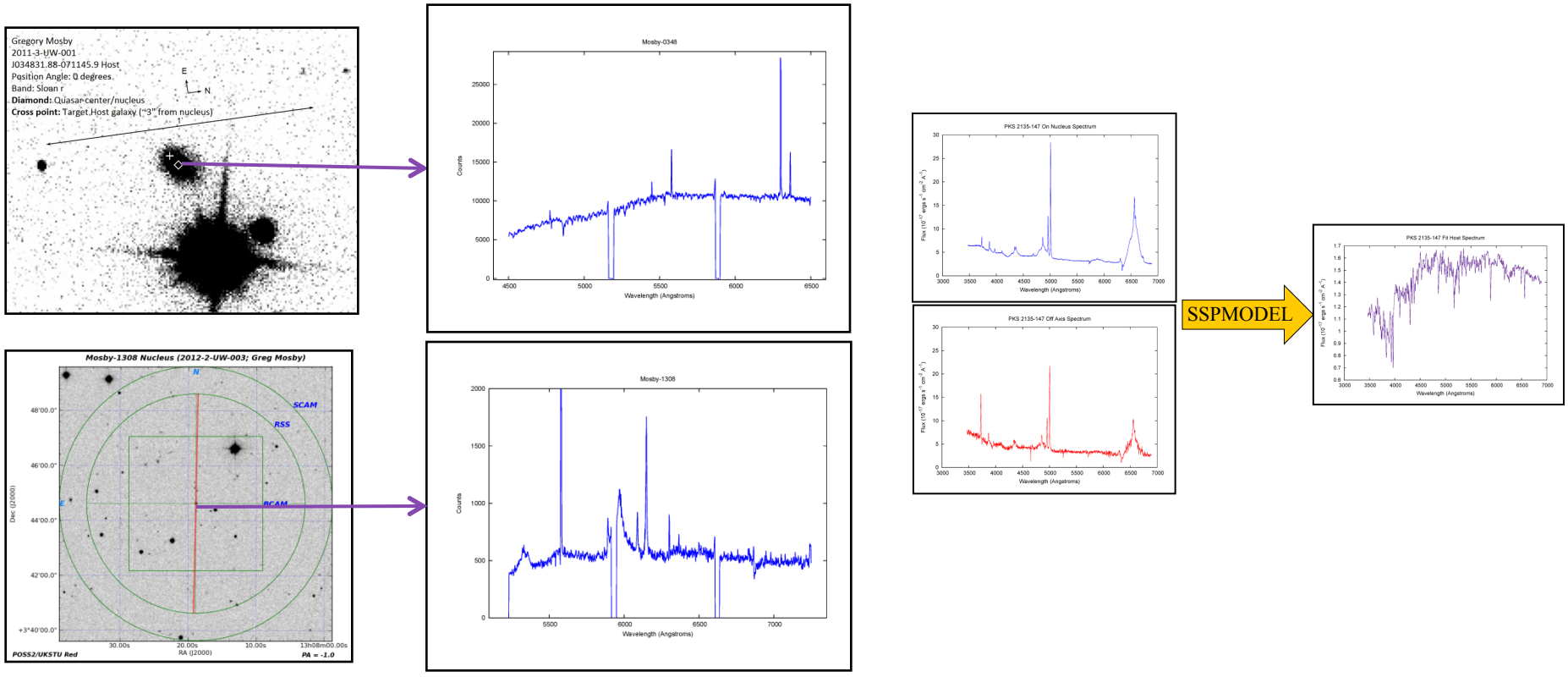
SALT Science – UW Madison

Properties of Quasar Host Galaxies

Greg Mosby, Marsha Wolf, Christy Tremonti, and Eric Hooper

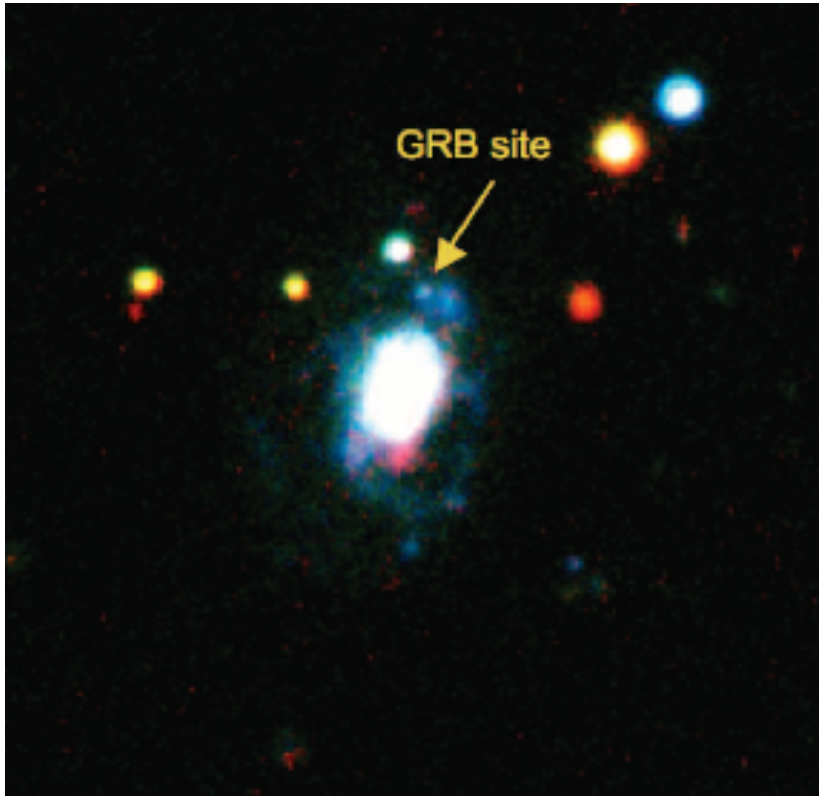
The goal of this work is to understand connections between galaxies and the supermassive black holes at their centers, in the context of galaxy formation and evolution. We study this through the properties of luminous quasar host galaxies, objects in which the galaxy is actively feeding its black hole. This proposal focuses on a carefully selected sample of SDSS quasars, chosen over well-defined ranges of black hole mass, redshift and Eddington ratio in order to draw robust conclusions about these objects.



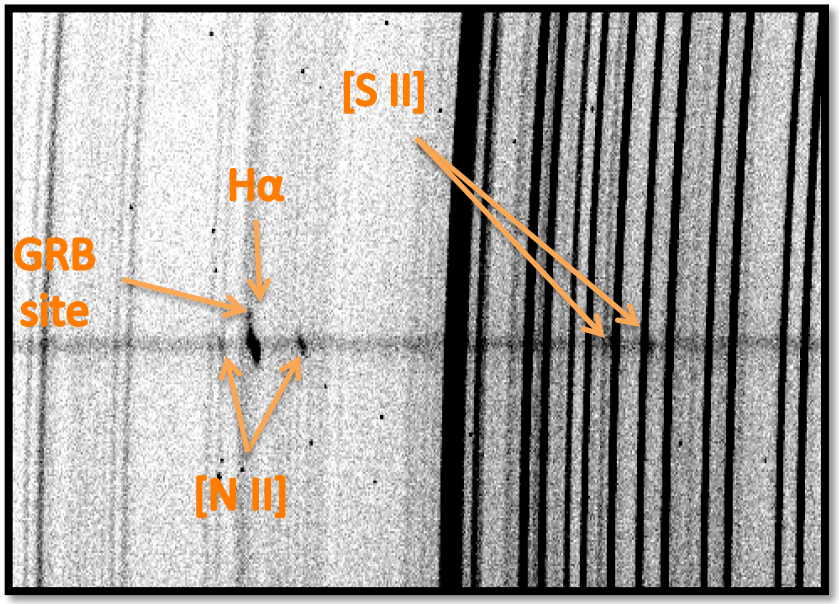
Above: Left: A schematic showing the observation setup and real data using SALT's RSS. Right: An ideal pair of spectra that would be used as input to a stellar population modeling code developed by Mosby to determine host galaxy properties.

Metallicities of GRB Host Galaxies

Brian Morsony and John Chisholm
University of Wisconsin-Madison

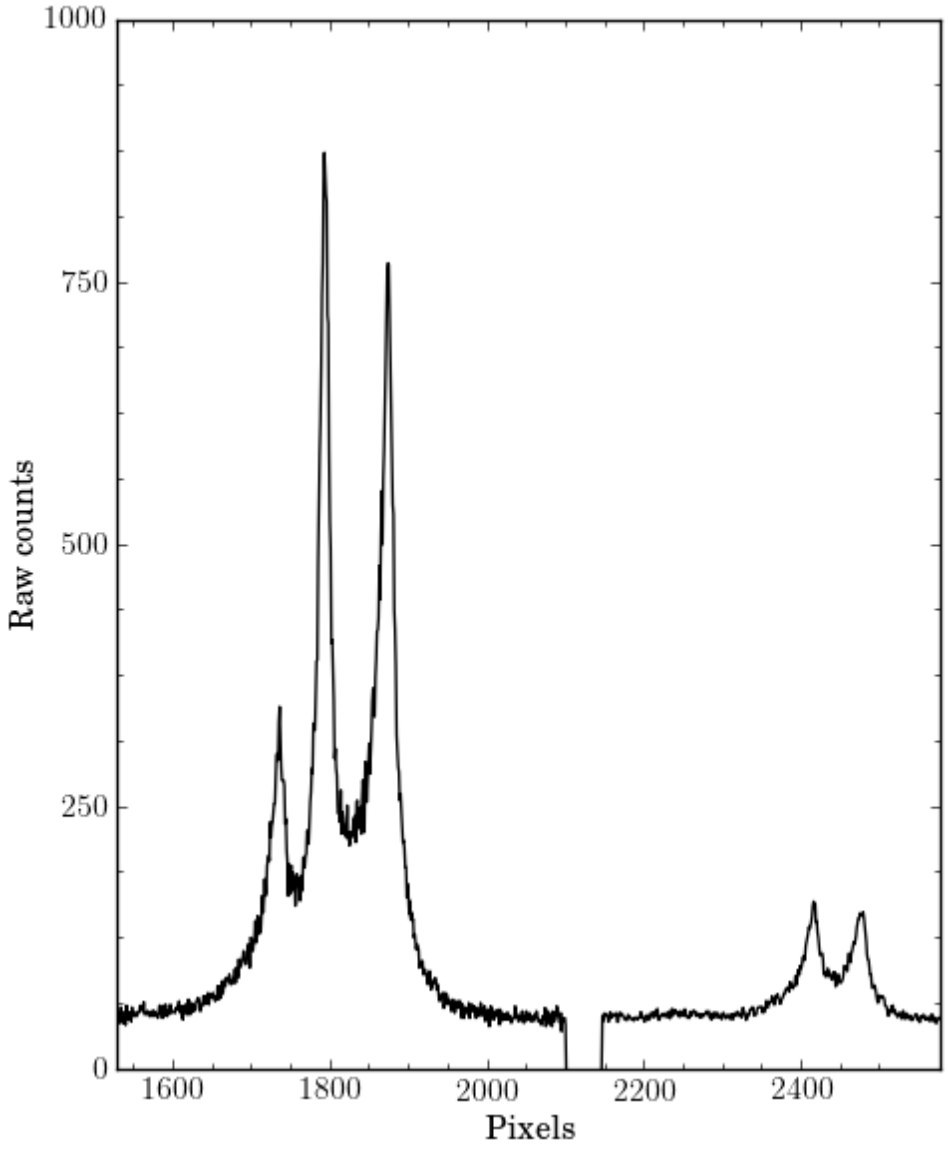


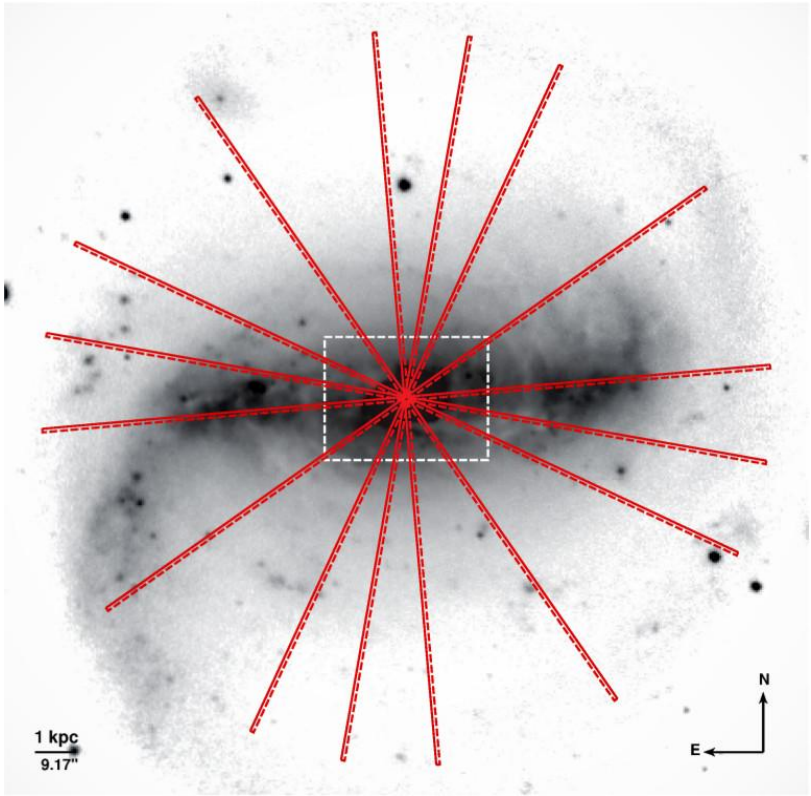
Color composite image of the host galaxy of GRB060505, with GRB site shown (Thöne 2008)



SALT spectra of GRB060505 taken on 5/11/13 with 1.14” seeing

Accurately measuring mass outflow rates in starburst galaxies.





Christy Tremonti, Corey Wood

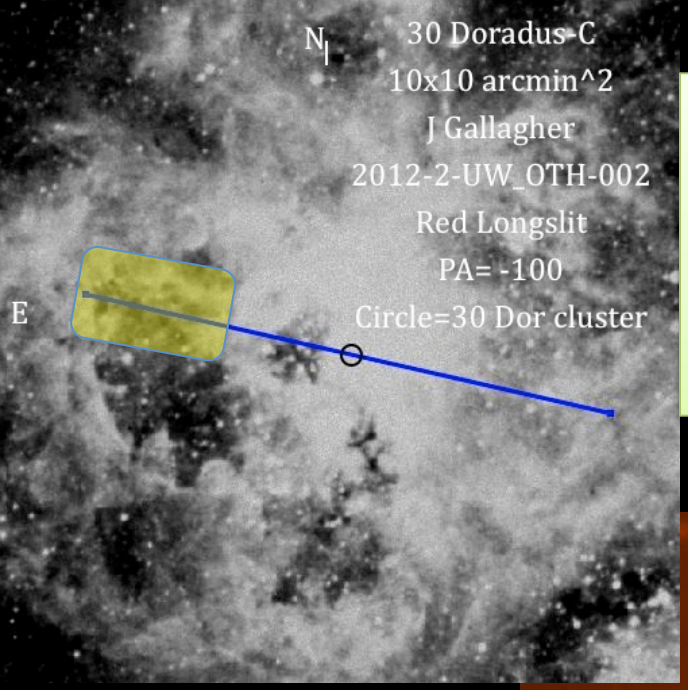
Hubble Tarantula Treasury Project (HTTP)

Mapping the Tarantula region with HST imaging

PI Elena Sabbi (STScI)

SALT RSS spectra map relationships between stars & gas, and yields insights into 3-D structures (NE region with strong line splitting & filaments shown above). Multiple slit positions to sample range of conditions.

HST 30 Dor; Sabbi+ 2013, AJ, submitted



30 Doradus: Stellar Feedback: Nebular Motions & Ionization

Jay Gallagher---Wisconsin

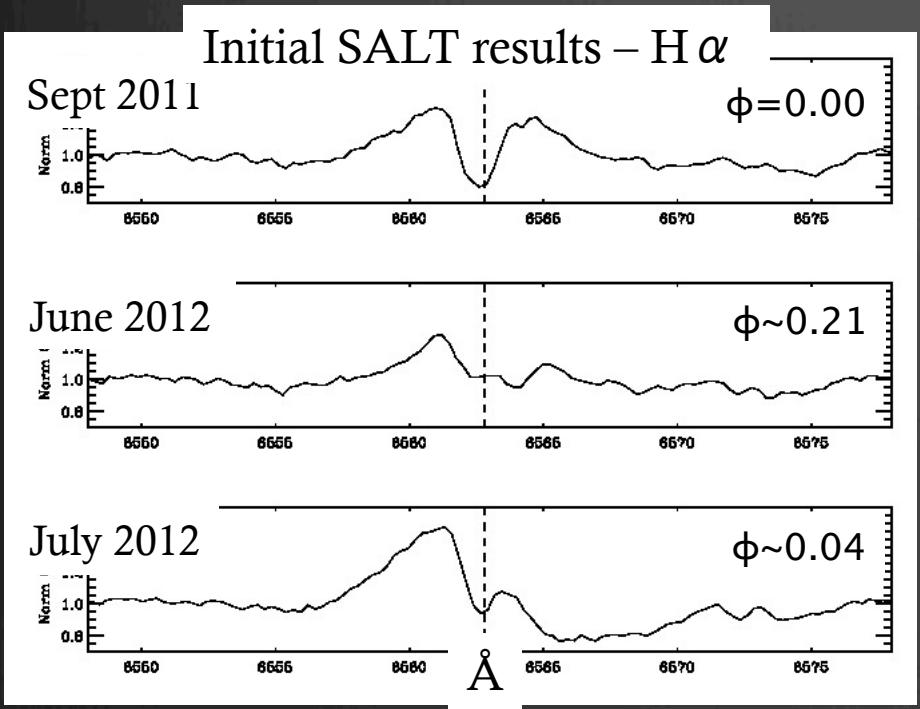
Long slit RSS spectra sample gas kinematics & line ratios for comparison with HTTP HST study.

Line splitting illustrates 3-D shell structure; strong [SII] signature of possible shocks.

Hα [NII] HeI [SII]

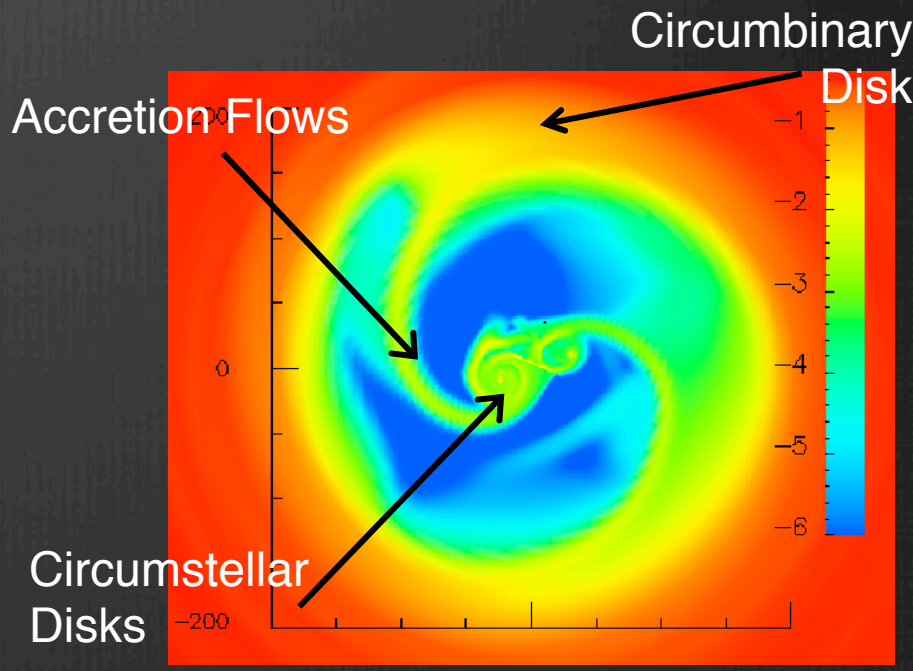
Time-Series Spectra of Accretion Flows in Pre-MS Binaries

R. Mathieu & B. Tofflemire (UW-Madison)



SALT is inherently ideal for time sensitive observing campaigns. The *nightly* frequency over months required for our science goals is within SALT's capabilities but has yet to be achieved. Currently receiving high cadence observations!

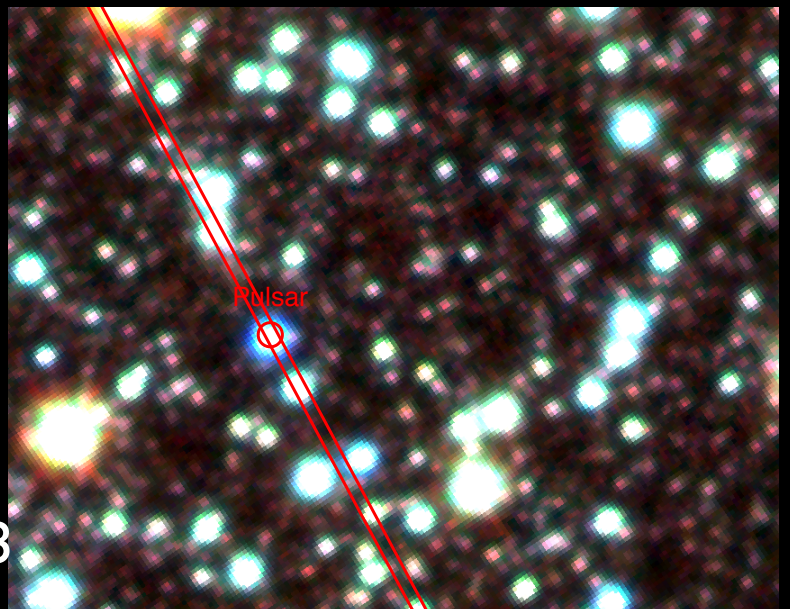
High-resolution, time-series spectra will help constrain simulations of DQ Tau stars (see below) providing evidence for time-variable accretion flows onto PMS binaries from circumbinary material.

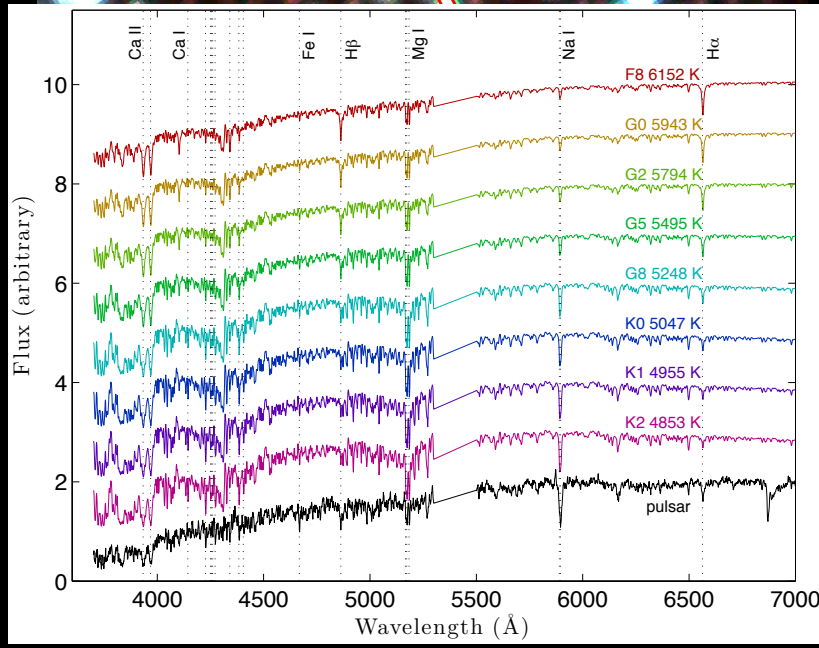


Günther & Kley 2002, A&A 387, 550

PSR J1723

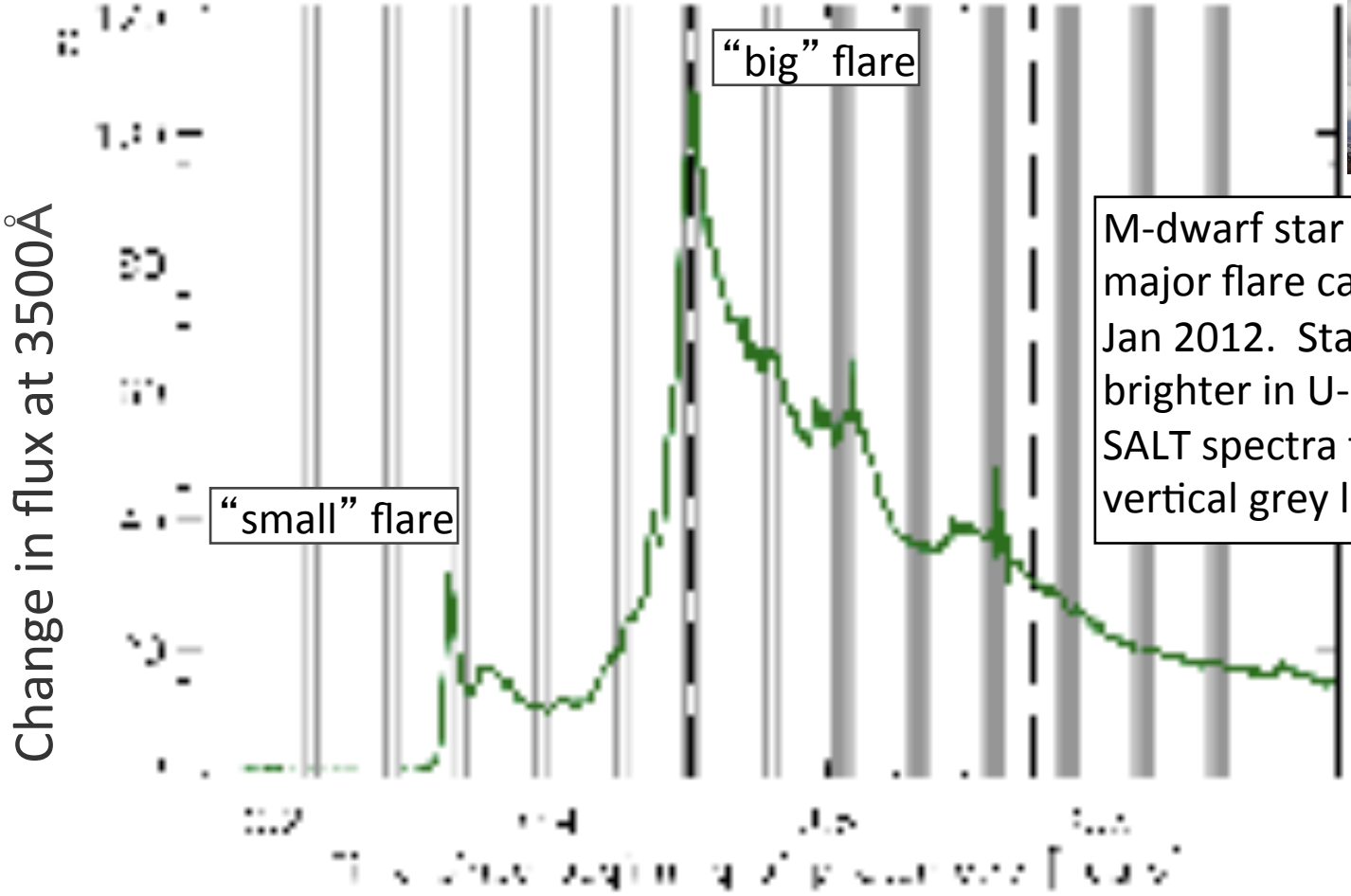
- Eclipsing millisecond pulsar discovered by Parkes (binary period=15h)
- Radio timing shows weird variations: lots of gas floating around the system
- Like the "missing link" system PSR J1023 (Archibald et al. 2009) that went from MSP ↔X-ray binary
- Optical companion:
  - *V*=15.8
  - Strange spectrum
- SALT program:
  - RSS spectra to measure orbit





Crawford et al. (2013, ApJ,

Megaflares on Tiny Stars



M-dwarf star (YZ CMi); major flare caught in Jan 2012. Star 100x brighter in U-band. SALT spectra taken at vertical grey lines.

- Major source of variability for time-domain astronomy surveys. Especially LSST.
- Large impact on habitability of low-mass stars.

(obs Jan 2012, spectra: Brown et al. SALT/RSS; photometry: Kowalski et al. WHT/La Palma)

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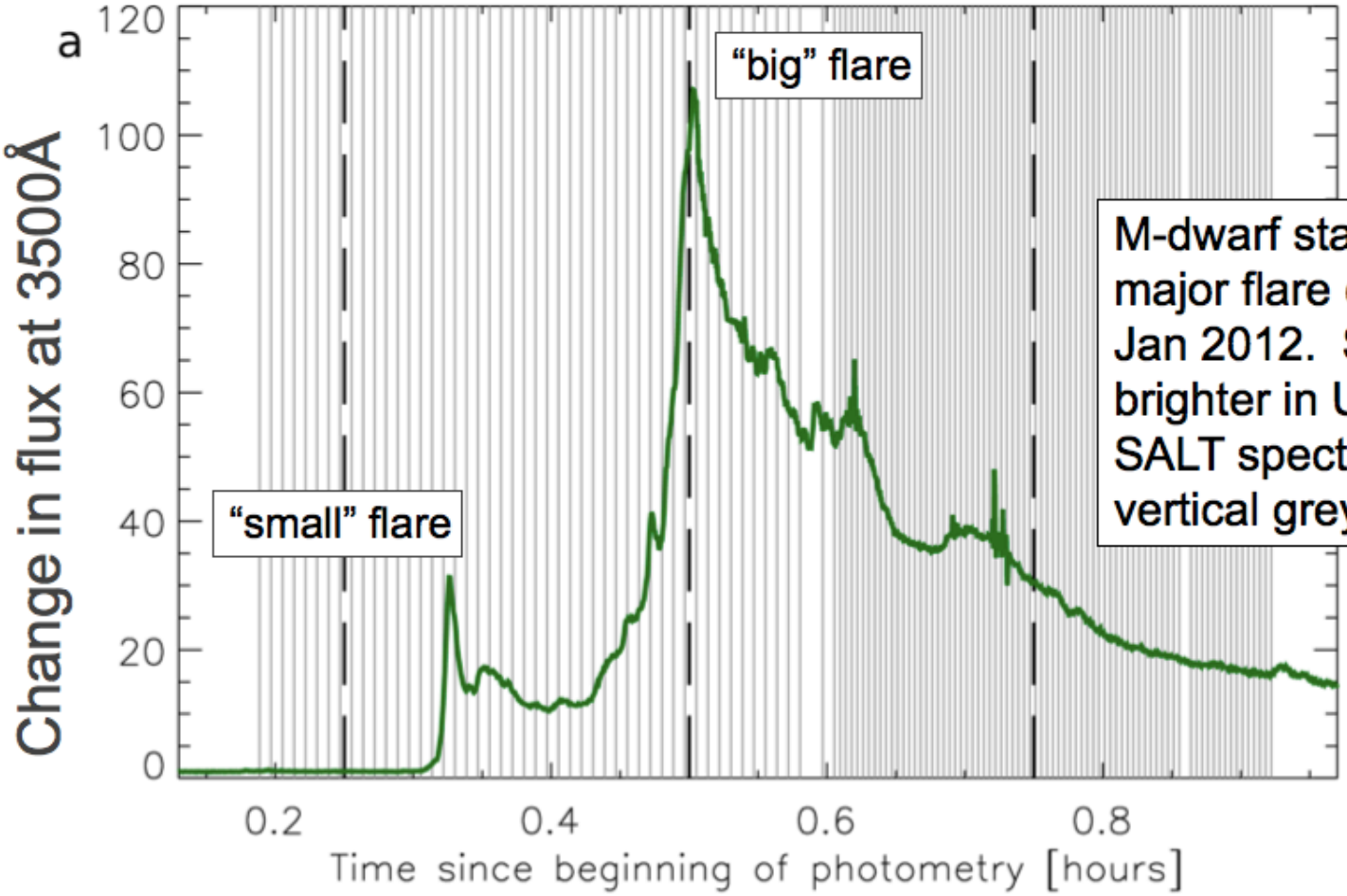

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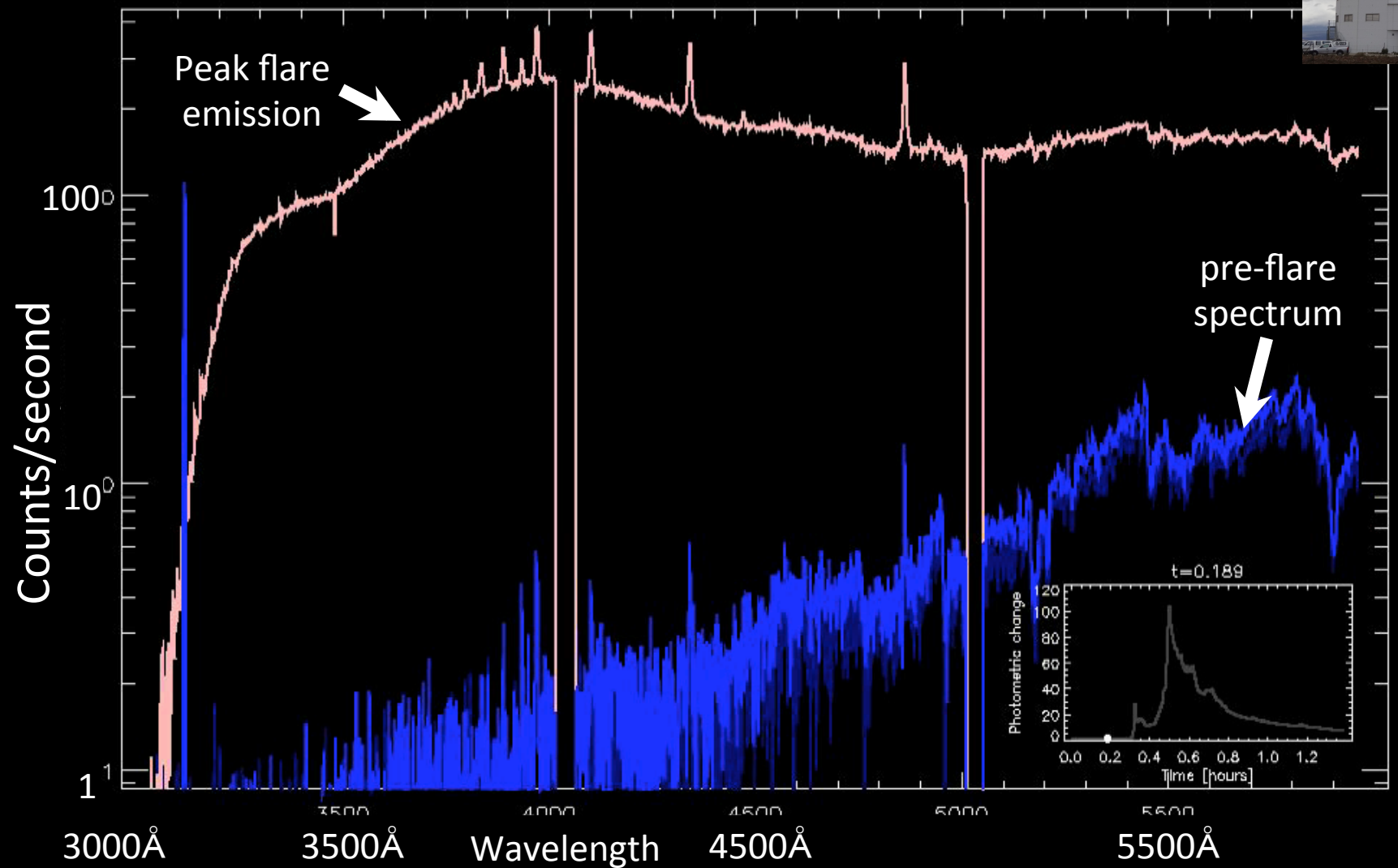
Spectral Movie of Megaflare



M-dwarf star, 15 sec cadence,
R~1000, 70x faster than VLT!

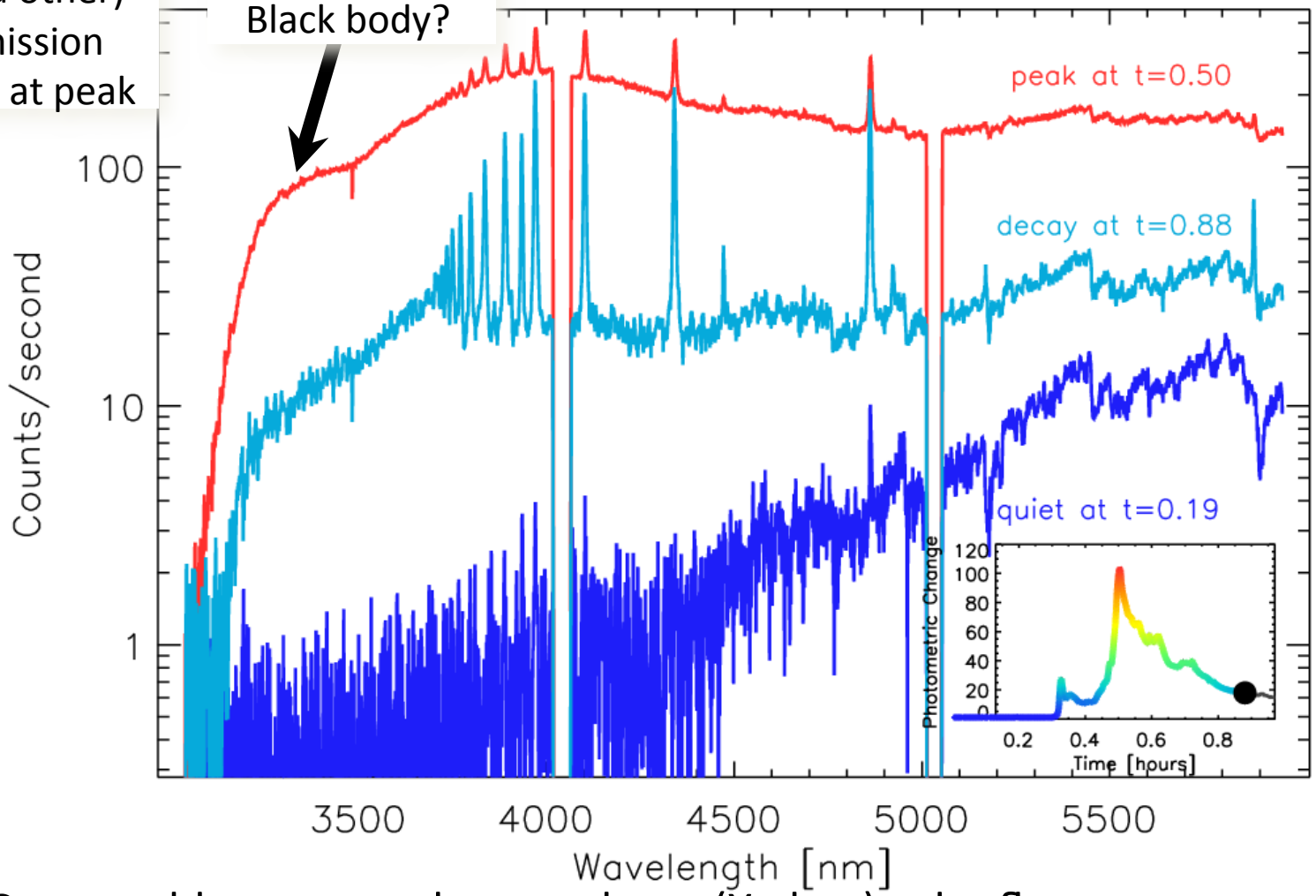
http://www.astro.wisc.edu/~bpbrown/Movies/

(Brown et al.; obs Jan 2012, SALT/RSS)

Megaflares on tiny stars

Hydrogen (and other) emission lines at peak

Signature of hot Black body?



Comparable energy release to large (X-class) solar flare.

Whole star brightens by ~100x.

Program has continued through 2013, strong undergrad involvement.