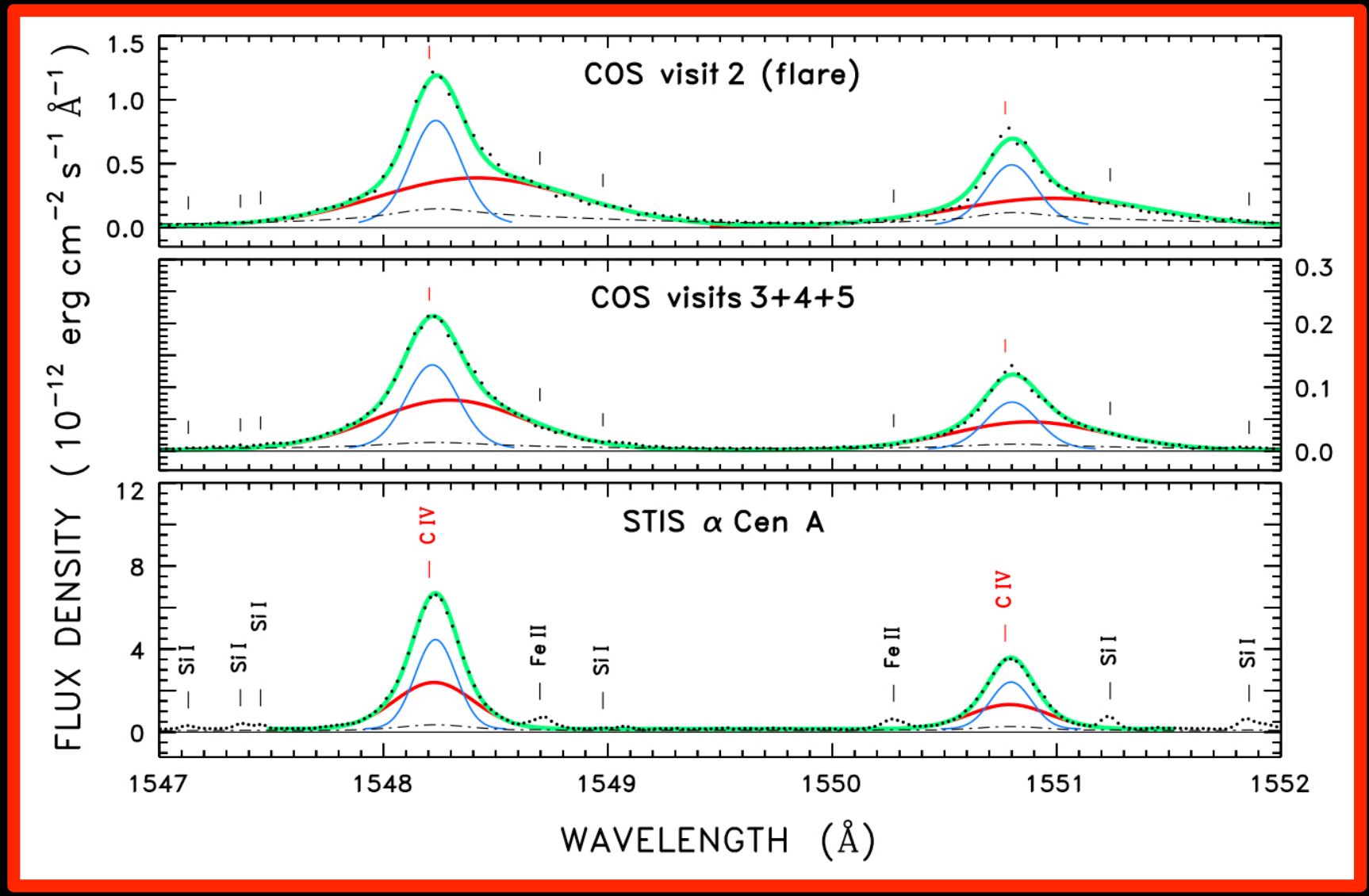


# Best laid plans of mice and Astronomers often go awry: giant flare interrupts STIS/COS cross-calibration (but all is not lost because Visits 3-5 as "quiet" as STIS Visit 1)



# COS EK Flare Big Picture






**Large *redshifts* of subcoronal C IV even more exaggerated during the flare**

# Conclusions

- Serendipitous large flare captured by *HST/COS* on young solar analog EK Dra estimated X25,000 on GOES scale: star already has 1,000× solar $L_X$, then brightened up another 10× during flare; such flares probably common; implications for planets ➡ hard radiation, atm stripping
- Flare accompanied by strong *redshifts* of the subcoronal lines; not "Doppler imaging," but rather extreme dynamics (coronal rain? super-arcade downflows? Failed CME?)