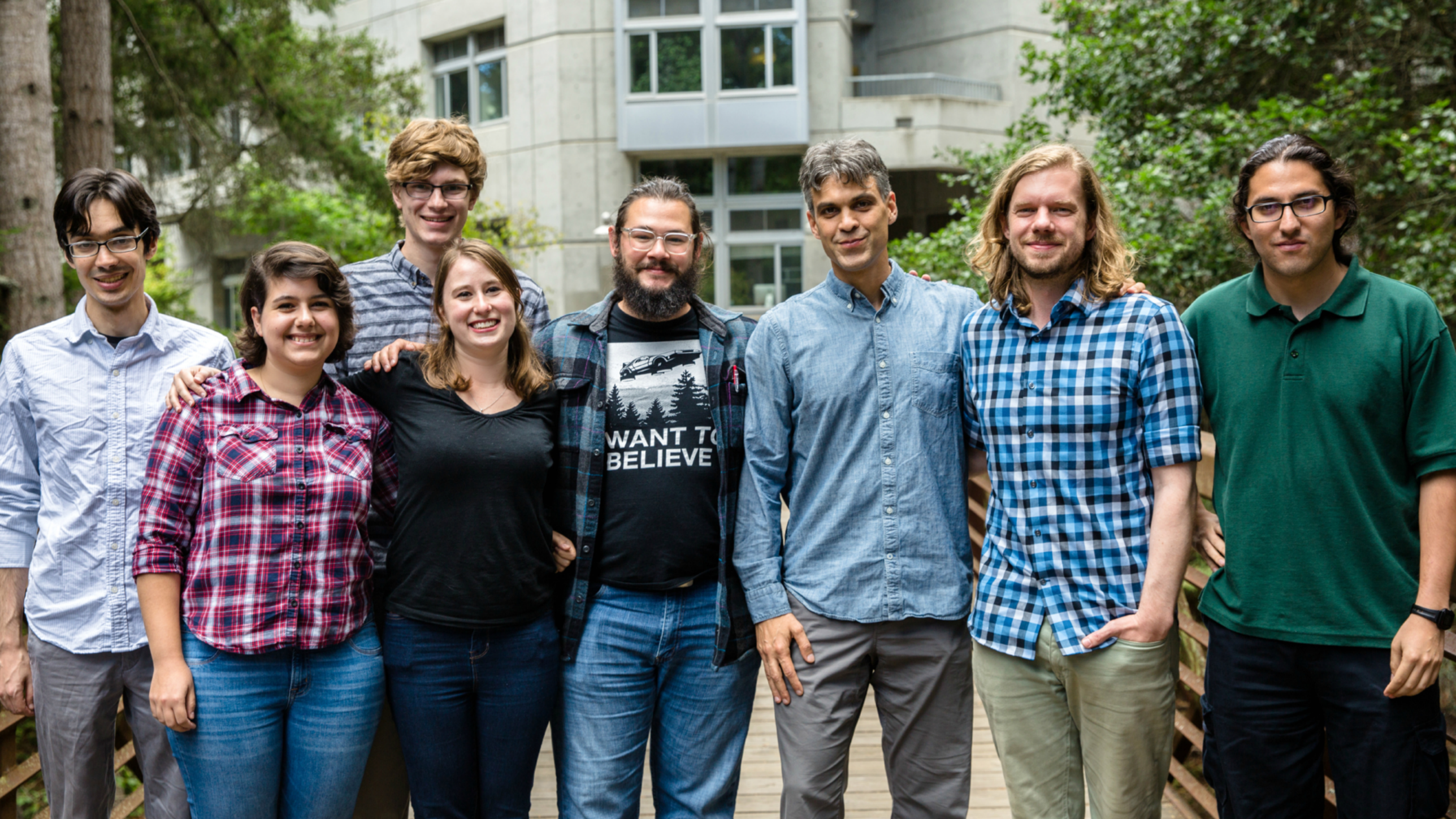
Early Optical Spectra of SSS17a

2017 August 17

2017 August 21

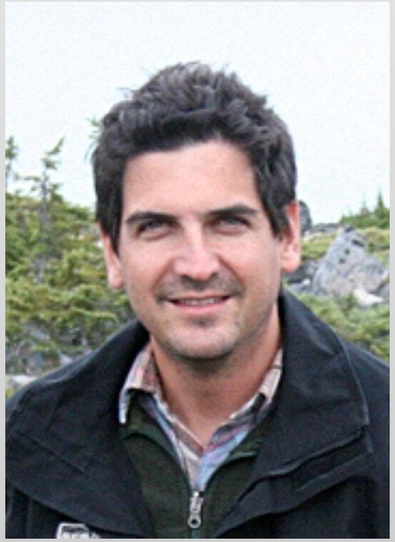
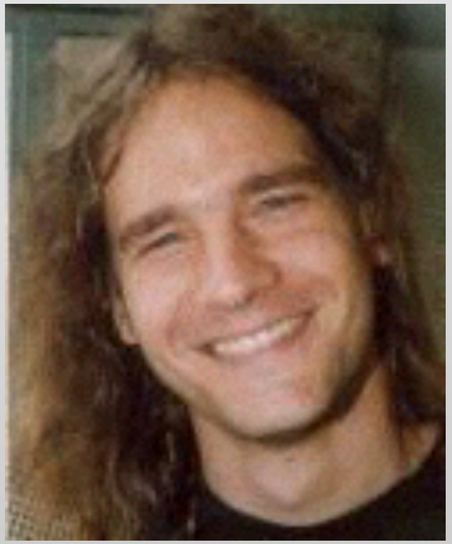
Ryan Foley
UC Santa Cruz 1M2H Team

Swope & Magellan Telescopes

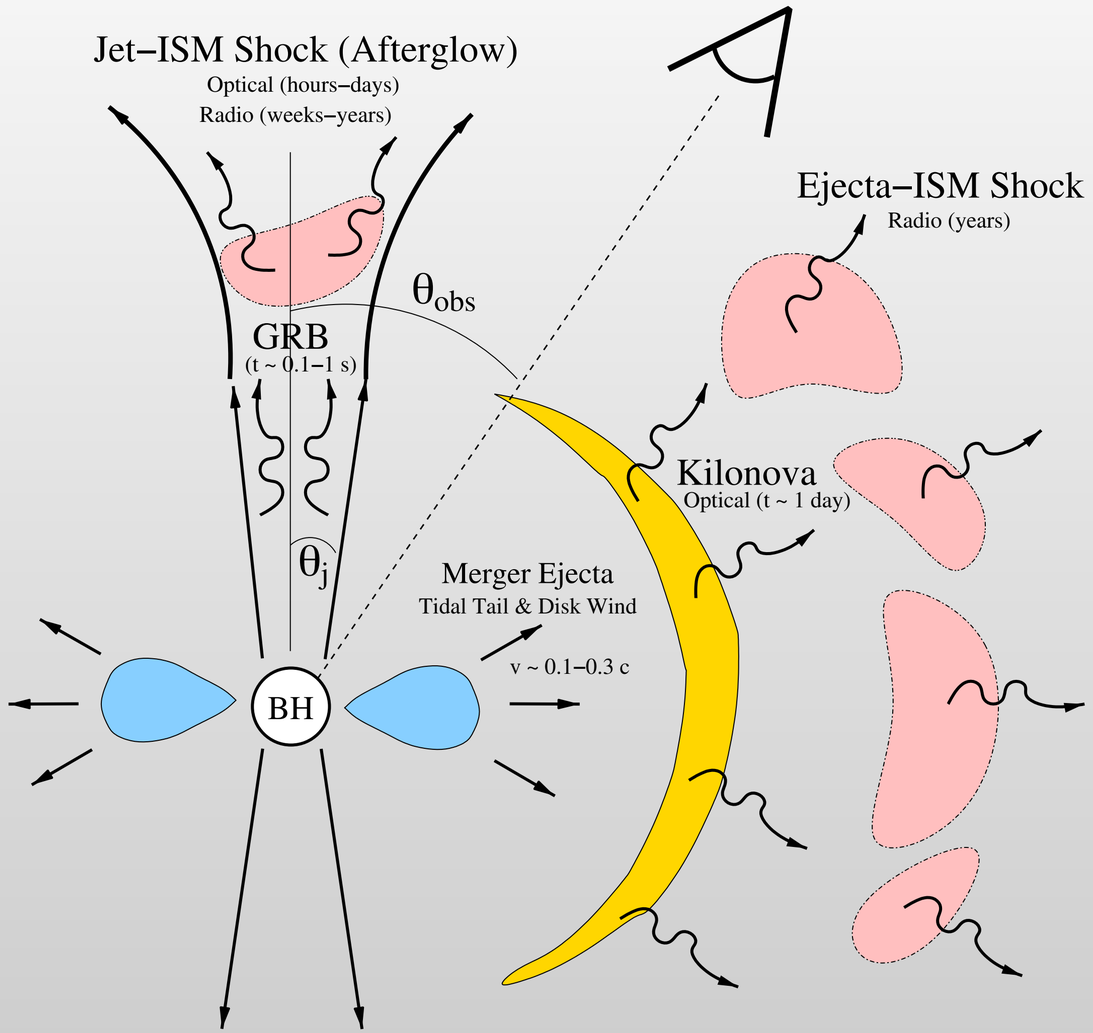

WANT TO
BELIEVE





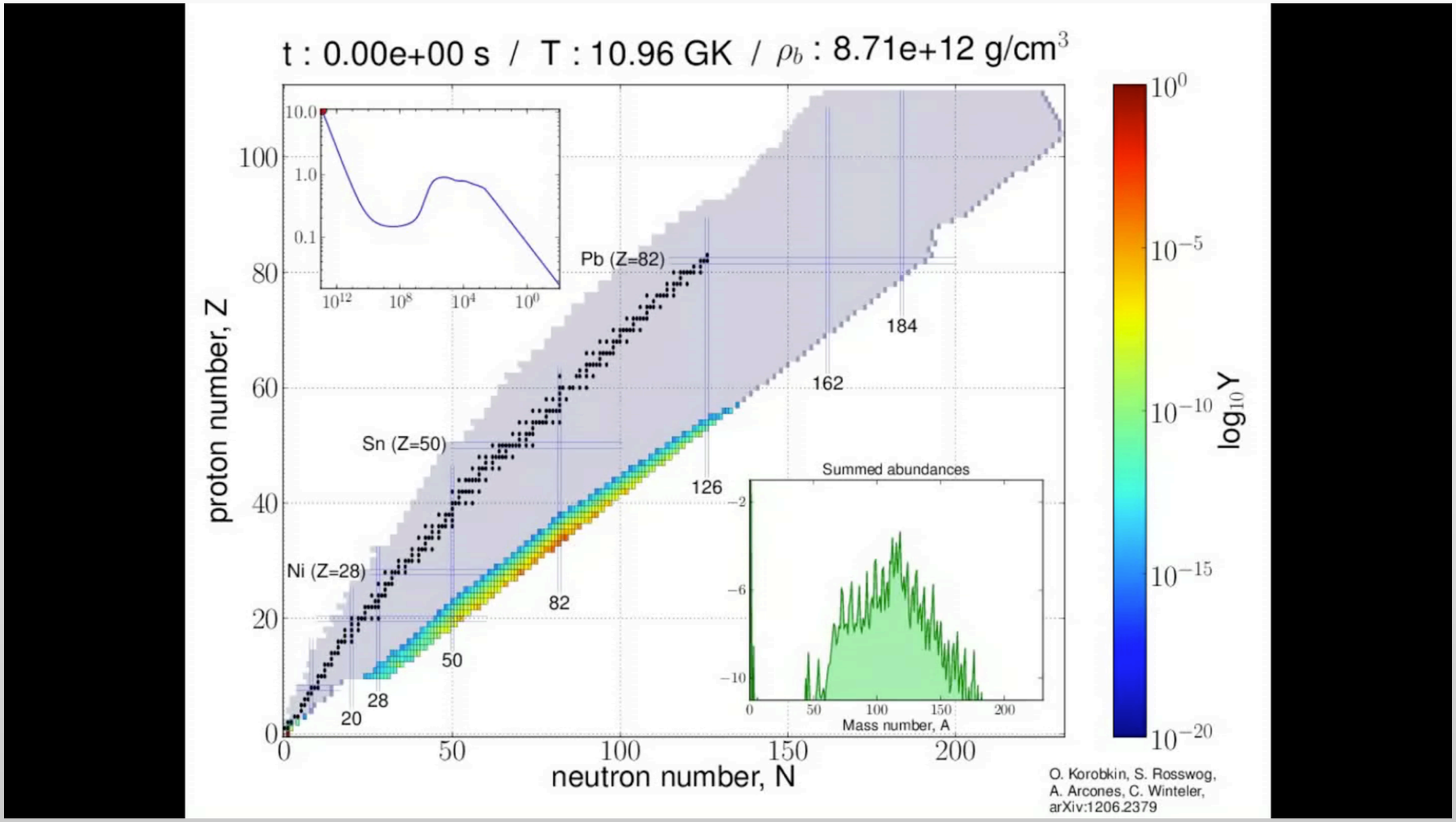



What are the EM Counterparts?

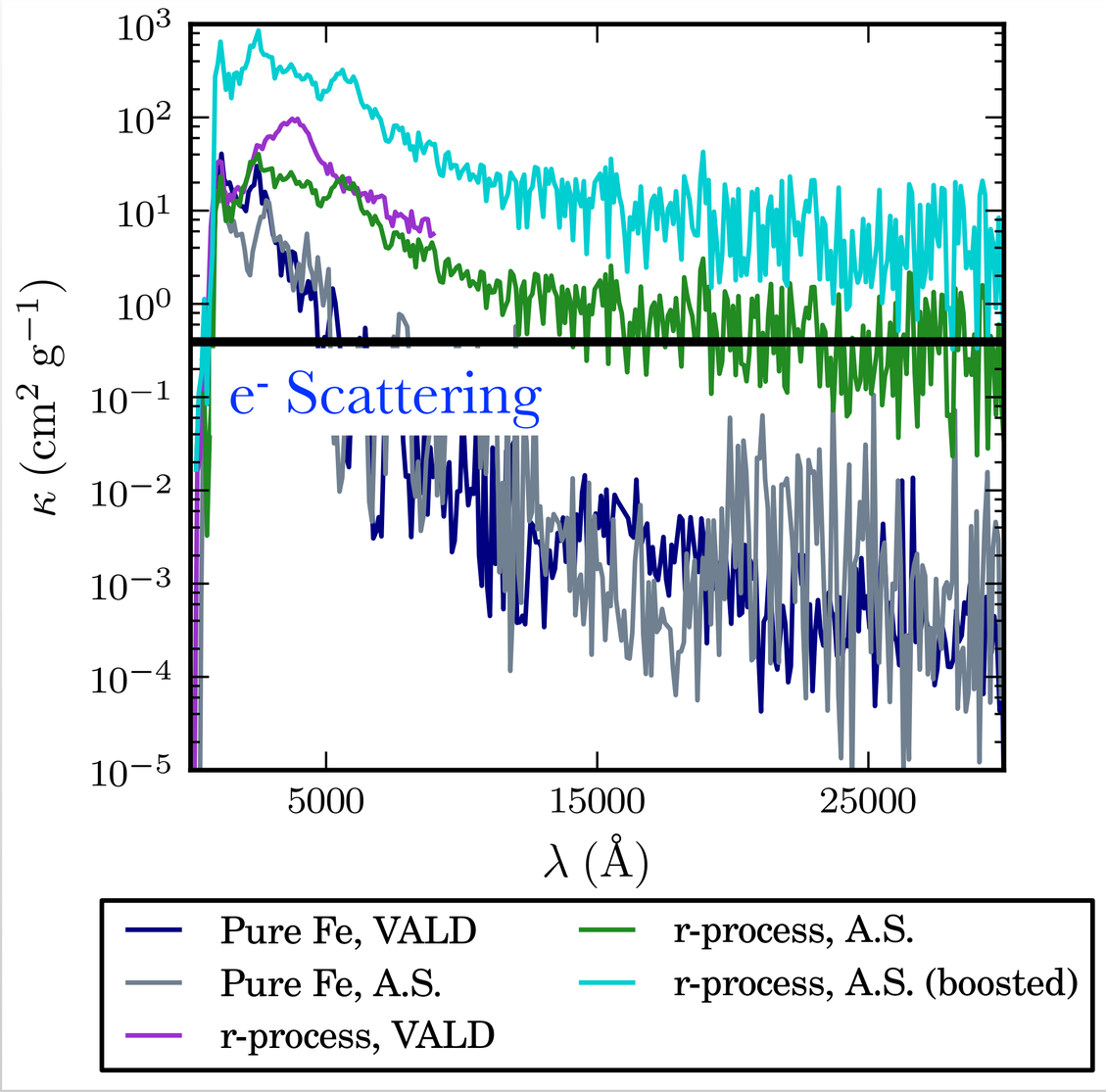


Metzger & Berger (2012)

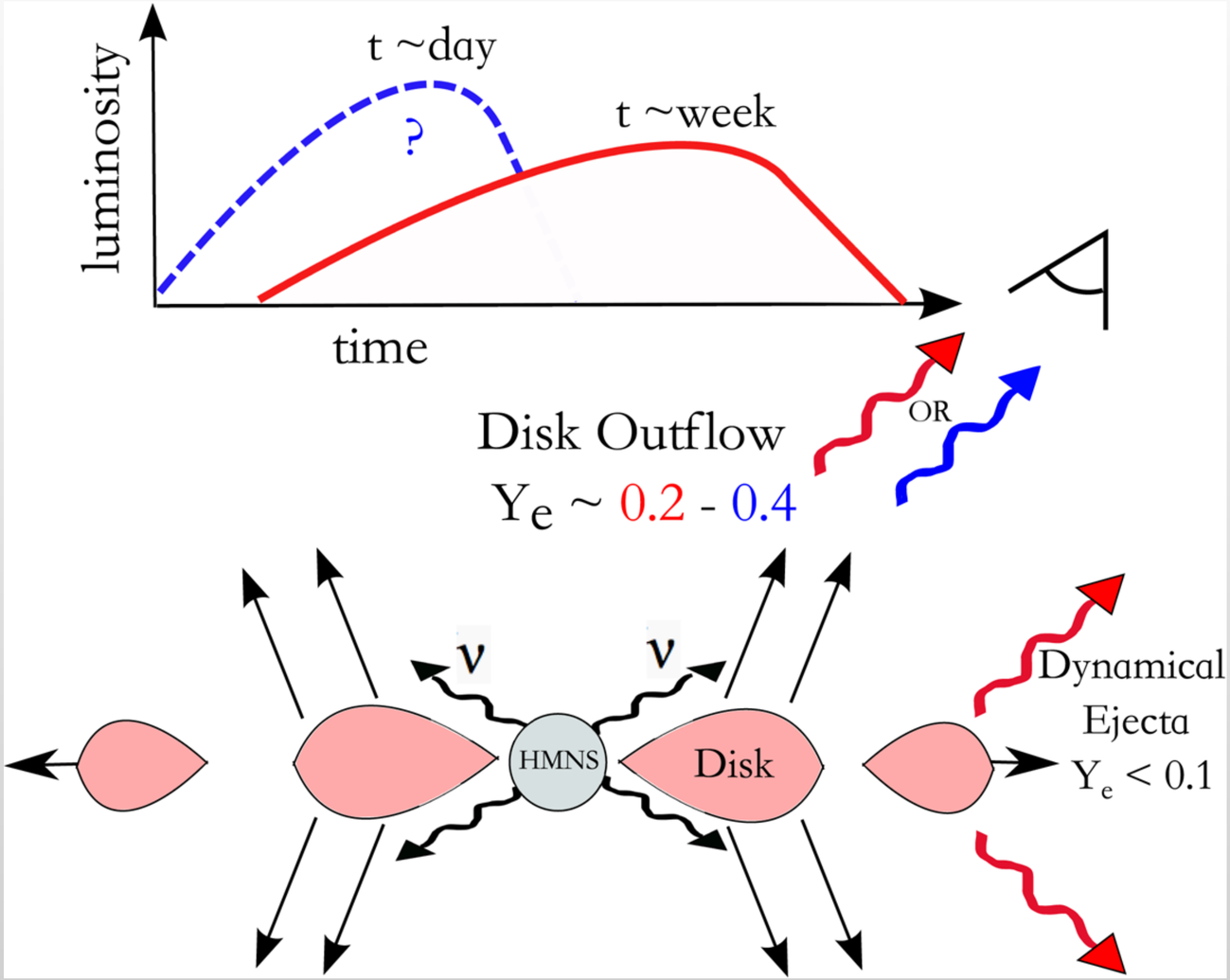
NS Mergers Produce r-process Elements



Lanthanides Have *Very* High Opacities



Fast Blue and Slower Red Components



Metzger & Fernández 2014

One Meter, Two Hemispheres (1M2H)

15

DC

Dave

Thu, Aug 17, 6:39 AM

Stop what you're doing and check your email.

Thu, Aug 17, 8:12 AM

I don't have email now. What's up?

NS NS merger at a false alarm rate as 1 in 10000 years

Coincident neutrinos and GRB

Position?

This sounds like a joke by the way

See who else is on Magellan, and ask

I might leave, but if you're joking and don't tell me now I will not be amused

Although, I keep fucking up my coordinates. One sec.

Well, it's a 11 degree radius for 1 sigma. So we have a big area.

If there is a grb, it would have a better coordinate

There should be booming x rays

I'M NOT JOKING. JESUS MAN, I WOULDN'T JOKE ABOUT THIS.

Copenhagen

Santa Cruz

Matt Siebert

Dave Coulter

Charlie Kilpatrick

César Rojas-Bravo

Pasadena

Tony Piro

Maria Drout

Las Campanas

Josh Simon

Ben Shappee

davecoulter 8:29 AM
Yeah

I got Ryan on text

He's on his way. He recommended a Galaxy comparison too

davecoulter 8:35 AM
Charlie

Do you think using the White 2011 catalog would be a good place to start?

I can make a distance cut, everything less than 50 Mpc, and then do a separation cut, where I got 12 degrees from the central point

and then match

ckilpatrick 8:38 AM
yes, use the white catalog

davecoulter 8:38 AM
OK

I am working on that now

ckilpatrick 8:38 AM
thanks

foley 8:51 AM
im at my apartment

davecoulter 8:51 AM
OK

foley 4:27 PM
@ckilpatrick when you get a chance, please verify that i didnt completely mess up those pointings and that we have multiple galaxies in those first pointings

ckilpatrick 4:28 PM
there are 4

galaxies

foley 4:28 PM
great!

ckilpatrick 4:28 PM
nothing im fields12

foley 4:29 PM
no transients, right?

ckilpatrick 4:29 PM
no transients

sorry, image is fine

foley 4:29 PM
fantastic

ckilpatrick 4:29 PM
but nothing I can see by eye

davecoulter 4:34 PM
uploaded this file

but nothing I can see by eye

davecoulter 4:34 PM
uploaded this file

LCO_Swope_20170817_Plot.png
3MB PNG

ckilpatrick 4:38 PM
ok, nothing in fields10

there was a bug in fields11 that we just fixed, but we're going back to that one

nothing in fields11

ckilpatrick 4:59 PM
@foley found something

sending you a screenshot

foley 4:59 PM
wow!

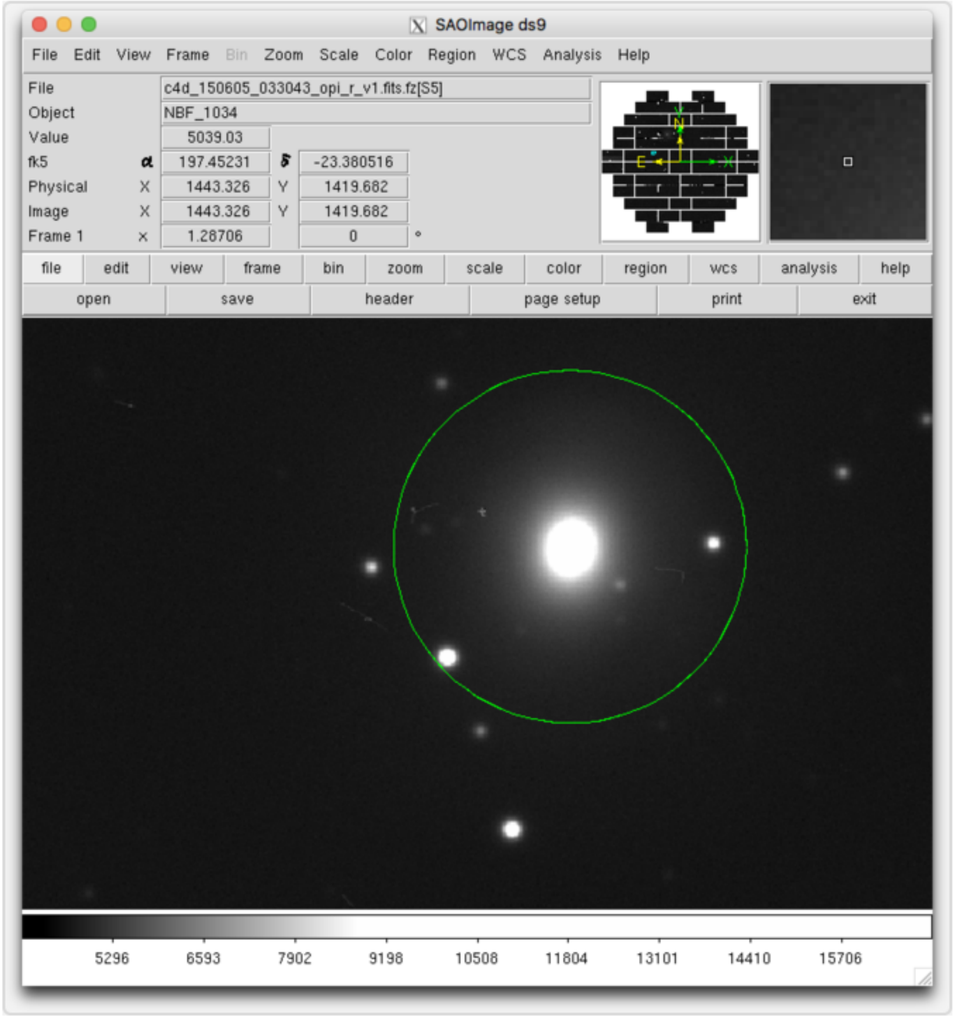
davecoulter 4:59 PM
!

ckilpatrick 4:59 PM
template

ckilpatrick 4:59 PM
uploaded this image: Screen Shot 2017-08-17 at 4.59.27 PM.png

ckilpatrick 4:59 PM
template

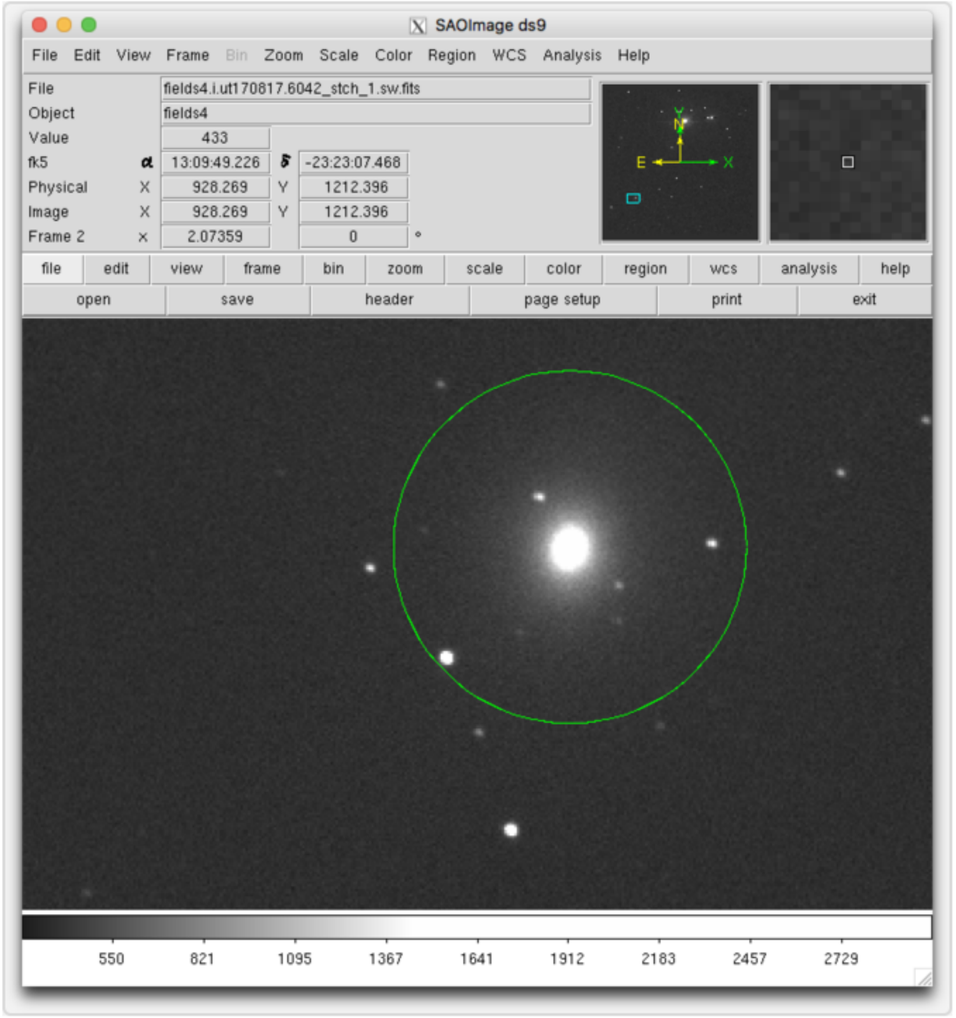
ckilpatrick 4:59 PM
uploaded this image: **Screen Shot 2017-08-17 at 4.59.27 PM.png**



ckilpatrick 5:00 PM
us

ckilpatrick 5:00 PM

uploaded this image: **Screen Shot 2017-08-17 at 4.59.53 PM.png**

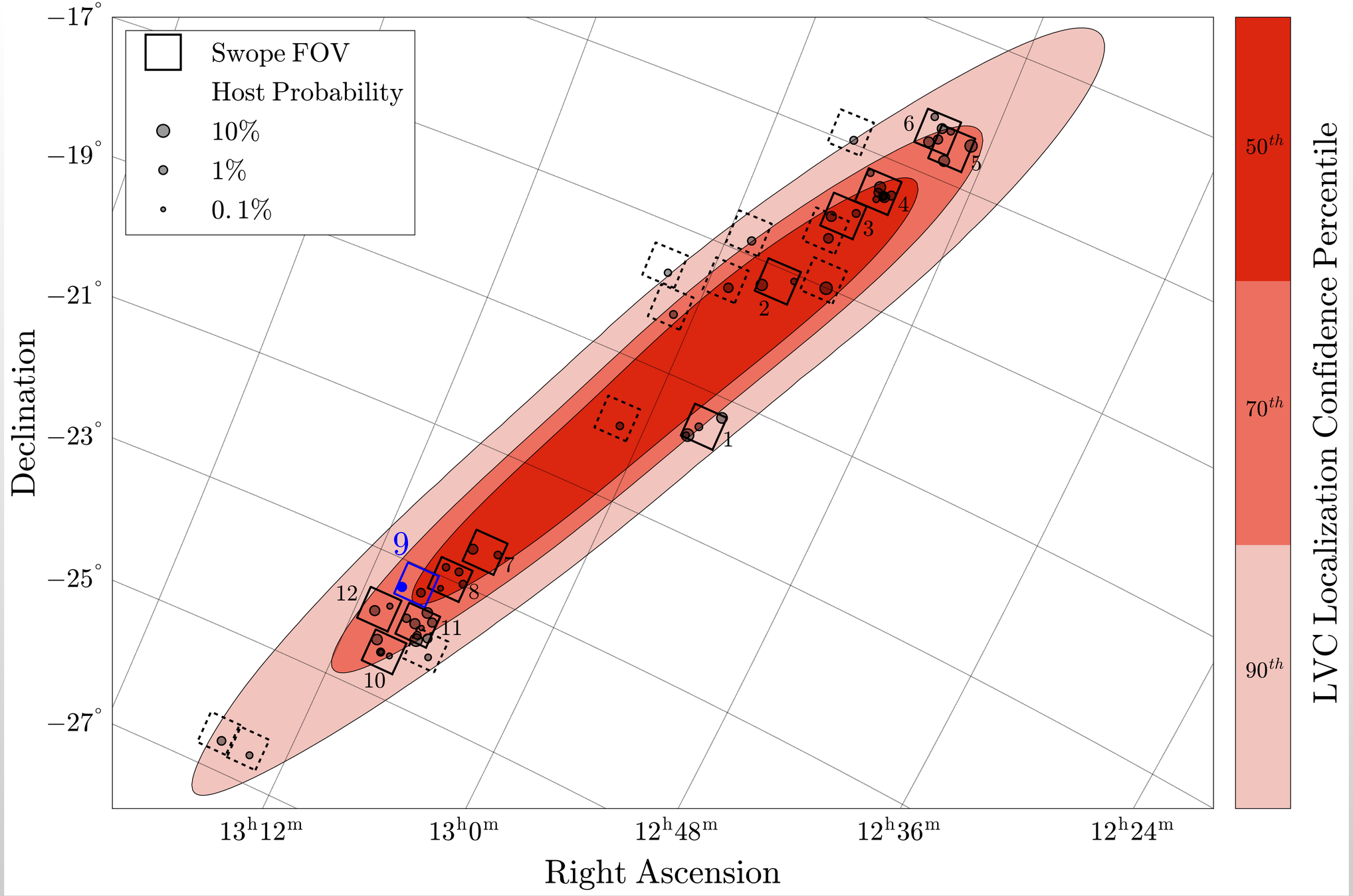


foley 5:00 PM

yep!

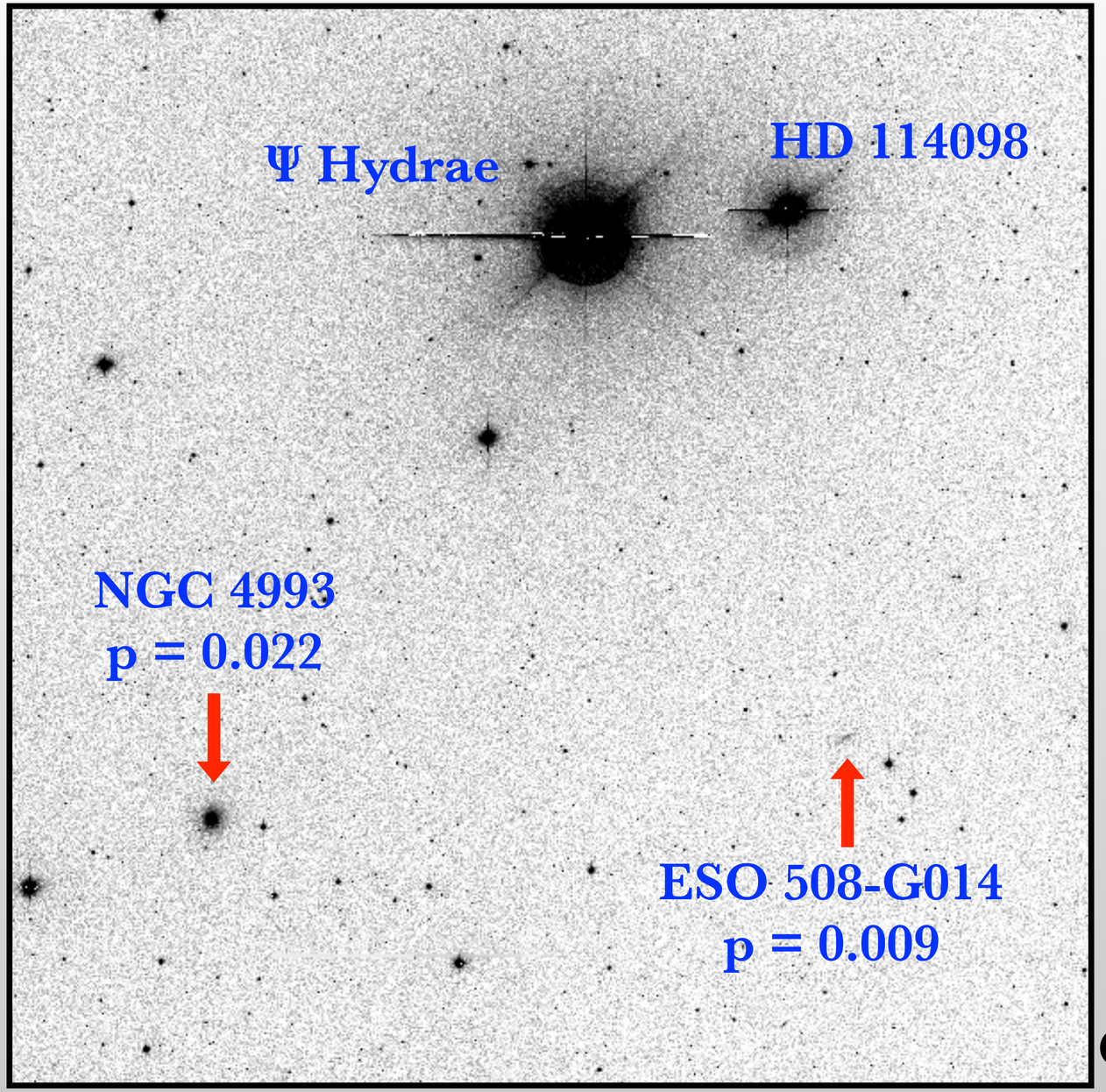
coorindates so we can check minor planet

and spectrum!



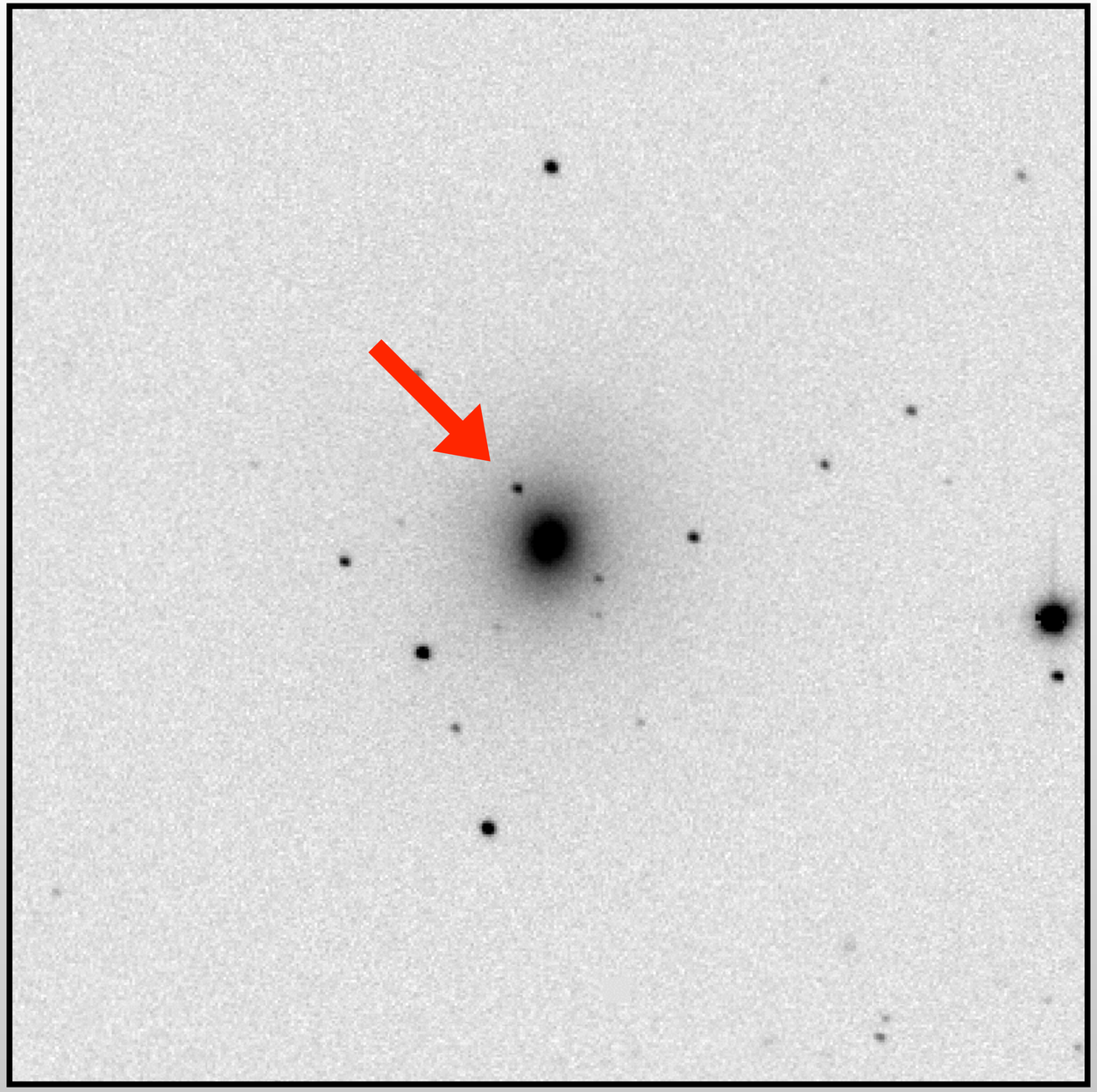
Coulter et al. 2017

Our 9th Image

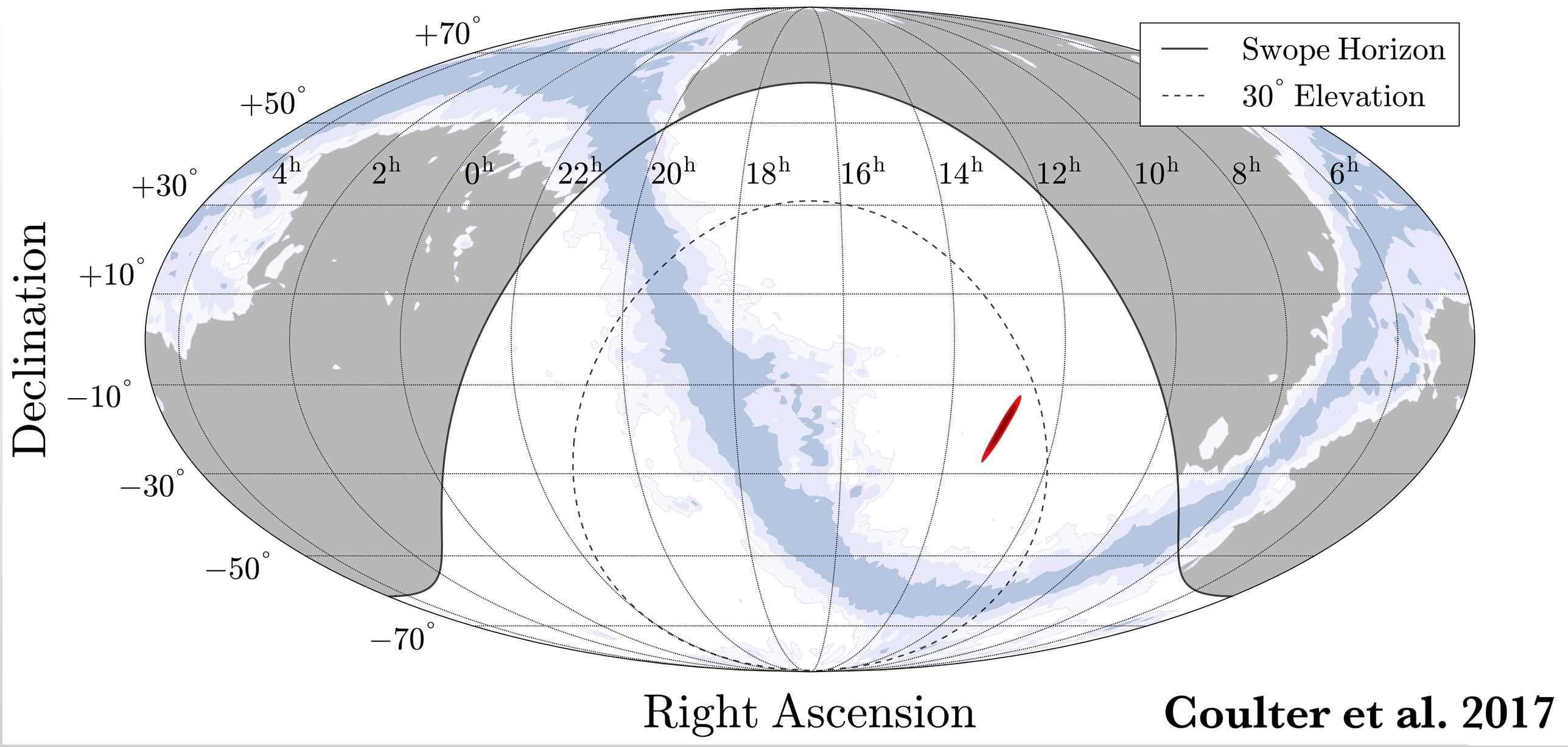


Coulter et al. 2017

NGC 4993 and SSS17a



Coulter et al. 2017



Coulter et al. 2017

Pasadena

Tony Piro

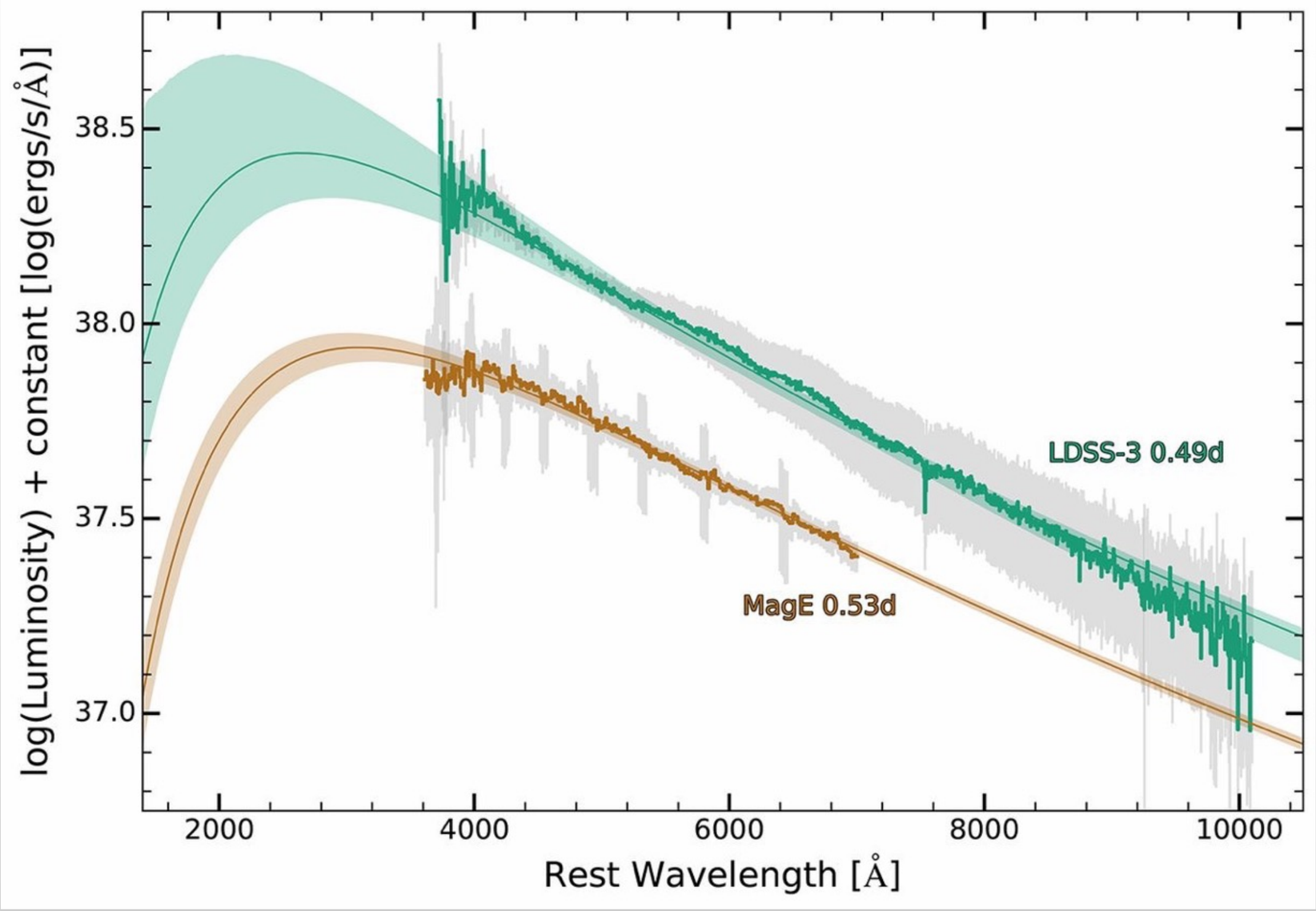
Maria Drout

Las Campanas

Josh Simon

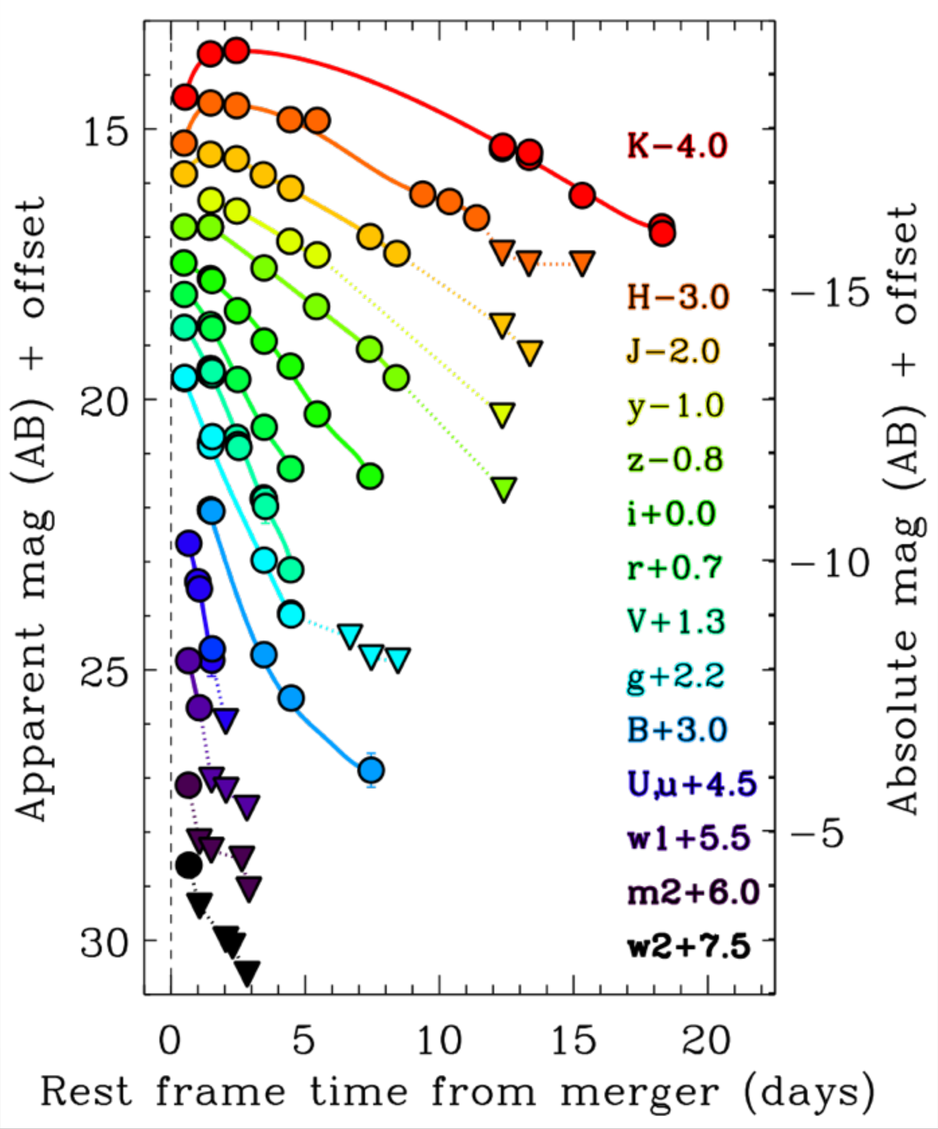
Ben Shappee

SSS17a Spectra at 12 Hours

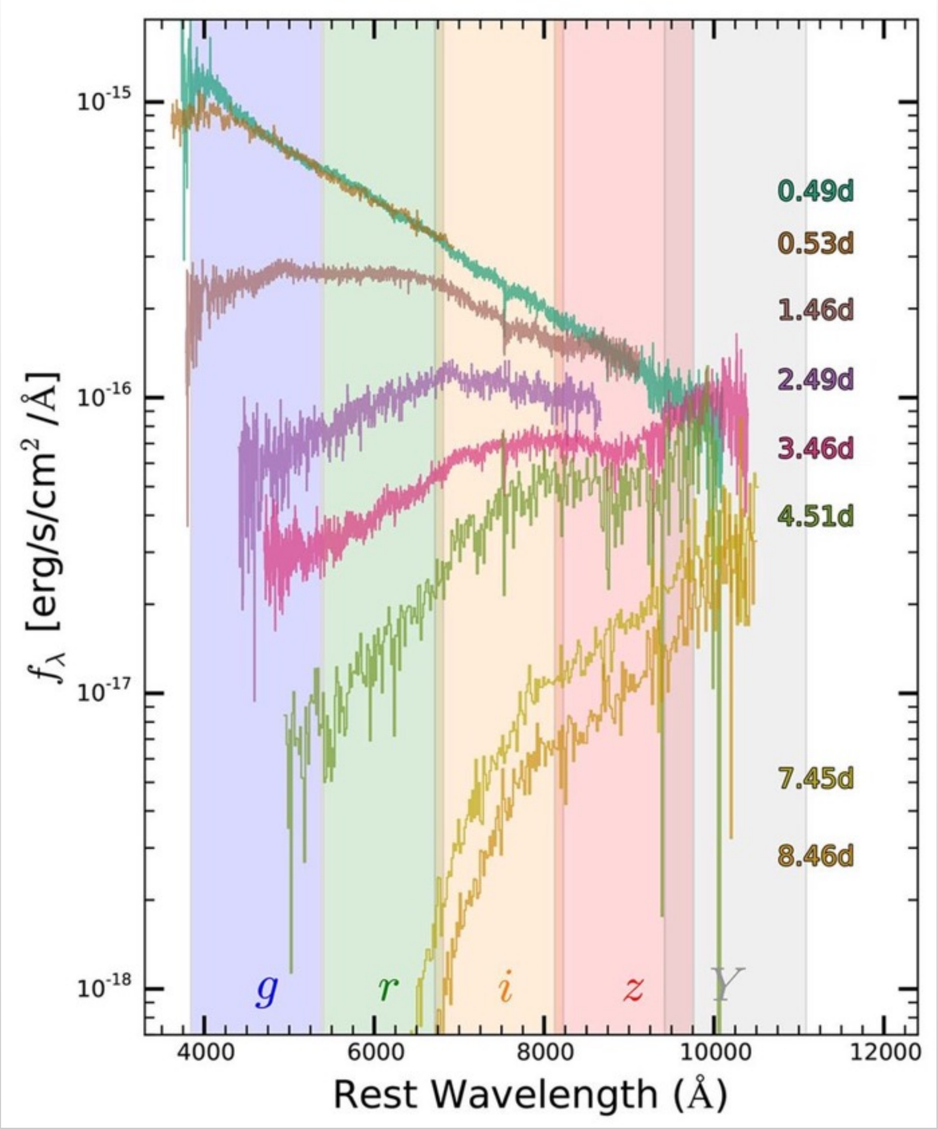


Shappee et al. 2017

SSS17a Spectral Evolution

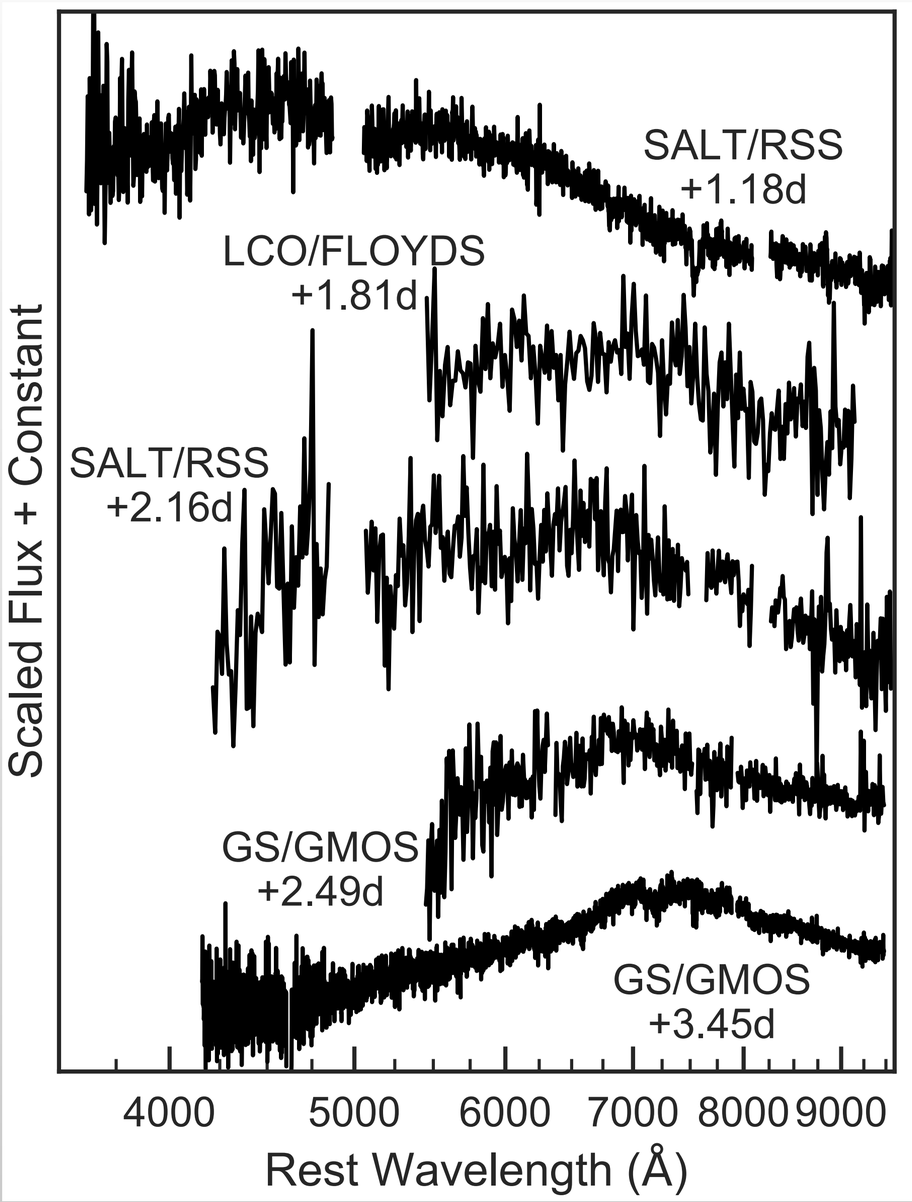


Drout et al. 2017



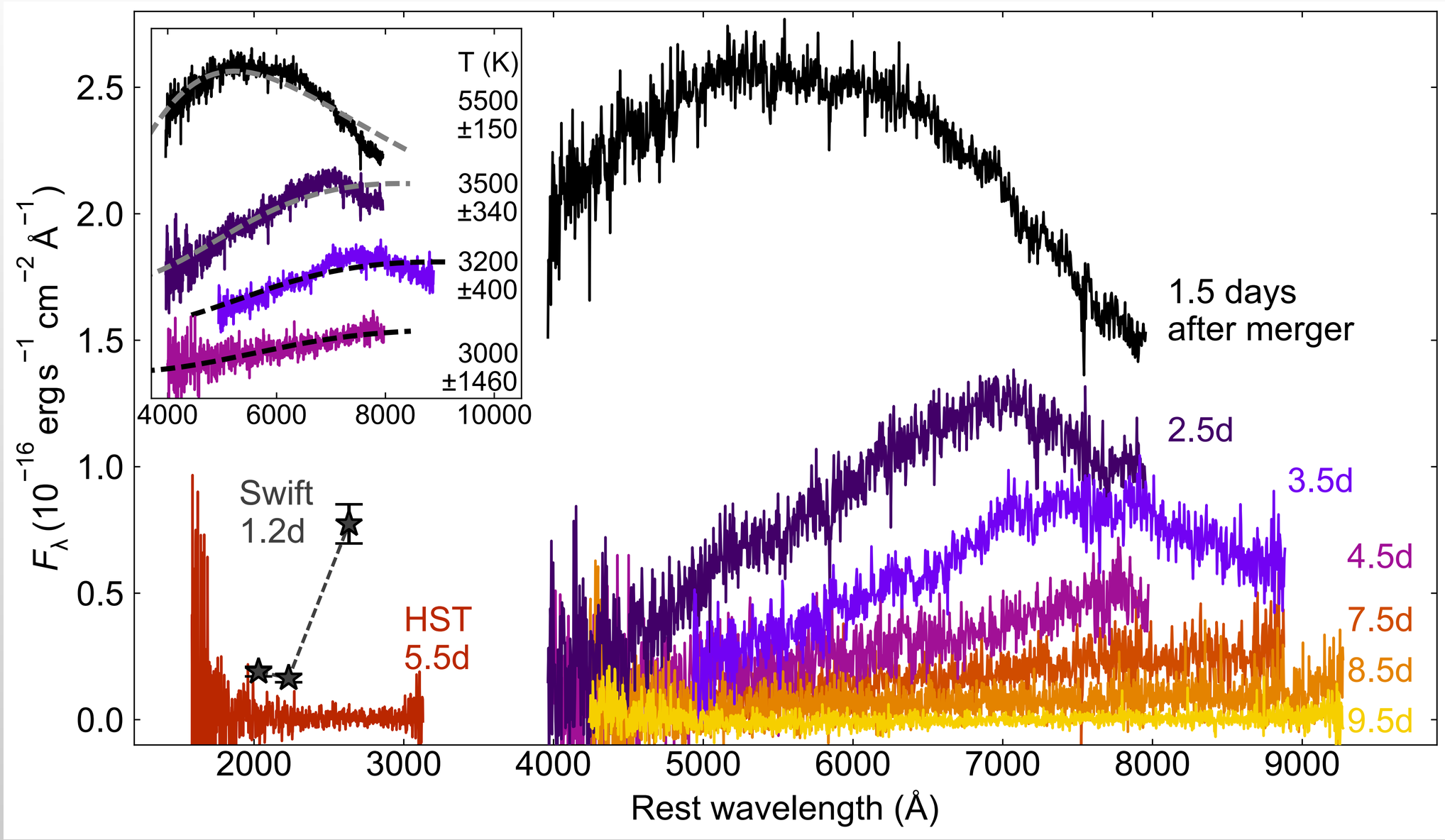
Shappee et al. 2017

SSS17a Spectral Evolution



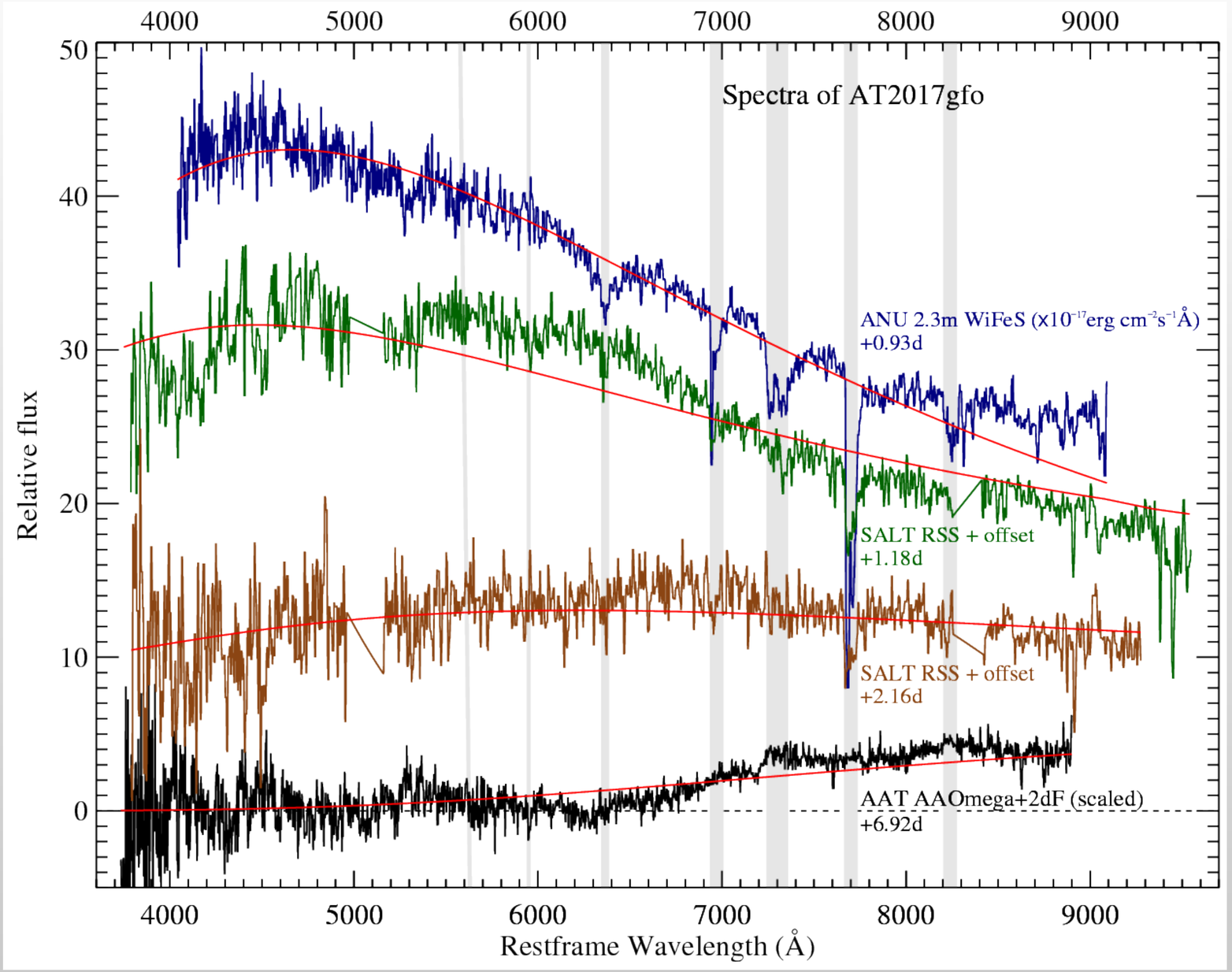
McCully et al. 2017

SSS17a Spectral Evolution



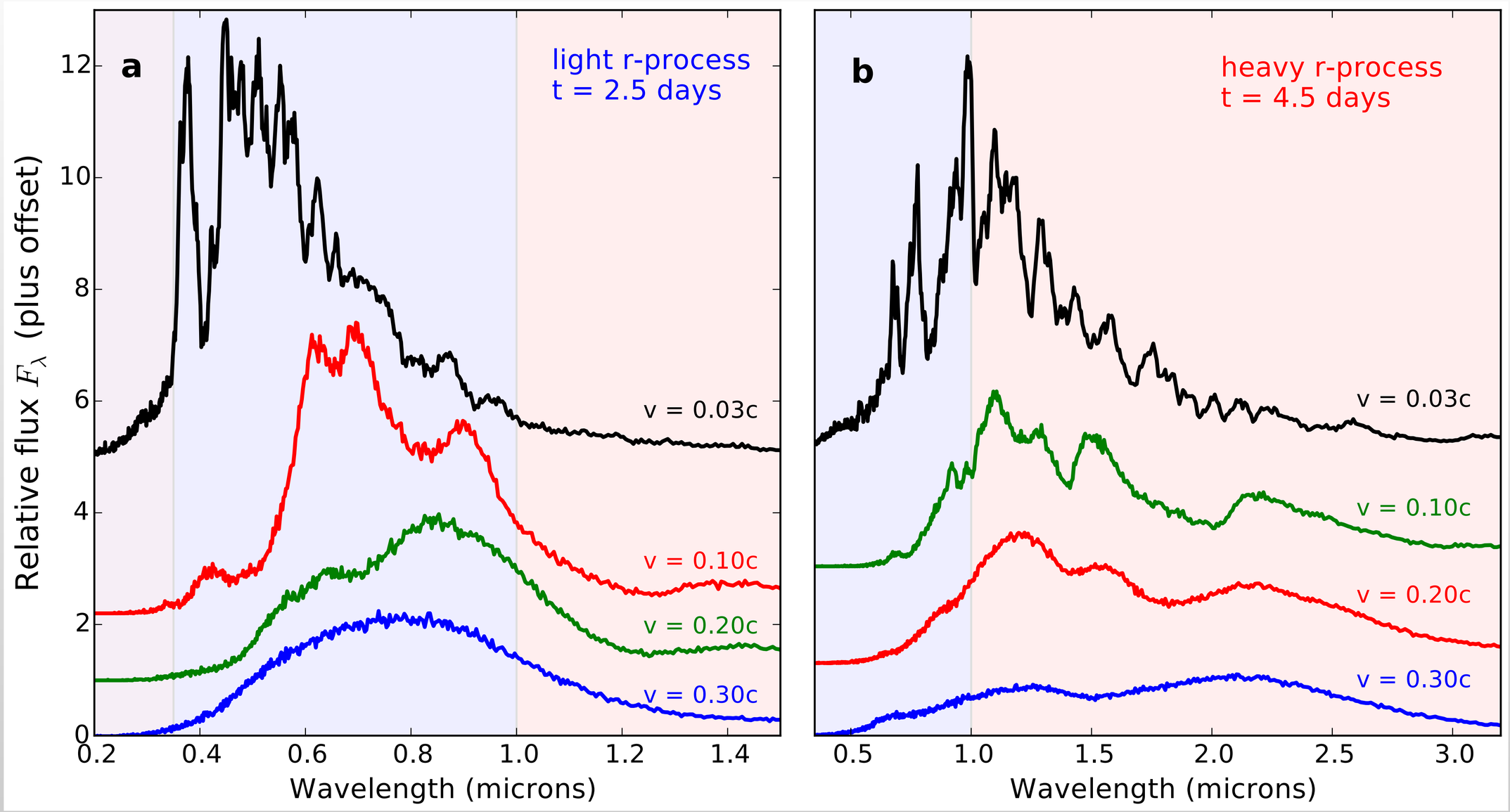
Nicholl et al. 2017

SSS17a Spectral Evolution



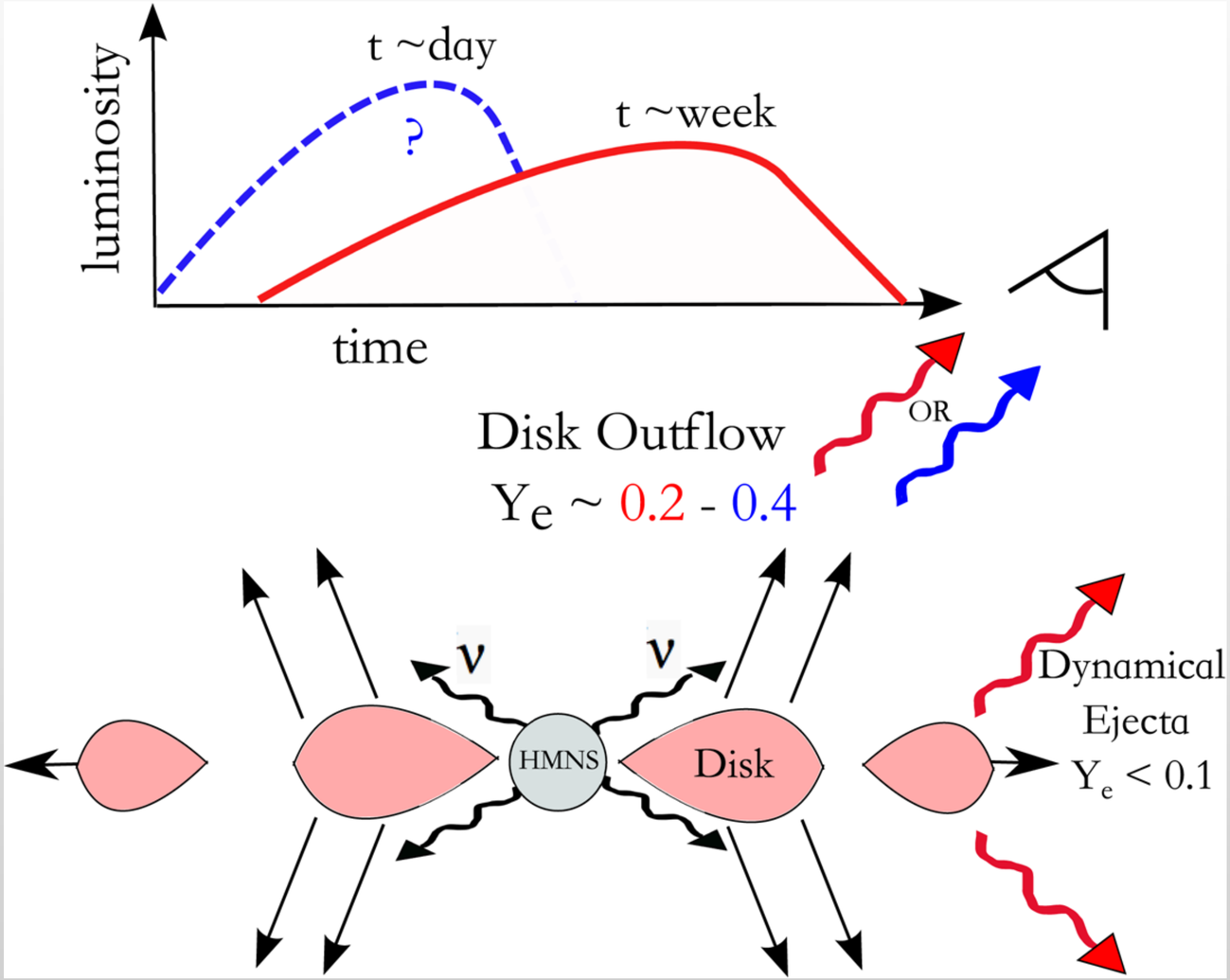
Andreoni et al. 2017
Buckley et al. 2017

Photometry/Spectra Match Kilonova Models



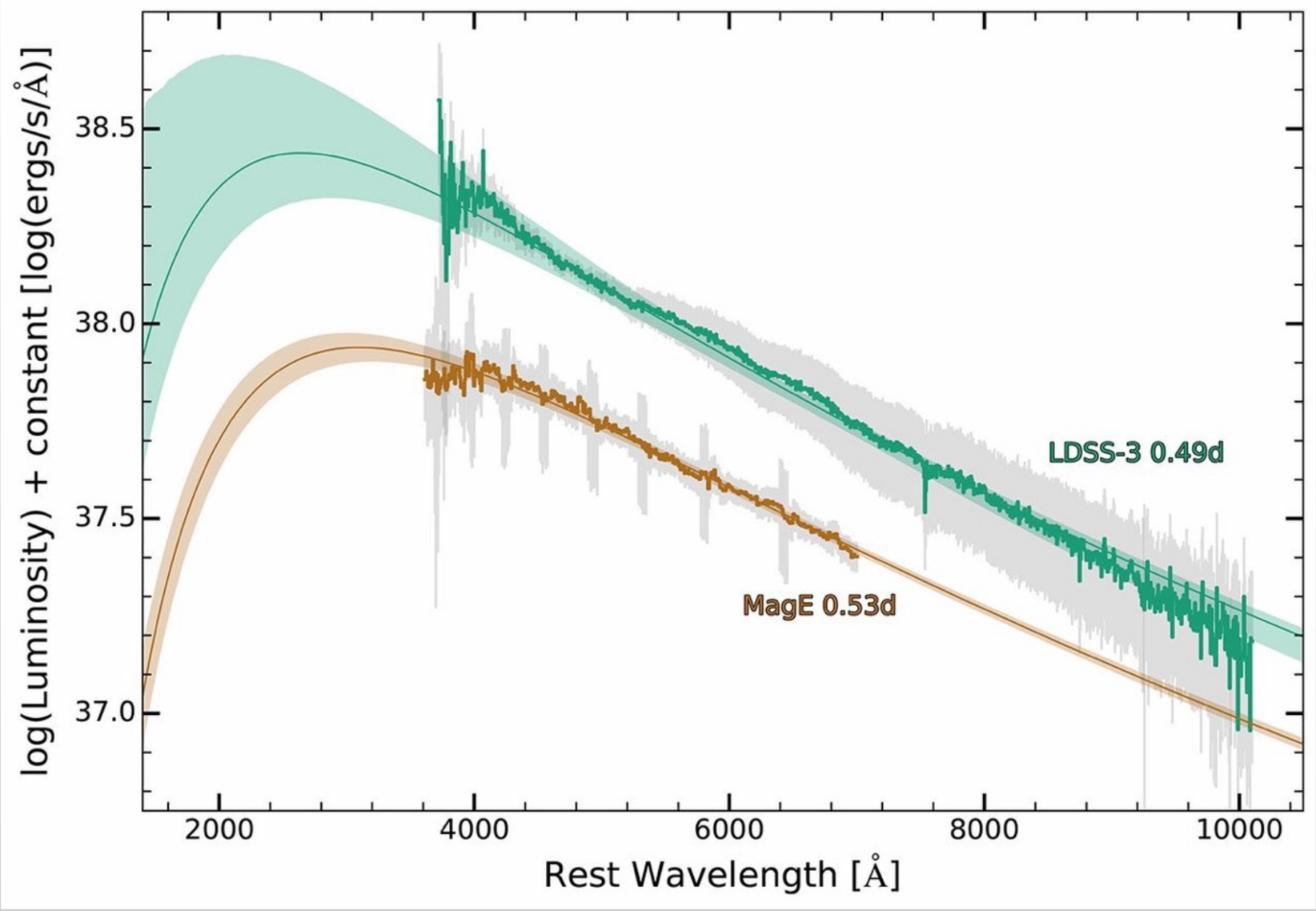
Kasen et al. 2017

Fast Blue and Slower Red Components



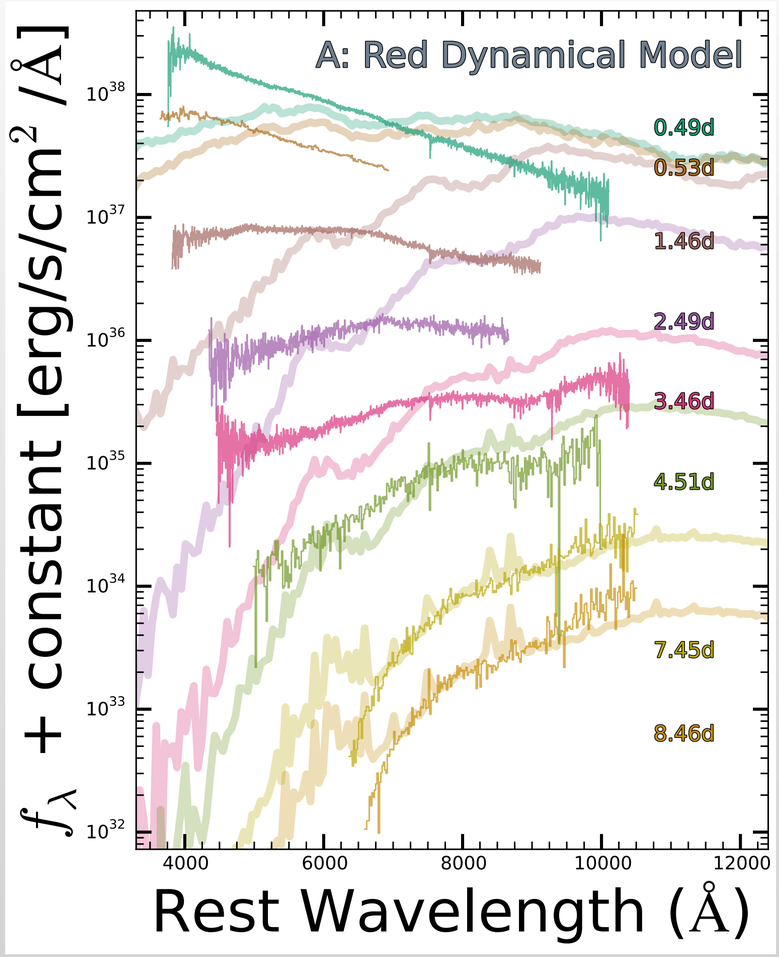
Metzger & Fernández 2014

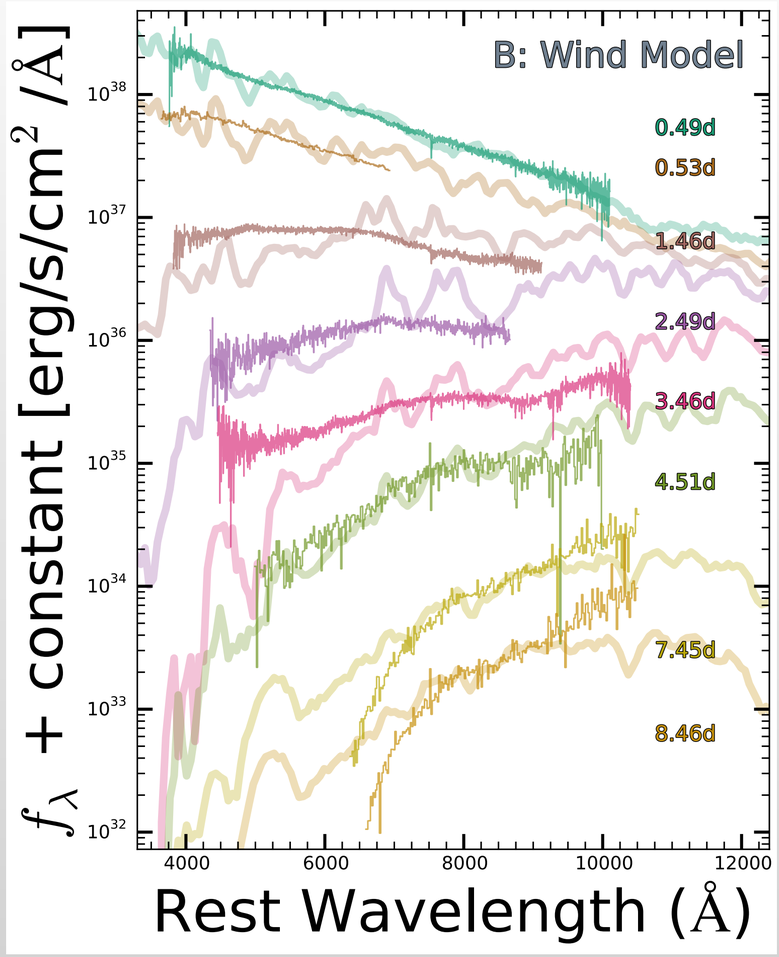
SSS17a: SED Evolution

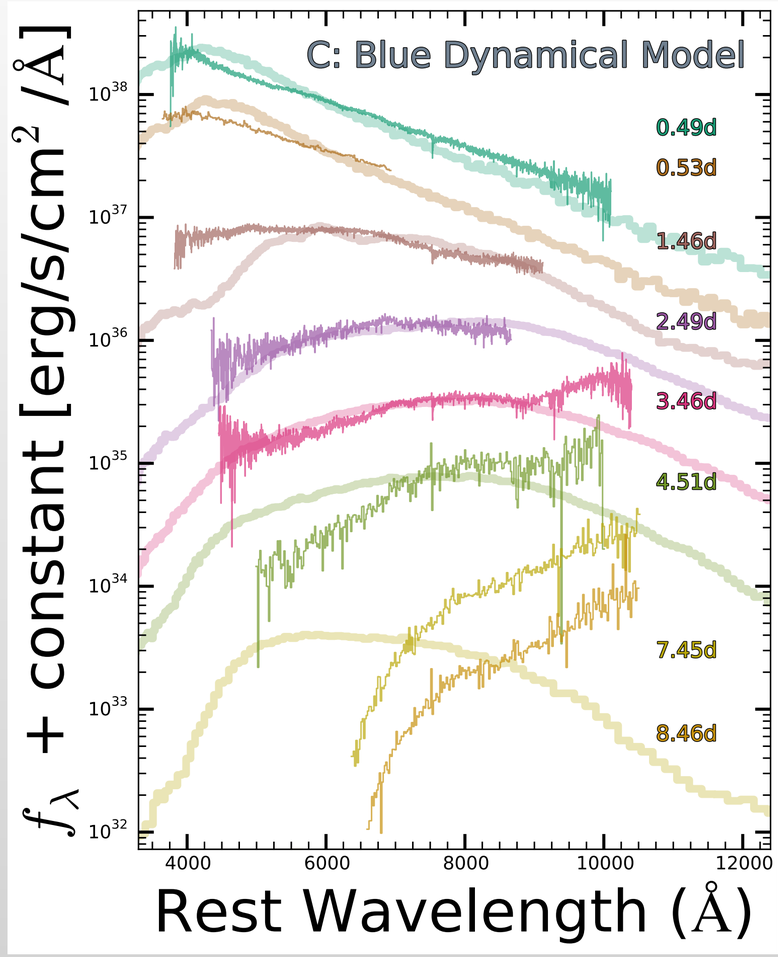


Shappee et al. 2017

SSS17a Model Comparison

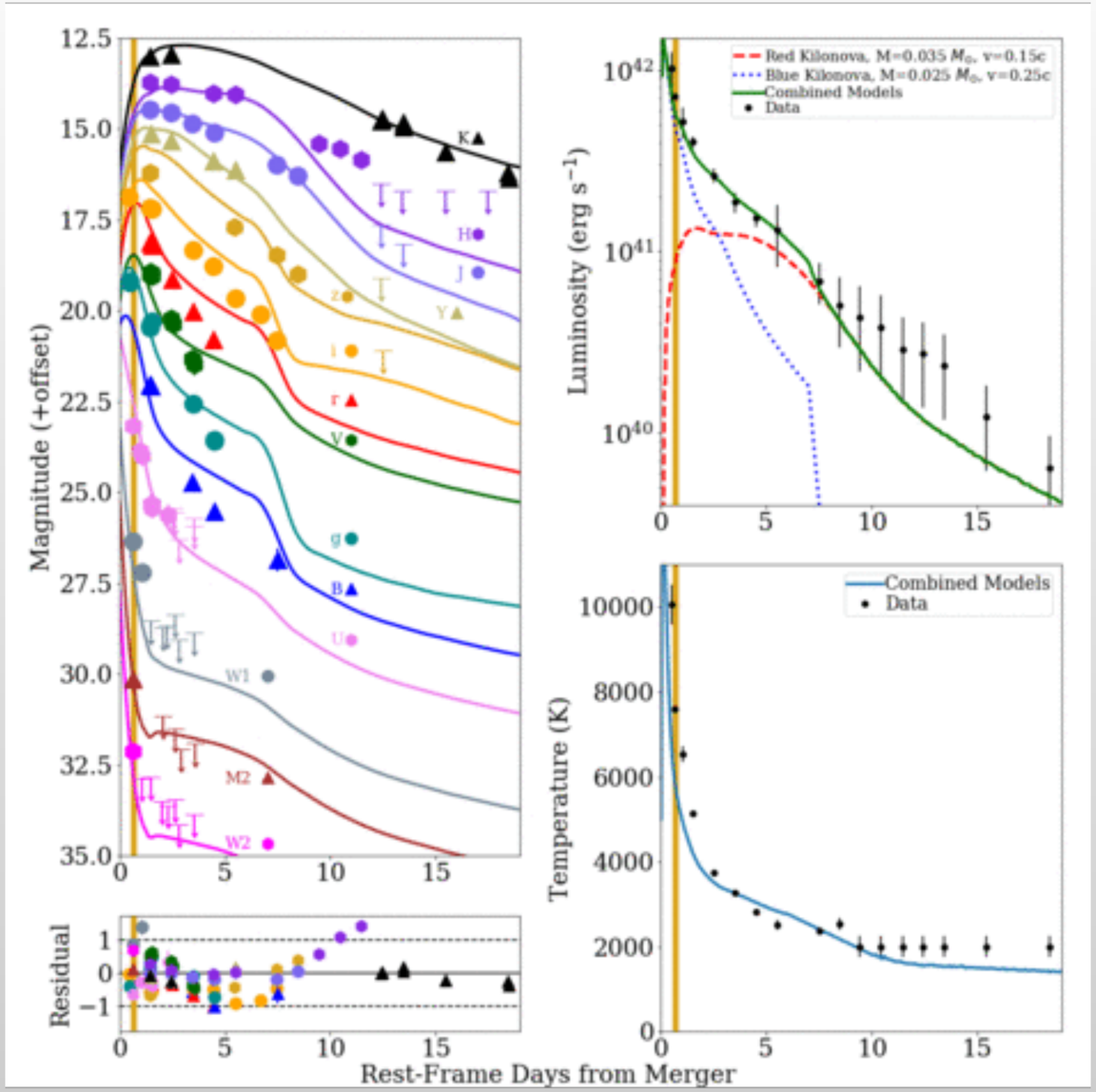






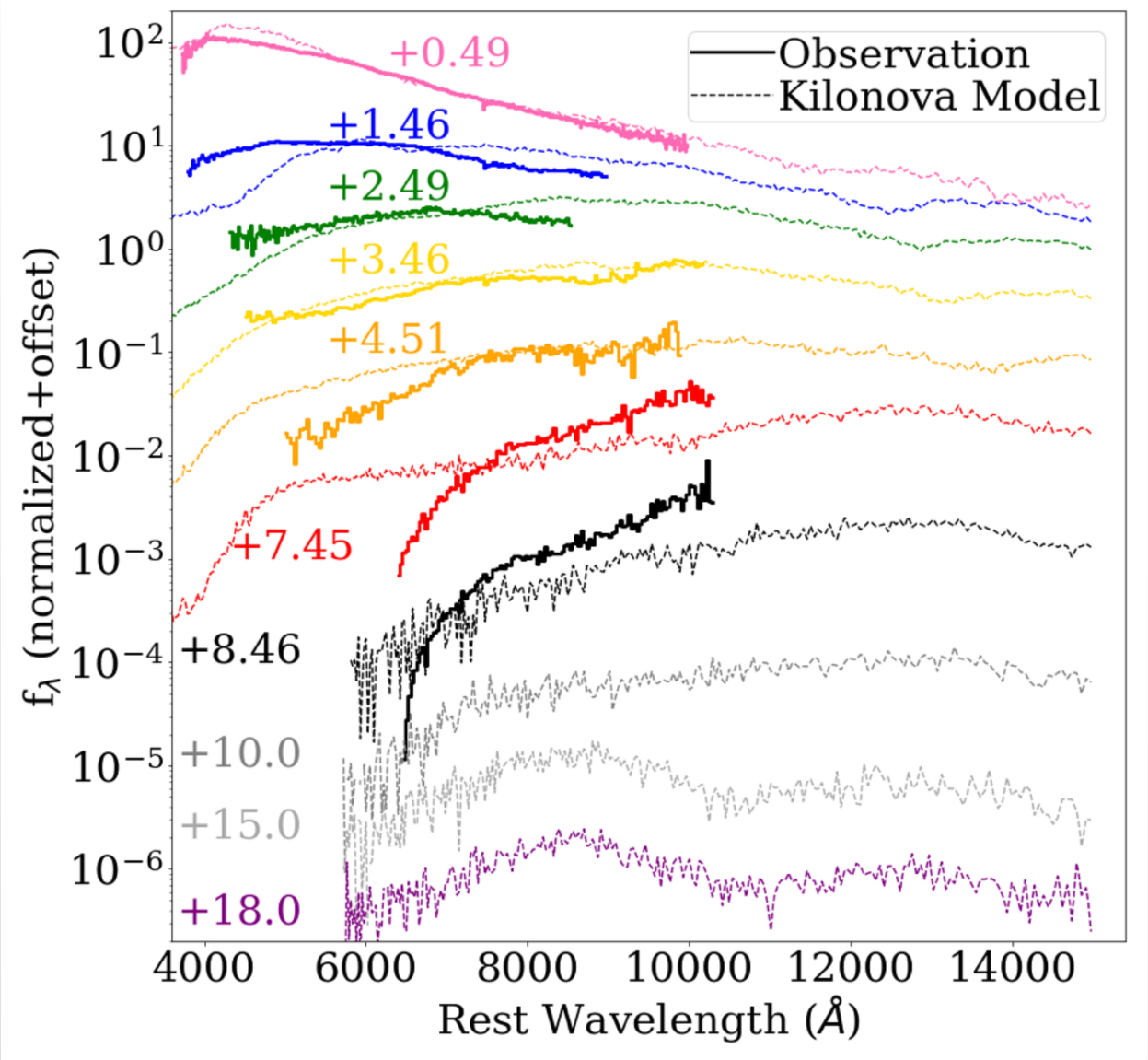
Shappee et al. 2017

Photometry/Spectra Match Kilonova Models



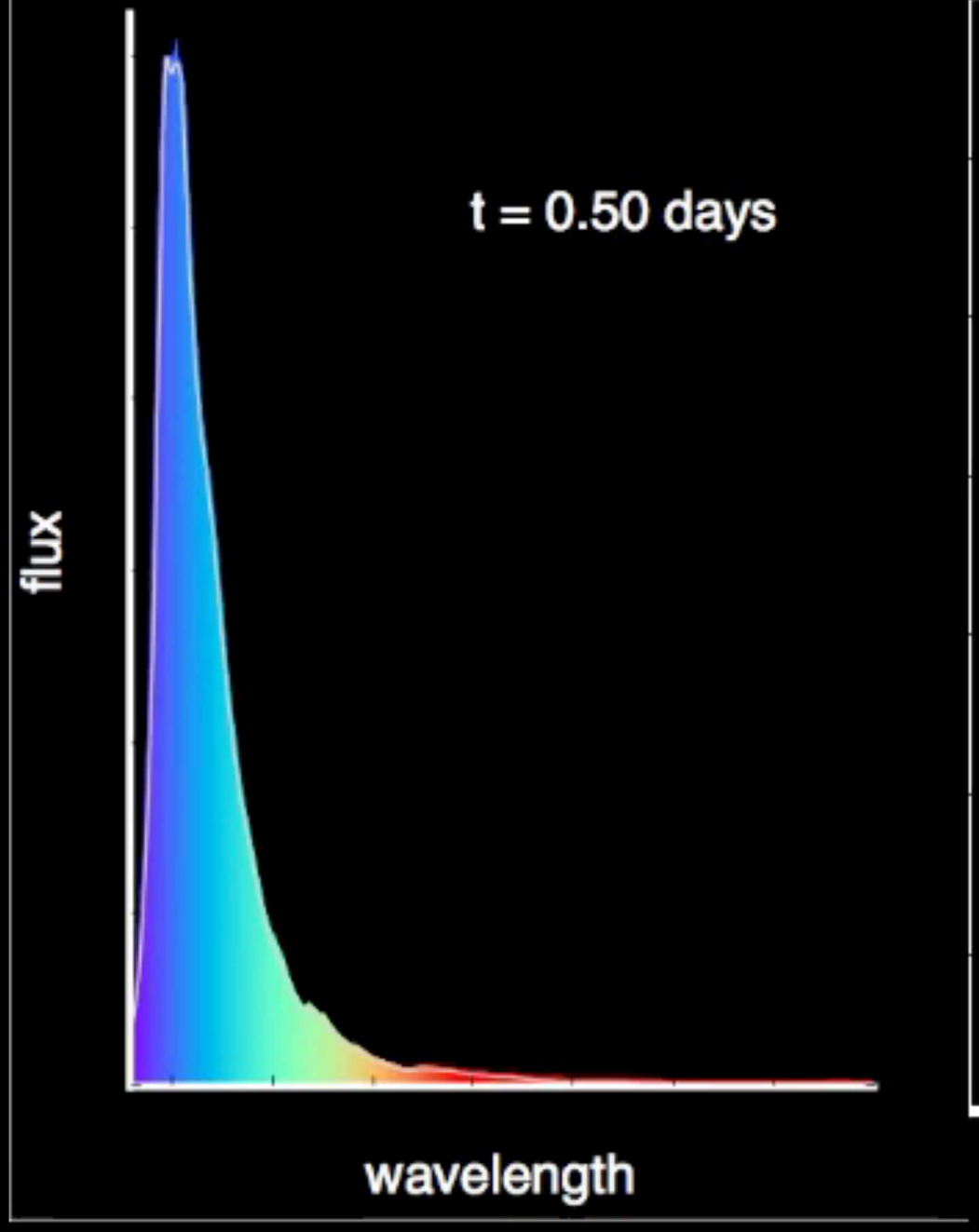
Kilpatrick et al. 2017, Kasen et al. 2017

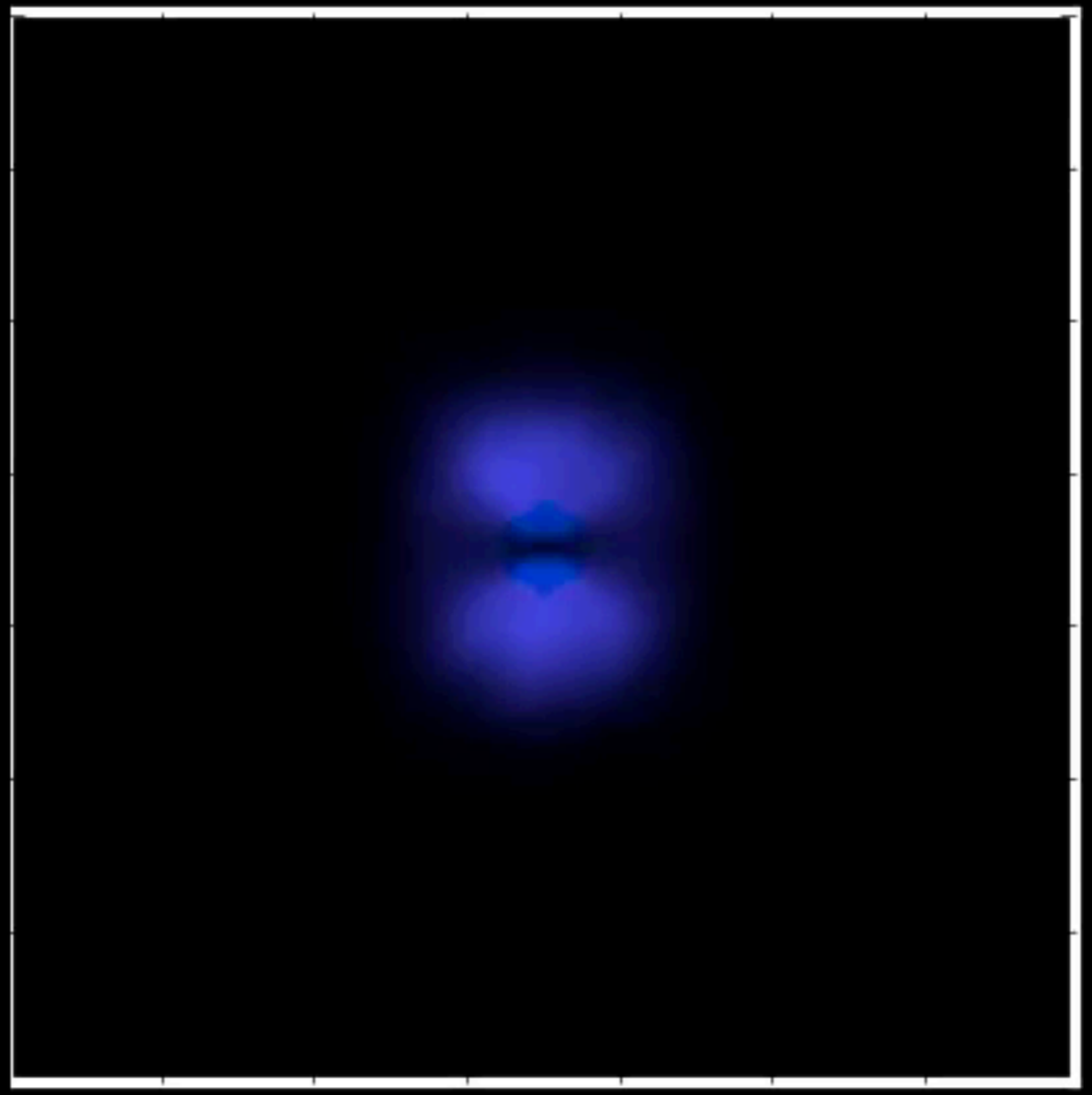
Photometry/Spectra Match Kilonova Models



Kilpatrick et al. 2017, Kasen et al. 2017

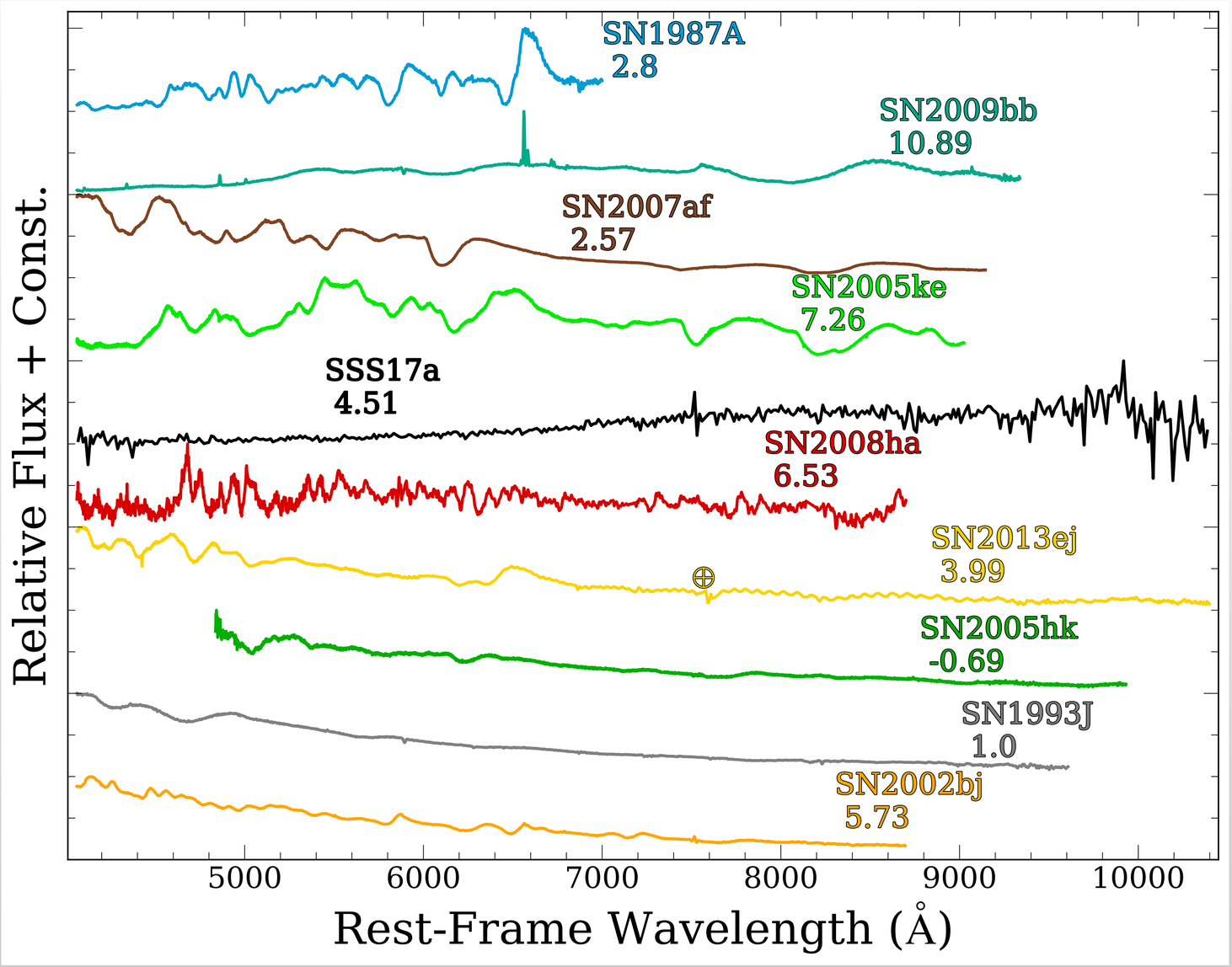
D. Kasen





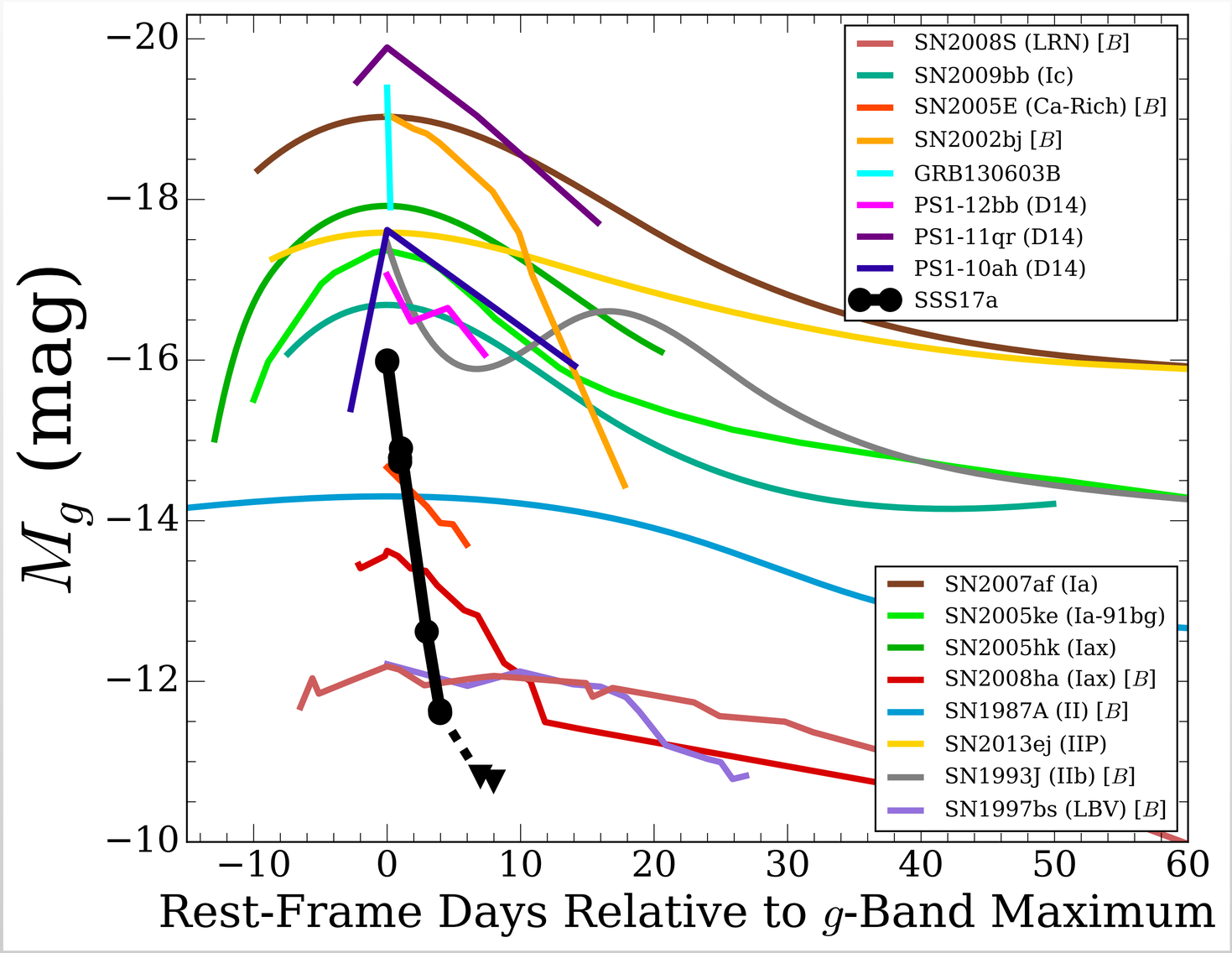
radioactive debris cloud

Spectra are Truly Unique



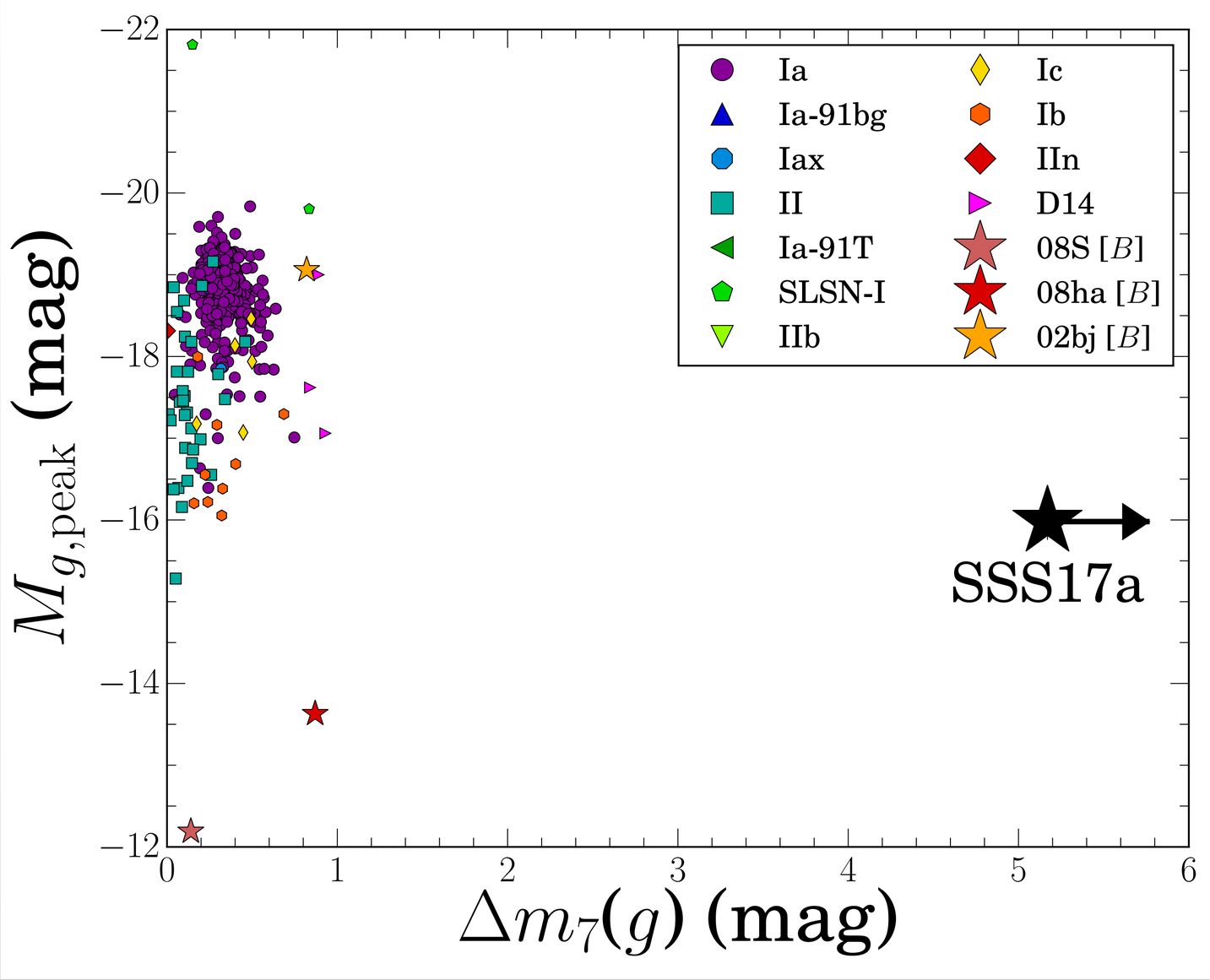
Siebert et al. 2017

SSS17a Faded Dramatically



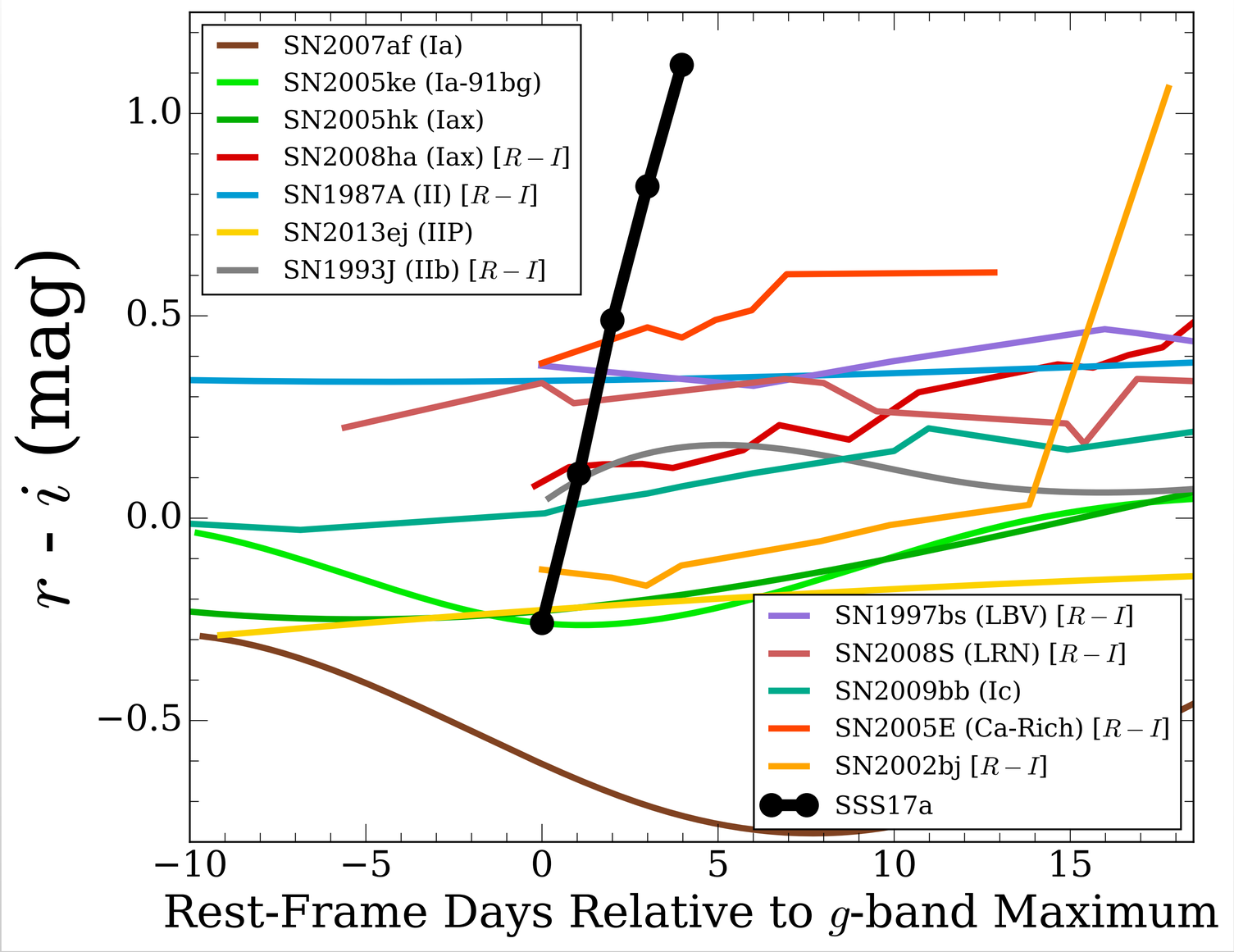
Siebert et al. 2017

SSS17a Faded Faster than *Any* Known SN



Siebert et al. 2017

SSS17a Quickly Turned Blue to Red



Siebert et al. 2017

Summary

- Blue featureless spectrum early
- Red spectrum with features later
- Blue component lanthanide free
- Blue component has v ≈ 0.3 c (comparable to red)
- Geometry likely important:
  Must have unobscured lanthanide-free ejecta that are overrun by lanthanide-rich ejecta or become optically thin

- SSS17a is unlike other transients
- MW rate <0.19 per century


WANT TO
BELIEVE