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**MWC 560:
linking accretion rate to disk outflow**

*with JL Sokoloski, U Munari, N Roy, NPM Kuin,
GJM Luna, MP Rupen, JHS Weston, MJ Darnley,
C Knigge, P Valisa, A Milani, P Somogyi*

GRS 1915's X-ray "heartbeat"

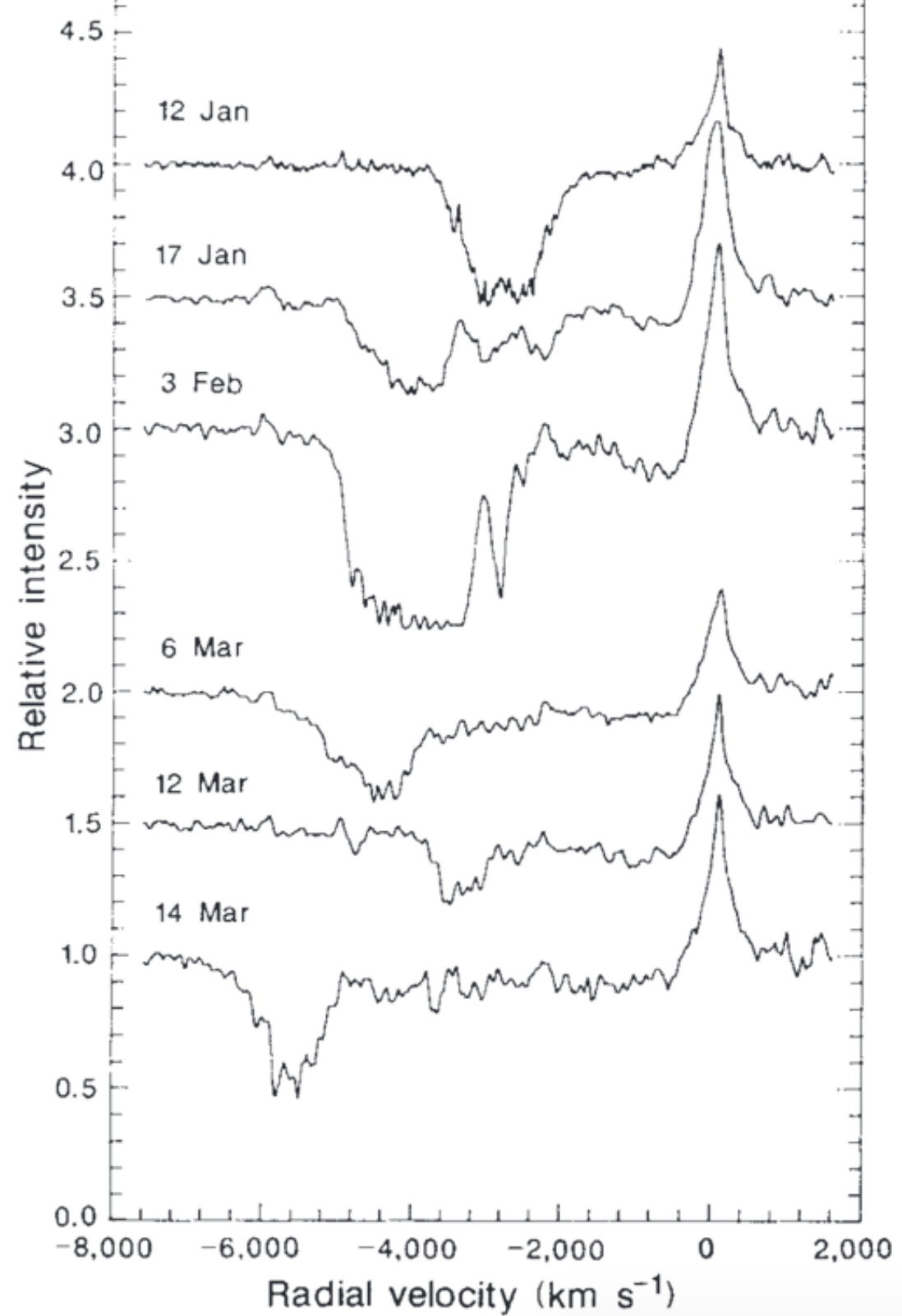
X-ray binary GRS 1915+105:

-heartbeat from regulatory relationship between wind, jet, and disk?

-outflow Shields (1986) oscillations perhaps "acting as a gatekeeper or a valve for the external accretion rate, and facilitating or inhibiting state transitions" (Nielsen et al. 2011, PhDT)

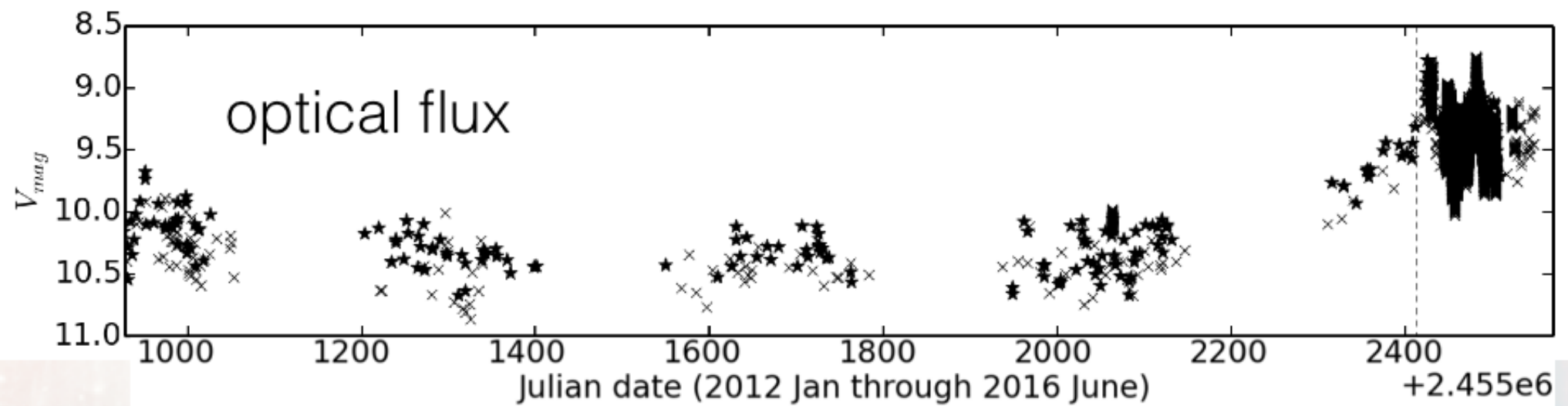
(Credit: NASA/CXC/Harvard/J.Nielsen et al & A.Hobart)

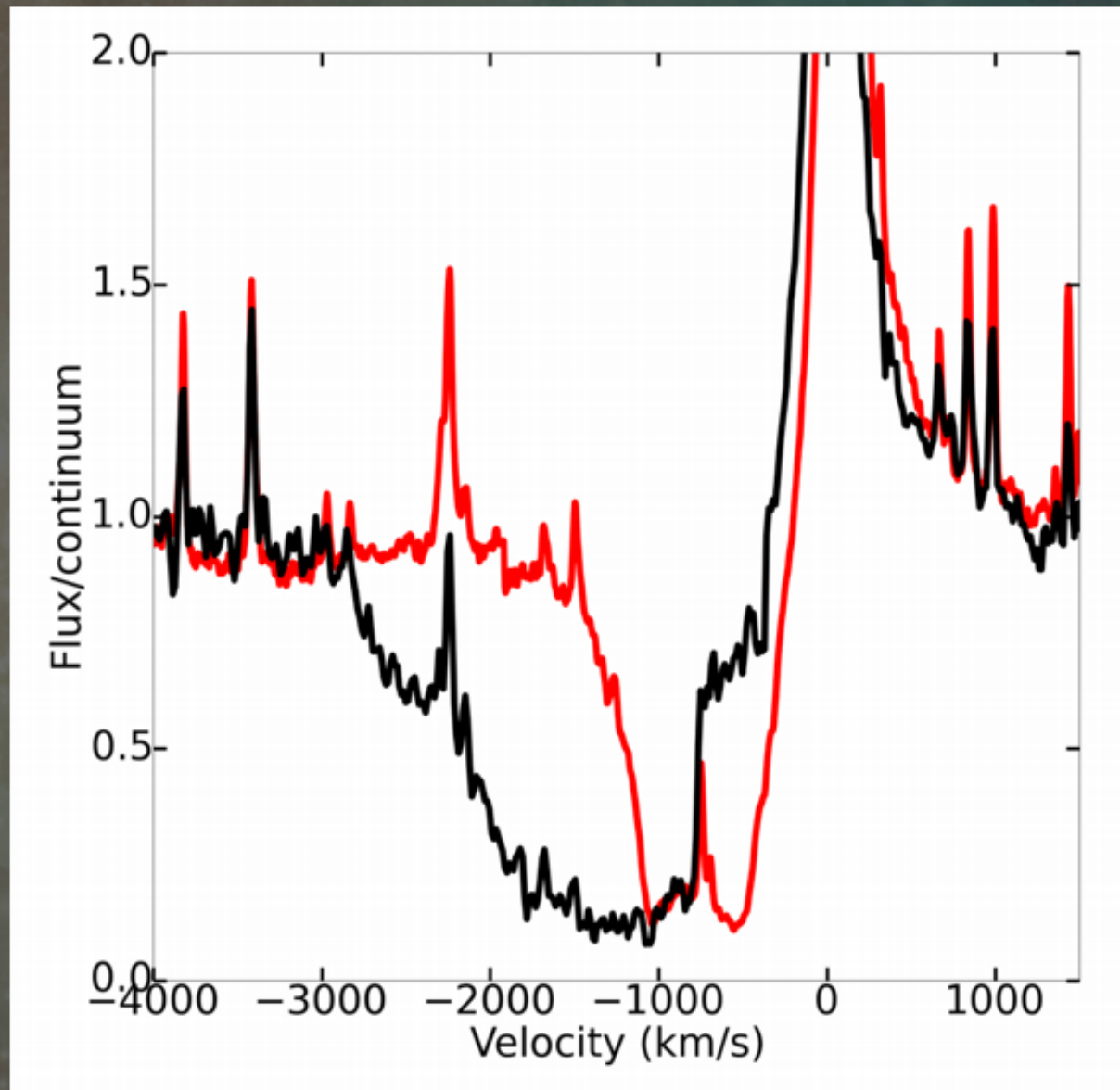
(Tomov et al. 1990, Nature)



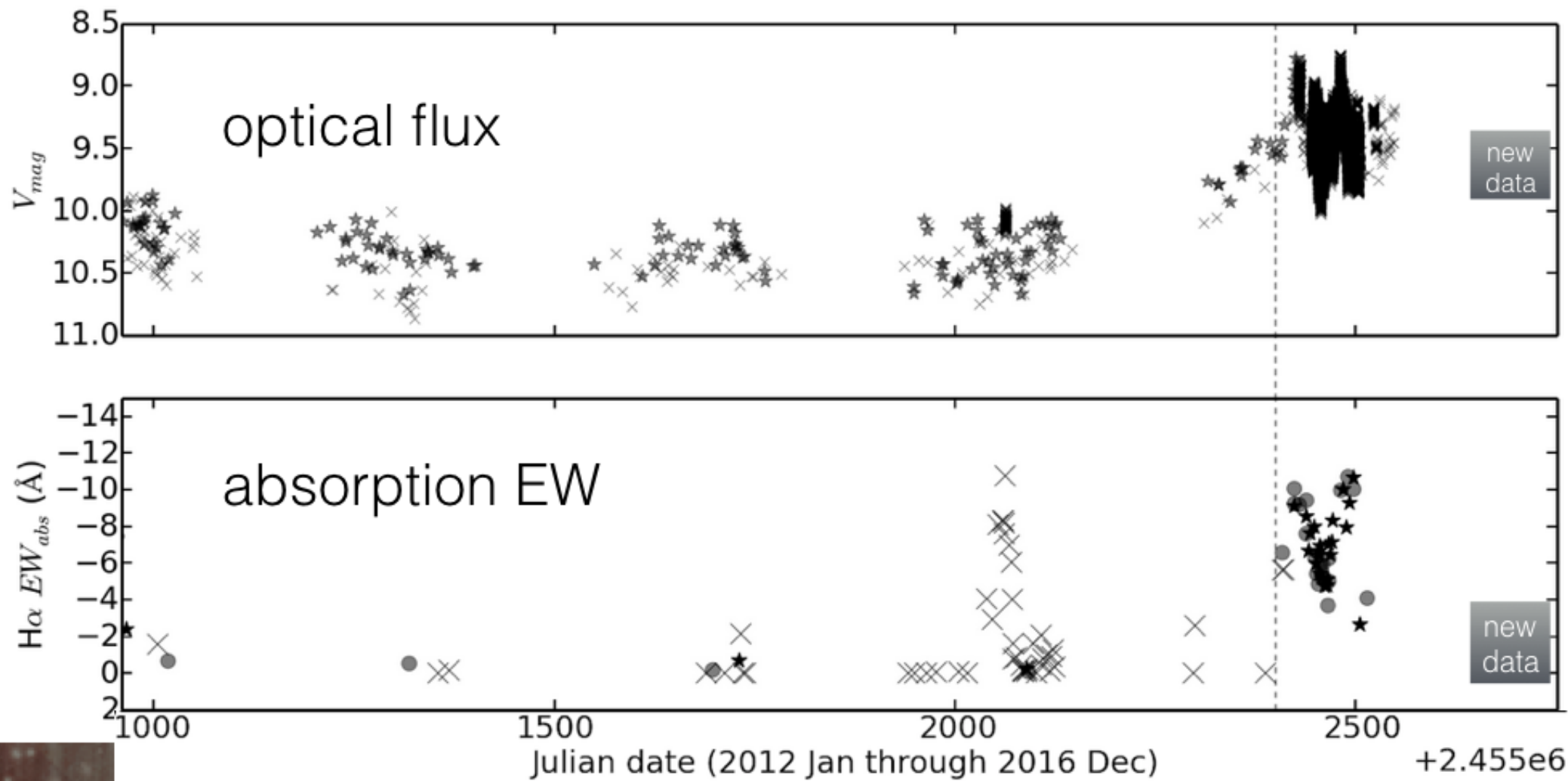
brightest outburst of MWC 560 in 26 yrs (possibly 87 yrs)

2012-2016 V band photometry:



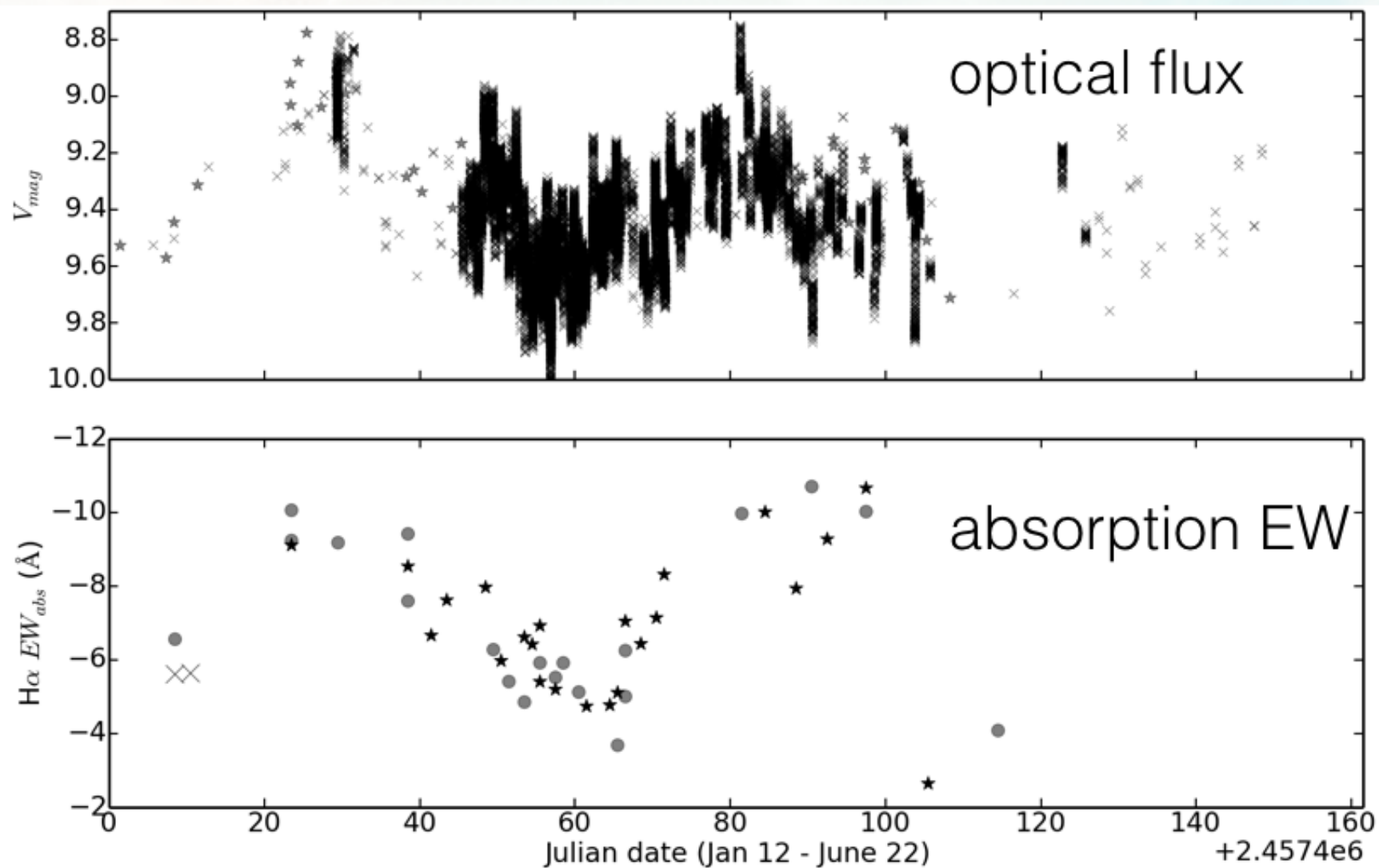


outflow velocity jump (Balmer lines in **quiescence** and **peak**)



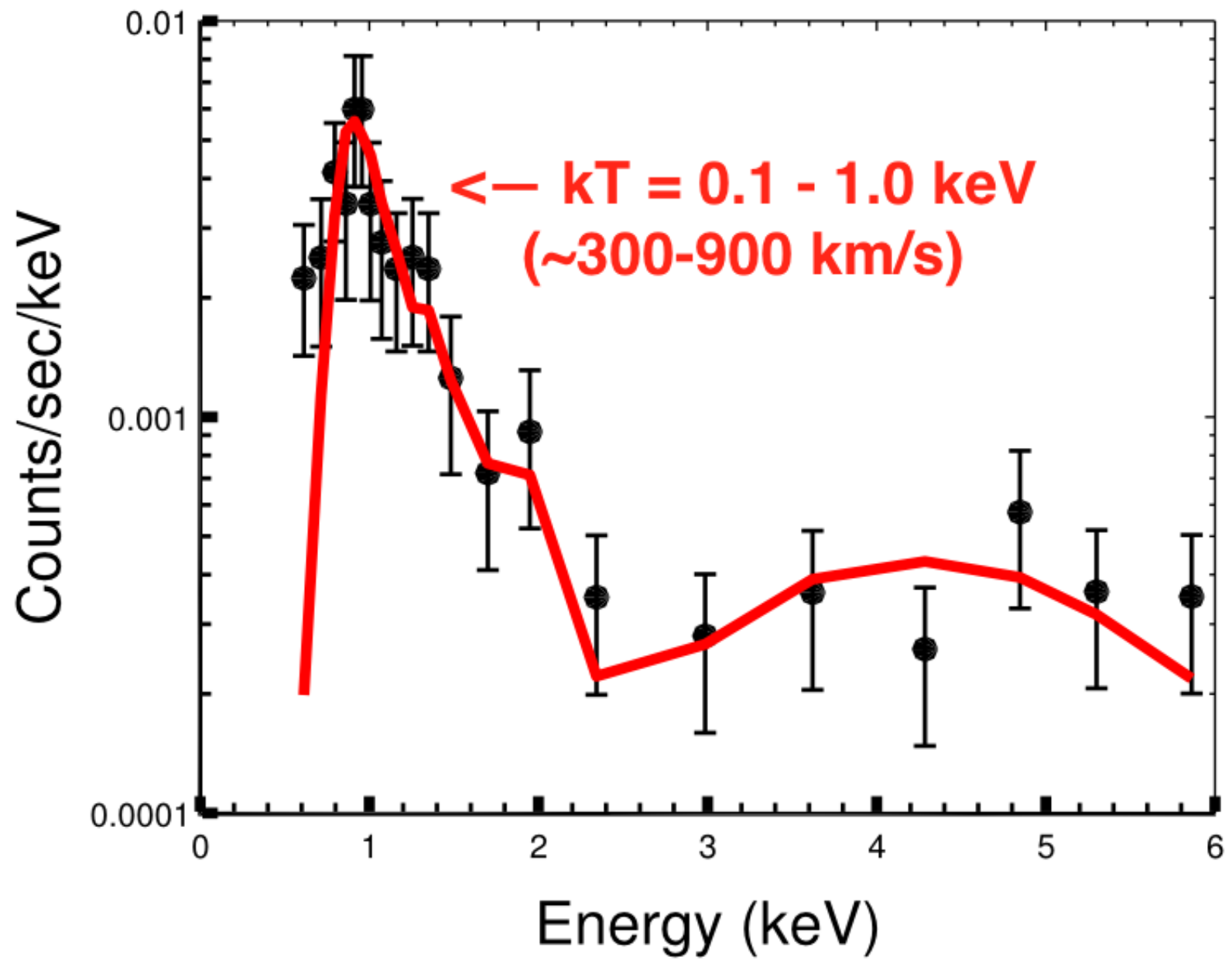
outflow velocity jump (EW of fast 1500-3000 km/s component)

zoom-in: at peak, fast component tracks accretion rate

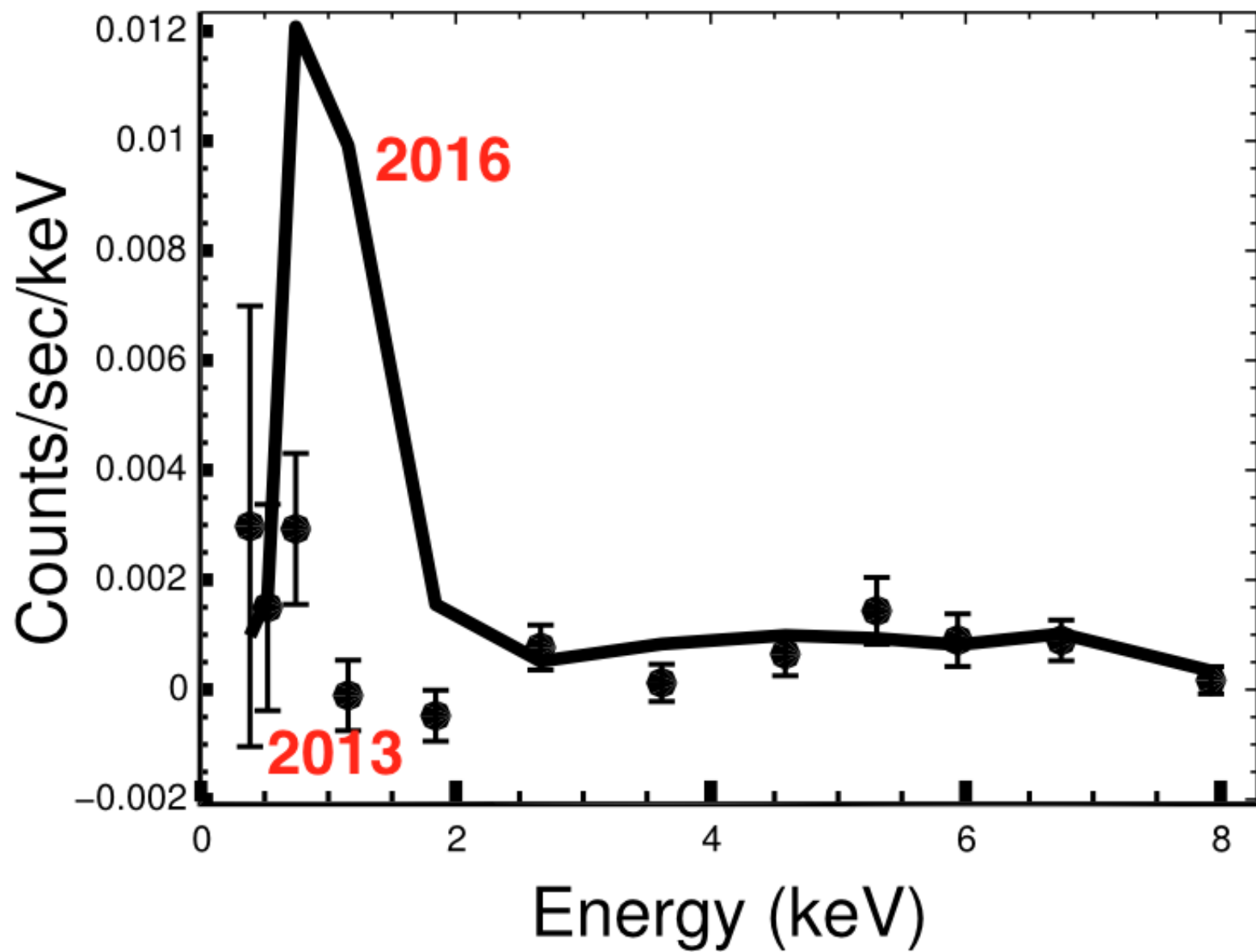


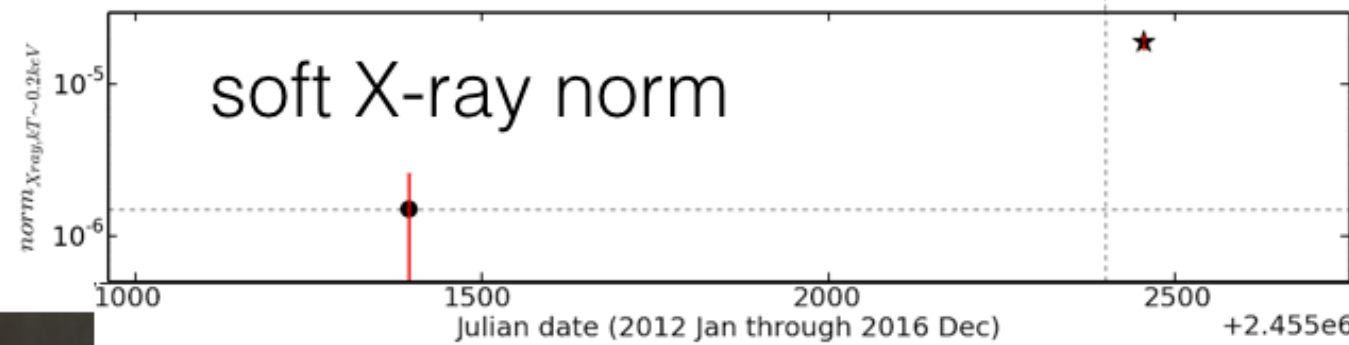
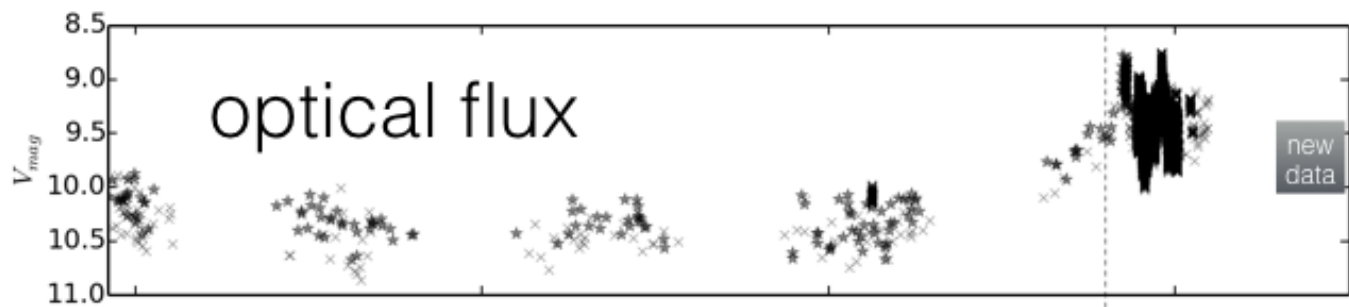


50ks Chandra exp @peak (fit w/ wabs1*apec1+wabs2*apec2):

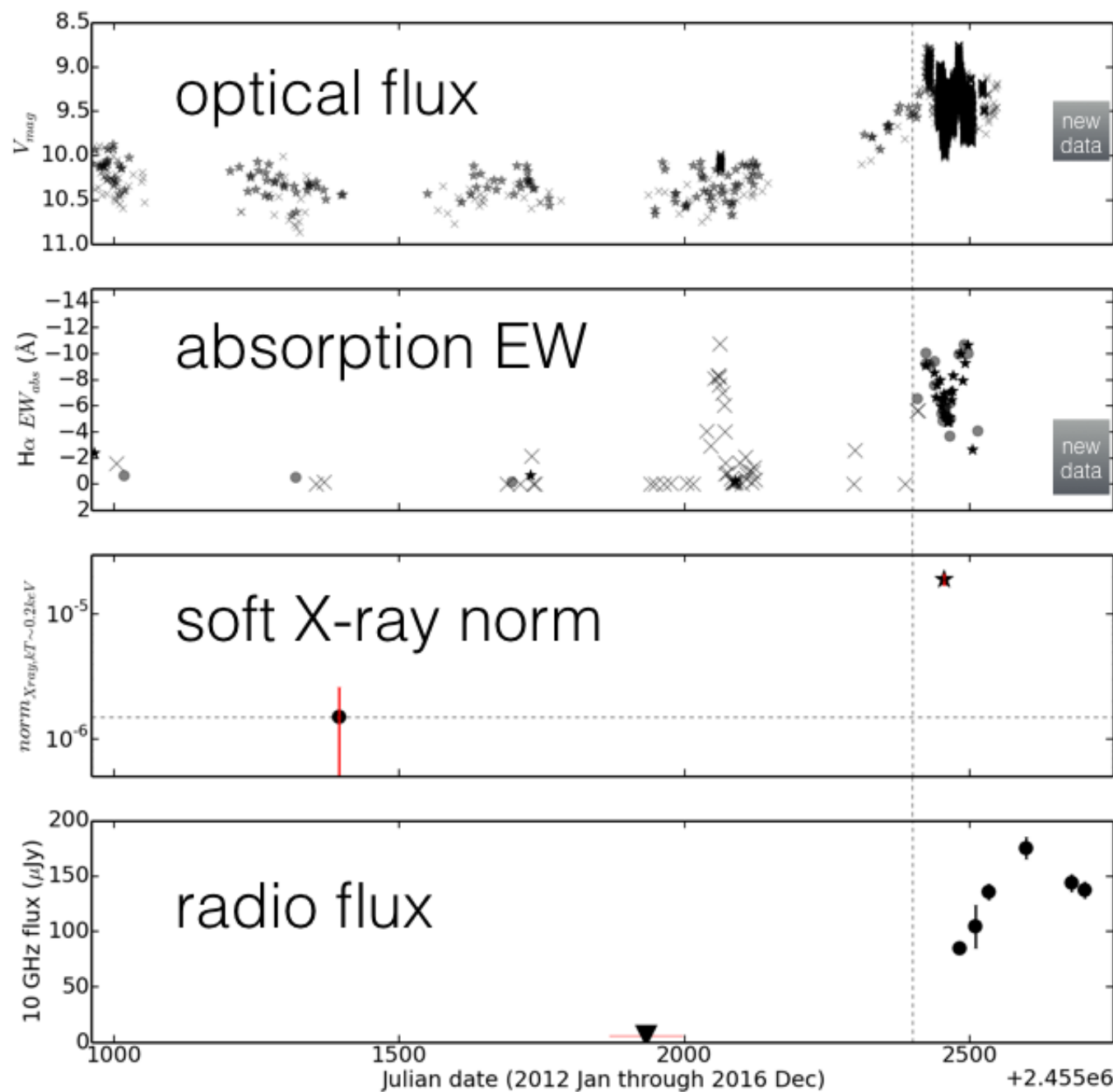


this component strengthened from quiescent epochs by $>10x$

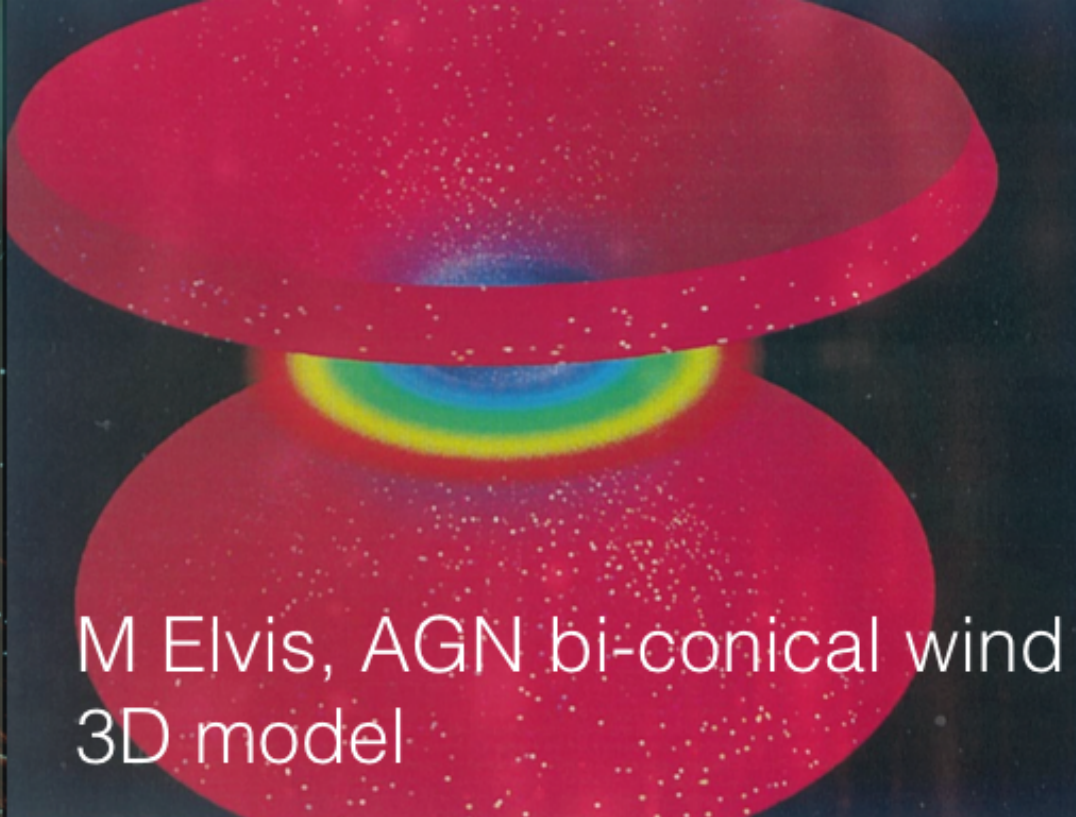
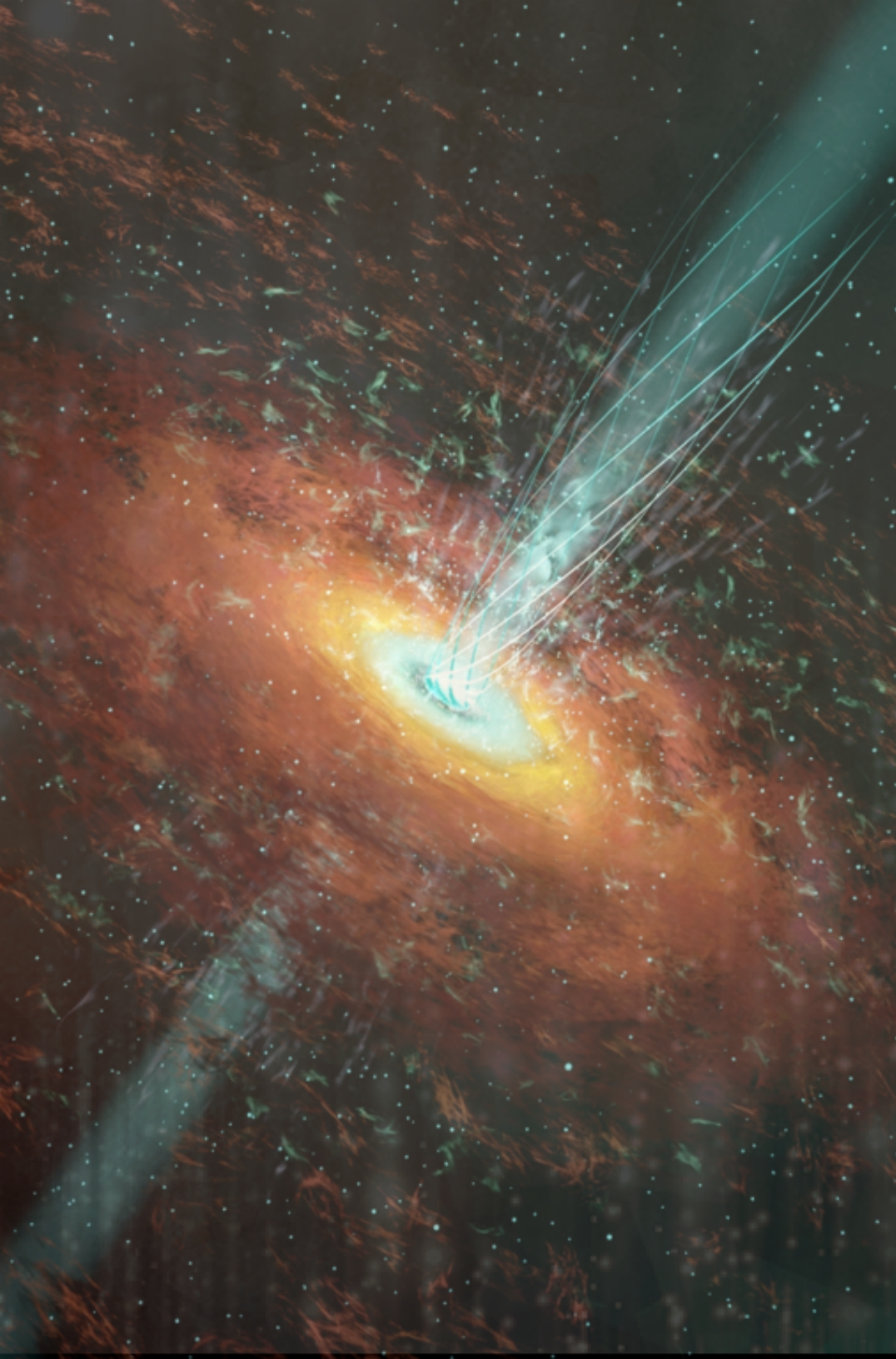




outflow power jump (X-rays)



outflow power jump / expanding outflow (radio)
 (~flat spectrum = opt thin thermal or opt thick synch)



M Elvis, AGN bi-conical wind
3D model

MWC560—a unique astrophysical object

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DESPITE its interesting behaviour^{1,2}, the object MWC560 has been little studied since its discovery 50 years ago during the Mount Wilson Observatory H α emission-line surveys³. To rectify

1. symstar disk \dot{M} high state \rightarrow disk outflow power jump...
2. ...at which point outflow velocity goes as \dot{M} ...
3. ...but not during \dot{M} rise to high state:
 - waiting for structural changes to $\dot{M}(r)$ and M-buildup \rightarrow delay?
 - start high state outflow \rightarrow start high state disk equilibrium?
4. MWC 560 outflow a bi-conical wind, not a jet? \rightarrow More symstar disk winds out there? \rightarrow Bright future for work on self-regulating accretion in WD+RG environment.

Questions?

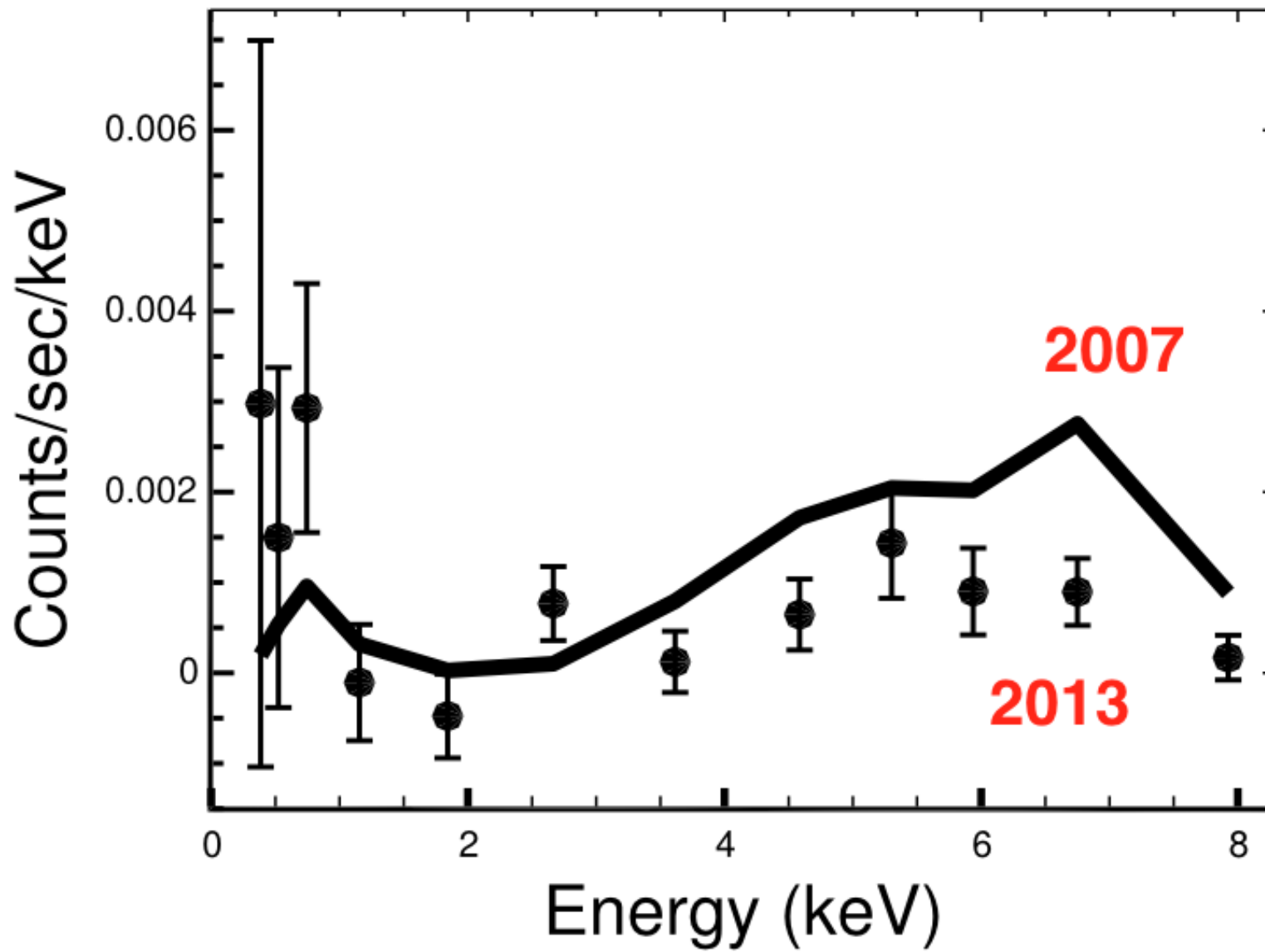
long: lucy@astro.columbia.edu

short: @adrianlucy on twitter

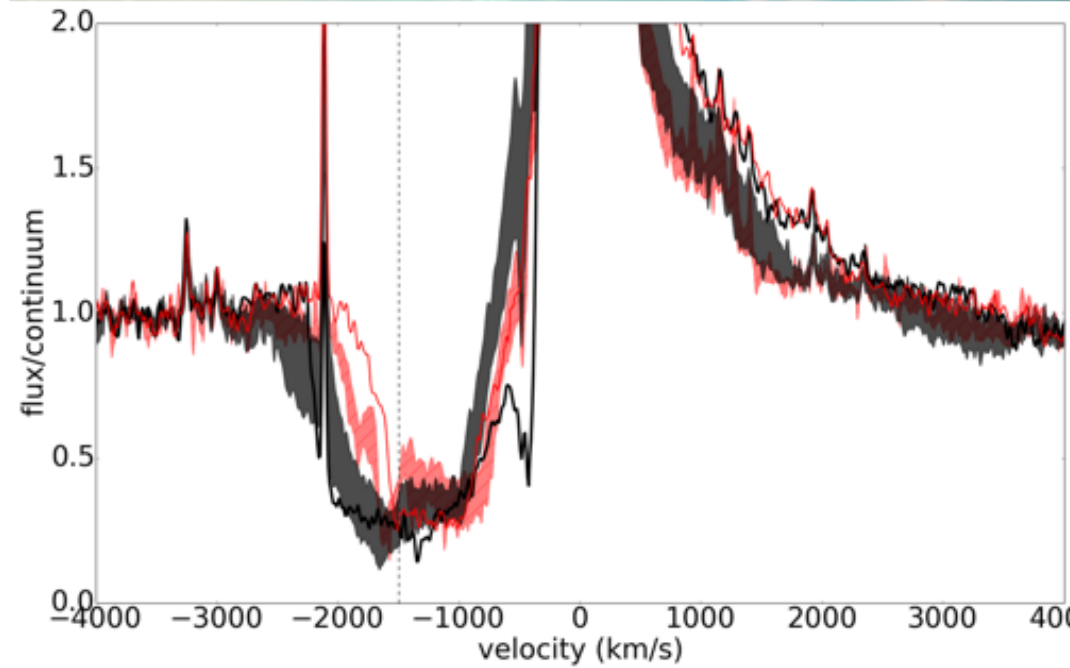
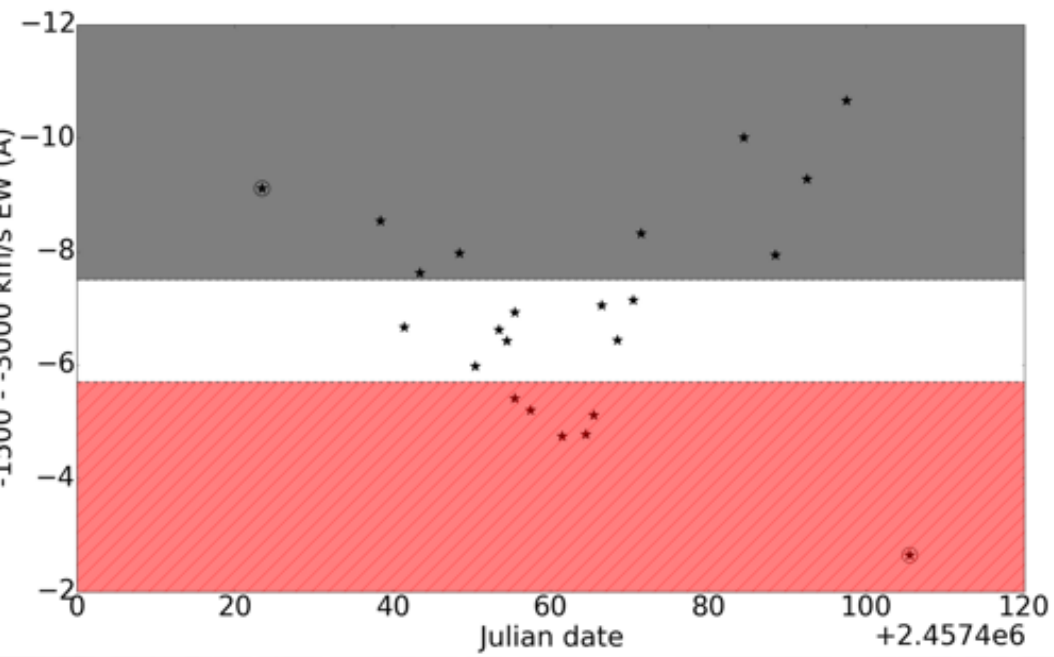
asocial: www.astro.columbia.edu/~lucy/
tiny.cc/mwc560library

look out for Lucy et al. paper in early-2017
& non-burning symbiotics survey results 2017-2020

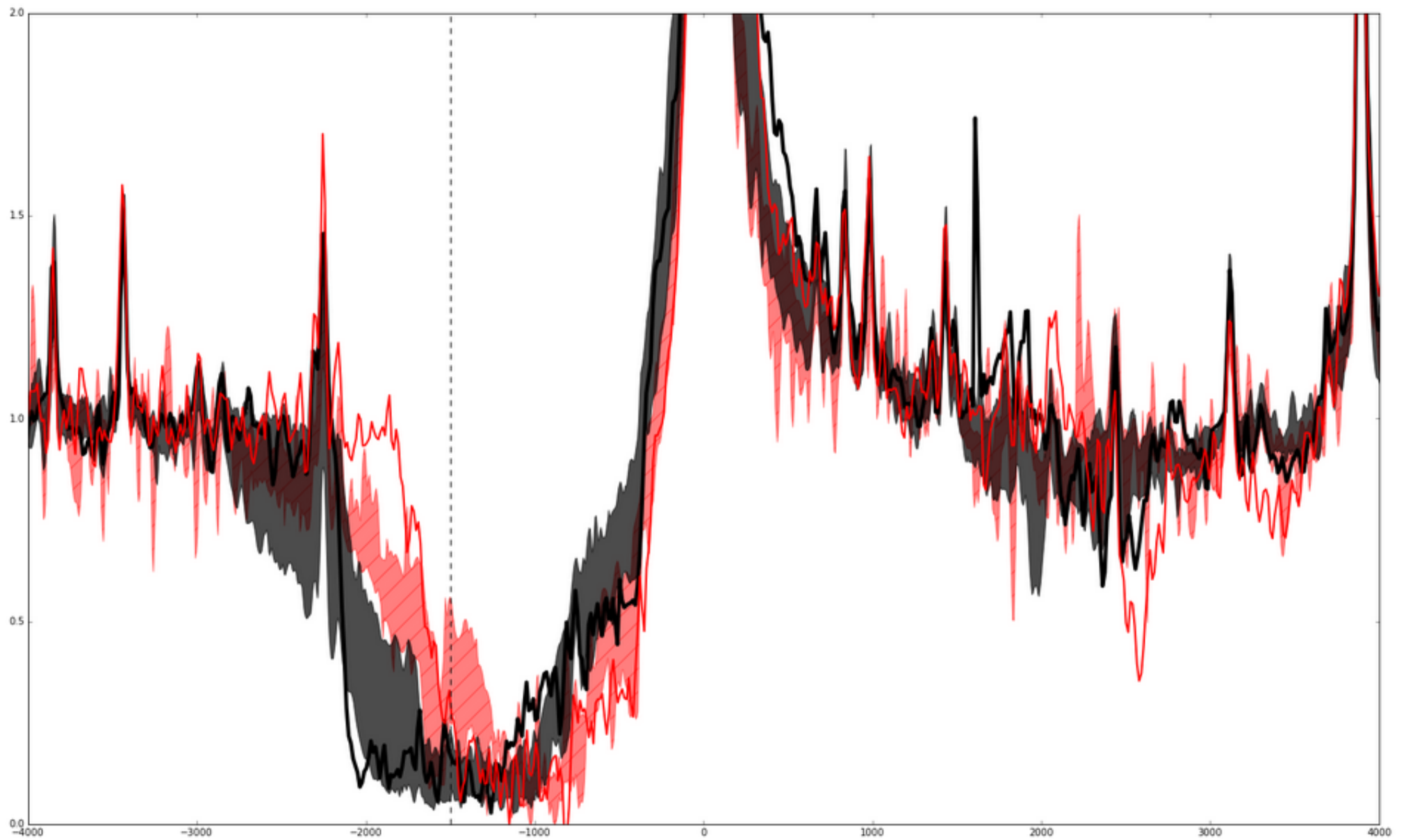
bonus slide 1



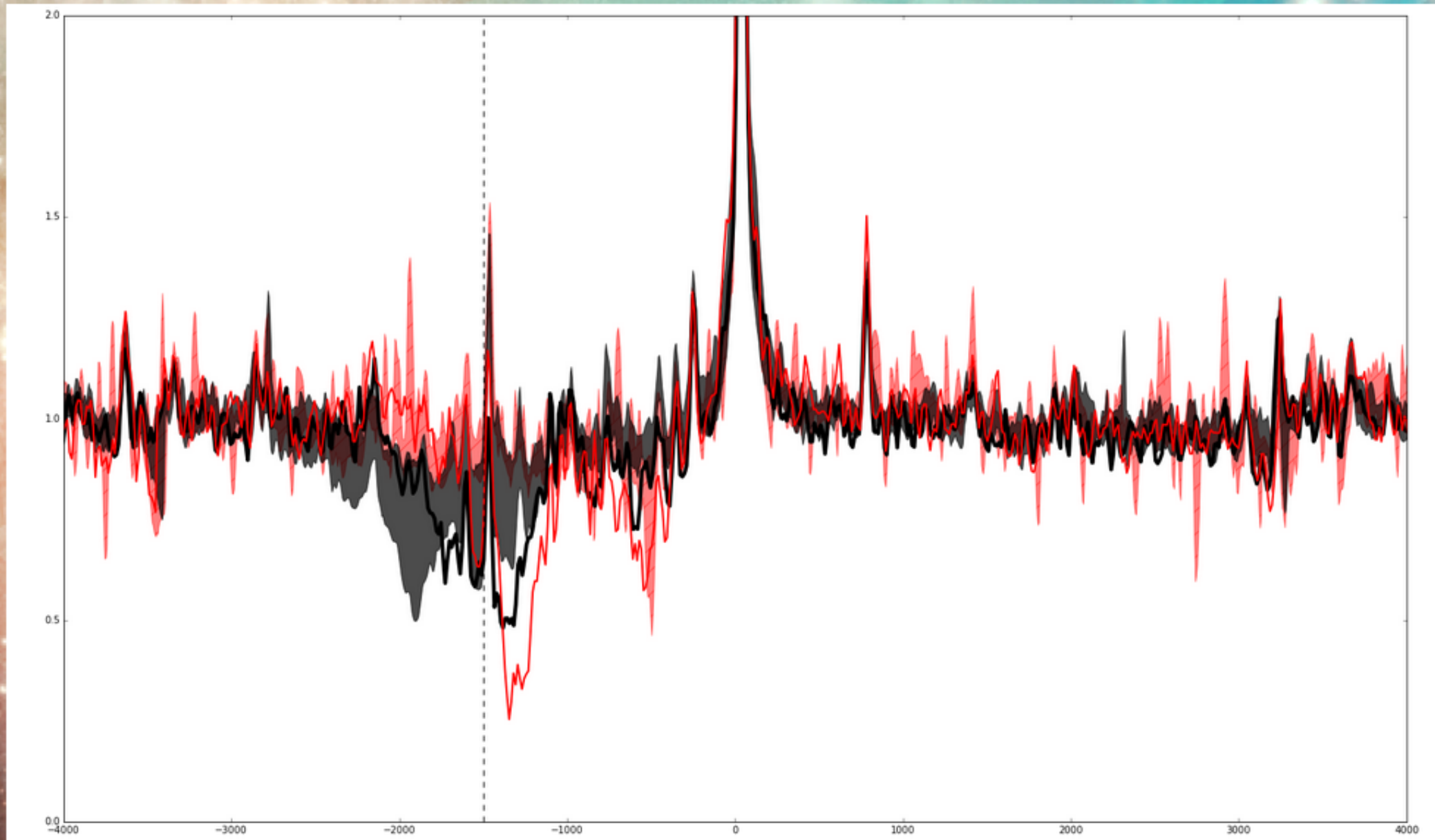
bonus slide 2 (Halpha)

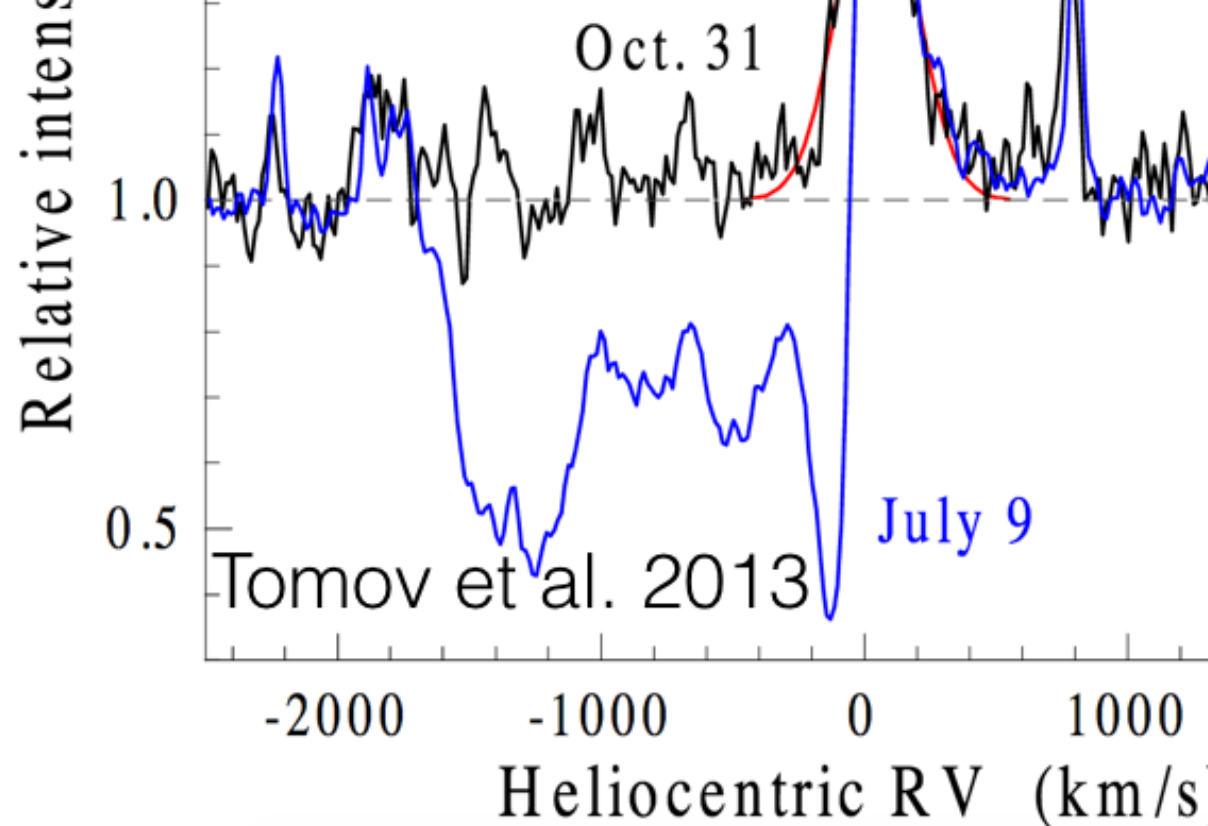


bonus slide 3 (Hbeta)

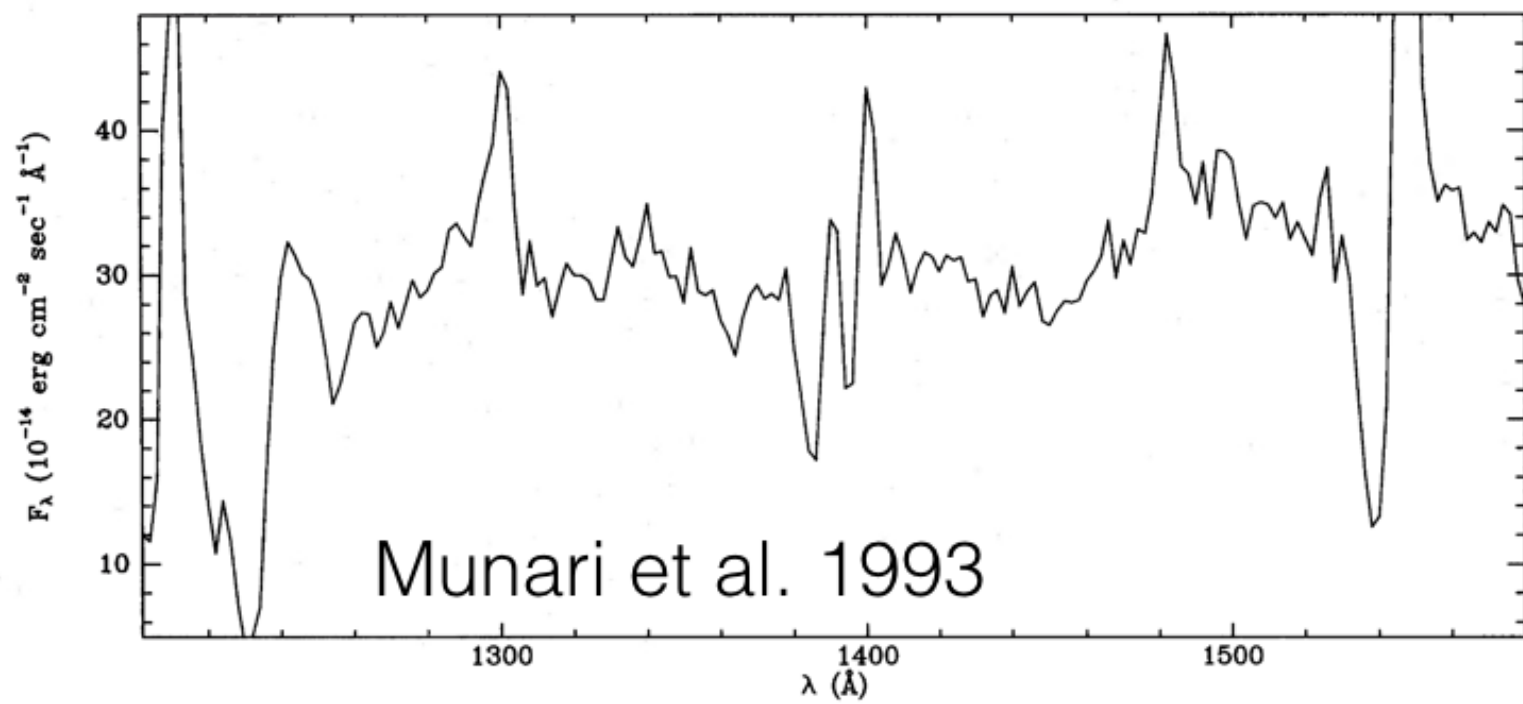


bonus slide 4 (Fe II)





Heavy mass loss from AS 304



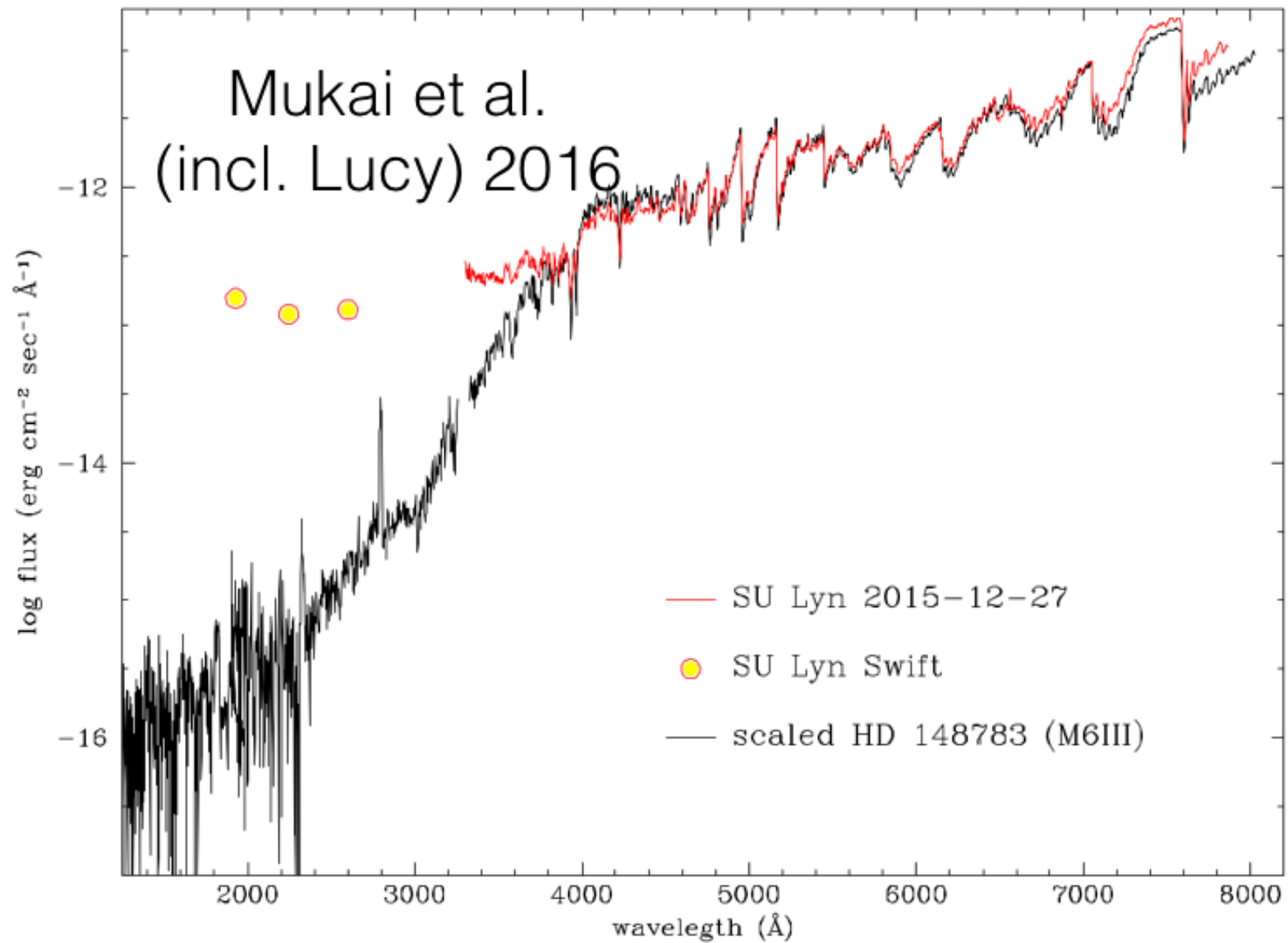


Figure 4. Low resolution optical spectrum of SU Lyn with *Swift* UVOT points, compared with optical and IUE spectra of MIII