

Gaia-discovered nuclear transients: Gaia I 6aax

Peter Jonker

Morgan Fraser, Lukasz Wyrzykowski, Seppo
Mattila, Paul Hewitt, Jim Pringle, NUTS
collaboration



Netherlands Institute for Space Research



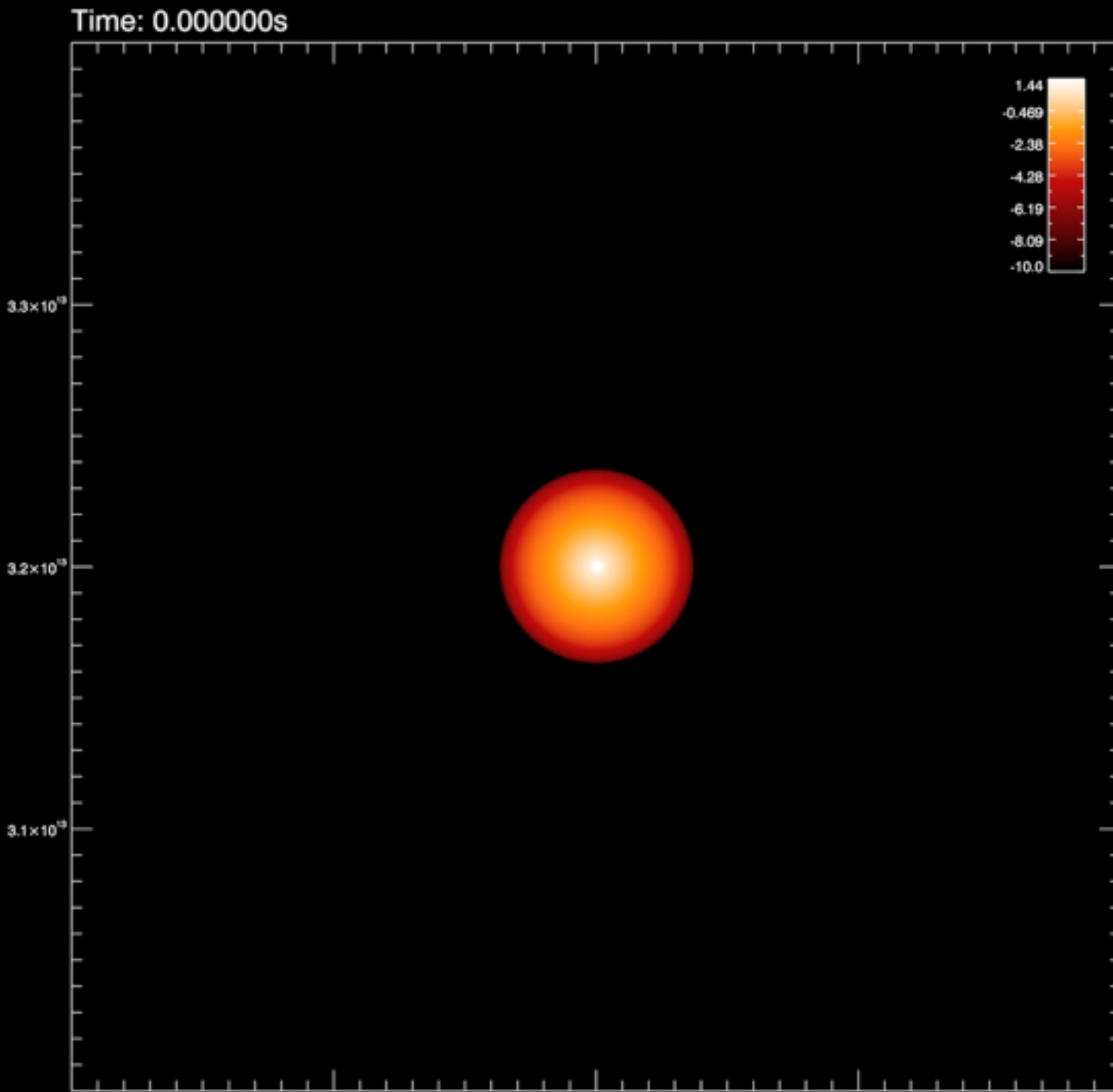
Utrecht, Dec 8, 2016: Gaia Alerts

A tidal disruption event

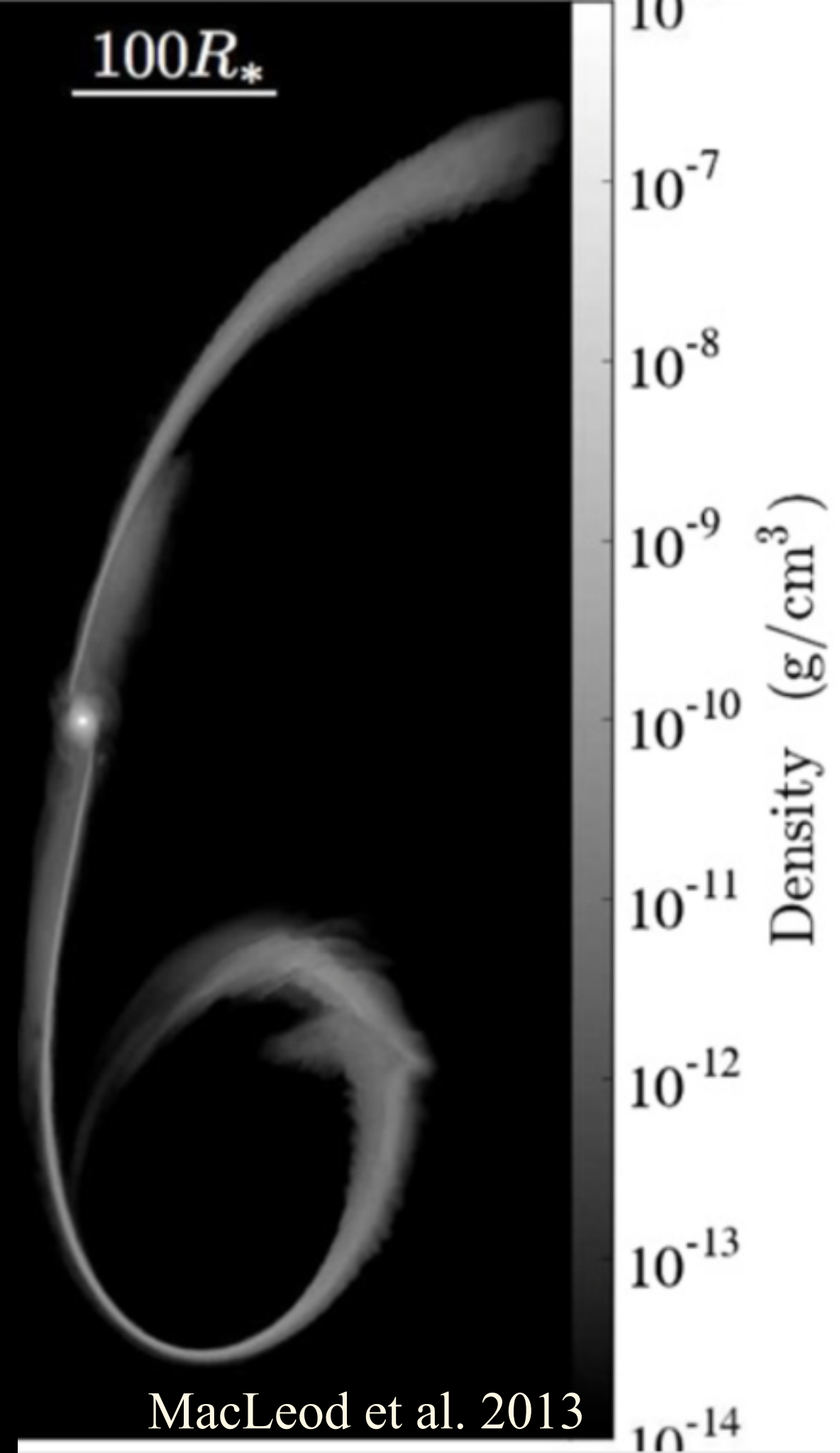
WD-BH encounter

masses (sol.)	0.2 (WD) & 1000 (BH)
in. separation	50 (in 1.E9 cm)
hydrodynamics	SPH (4 030 000 particles)
EOS, gravity	Helmholtz, N
nucl. burning	red. QSE-network (Hix 98)
simul. time	5.4 min
color coded	column density
penet. factor	12

Partial tidal disruption events

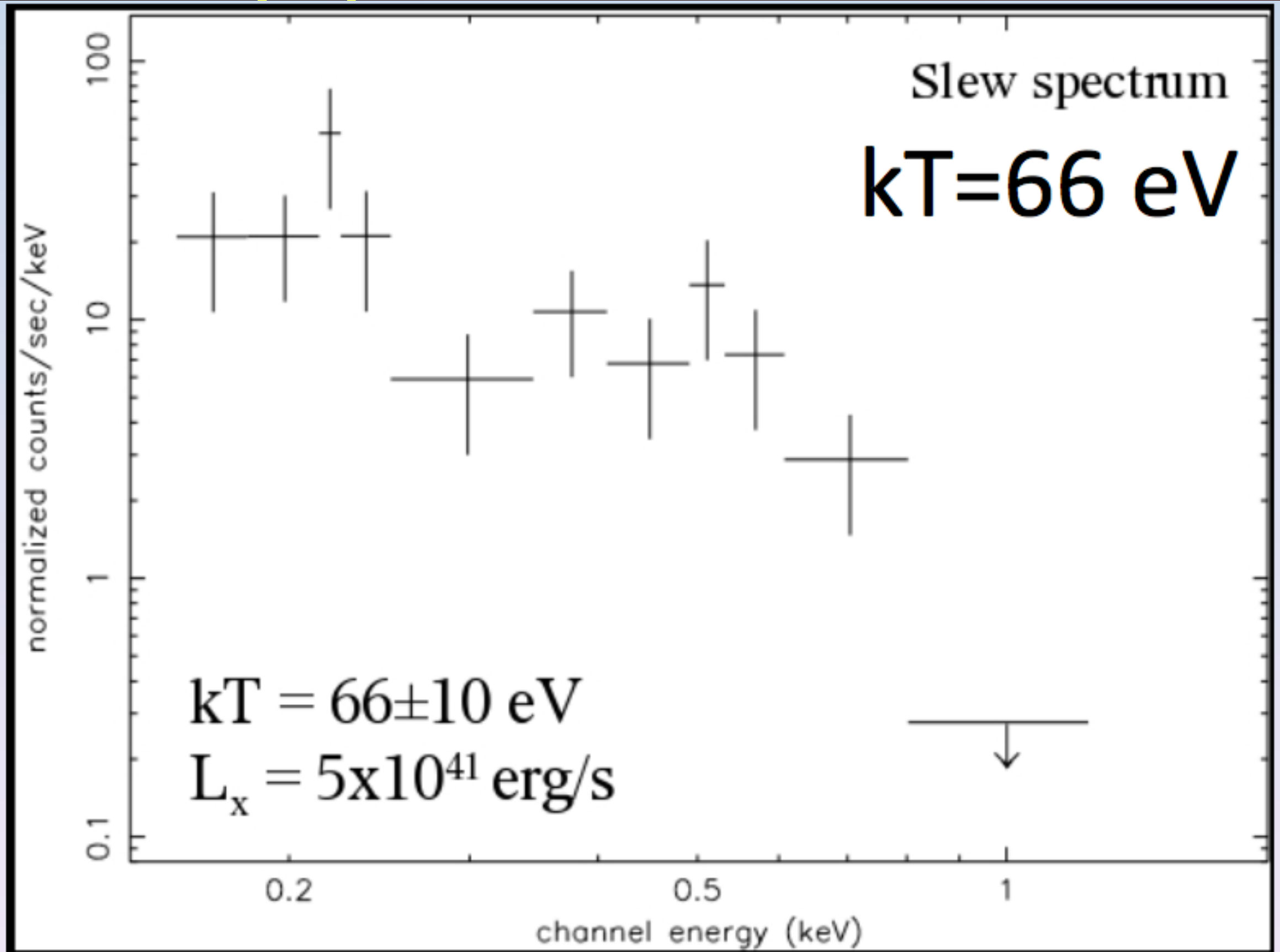


simulation courtesy James Guillochon

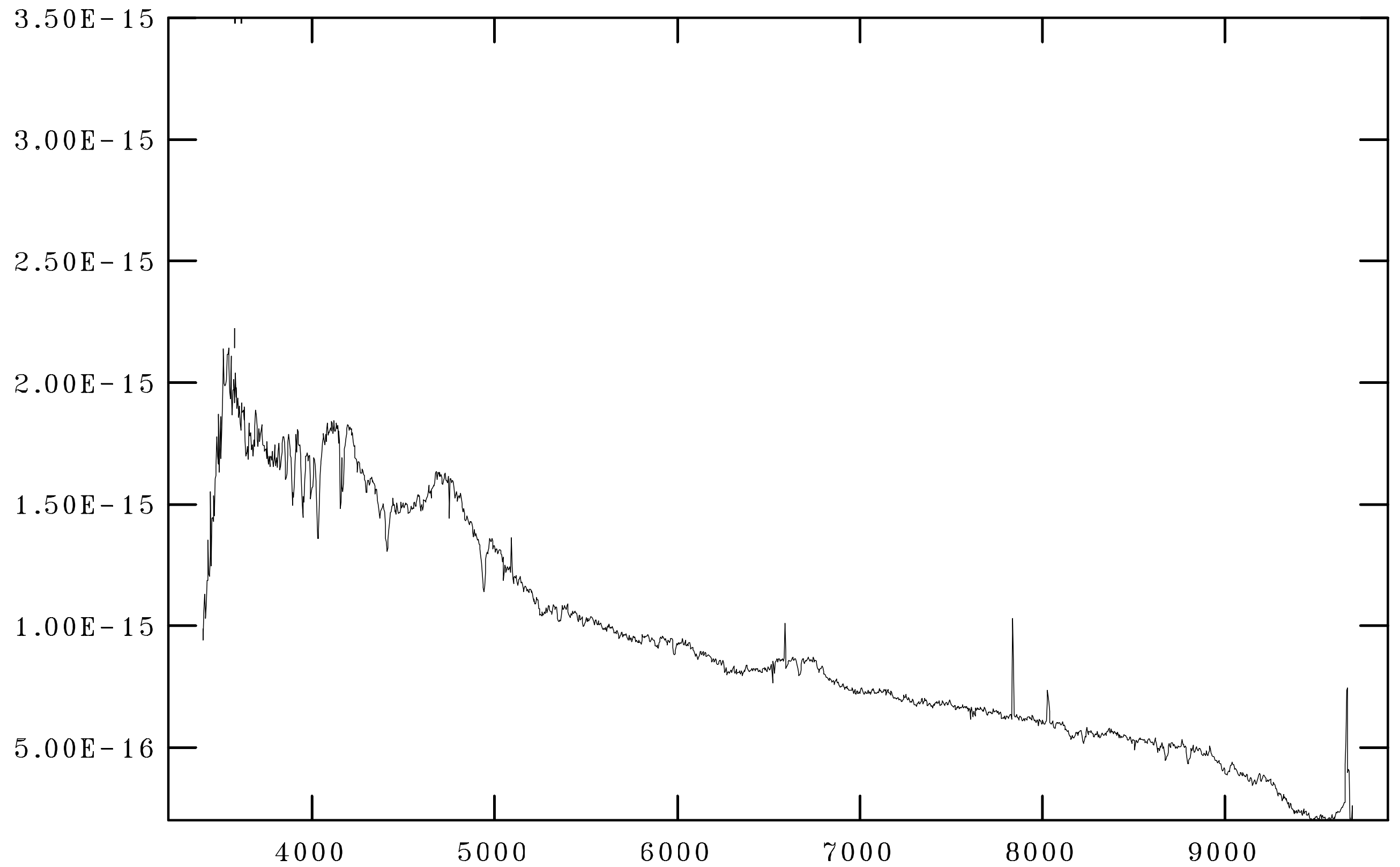


MacLeod et al. 2013

Example X-ray spectrum of a TDE



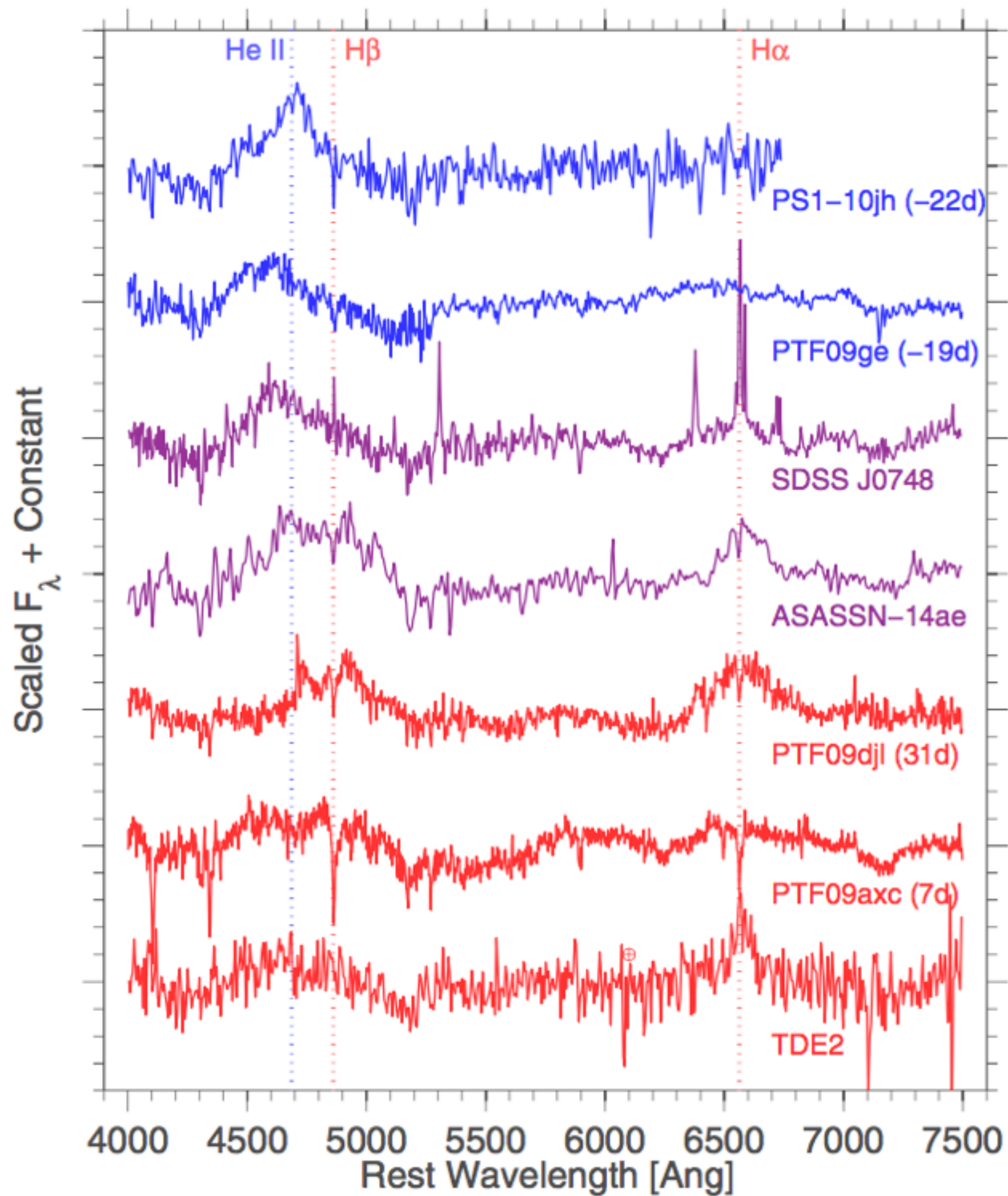
Example optical spectrum of a TDE (iPTF16fni)



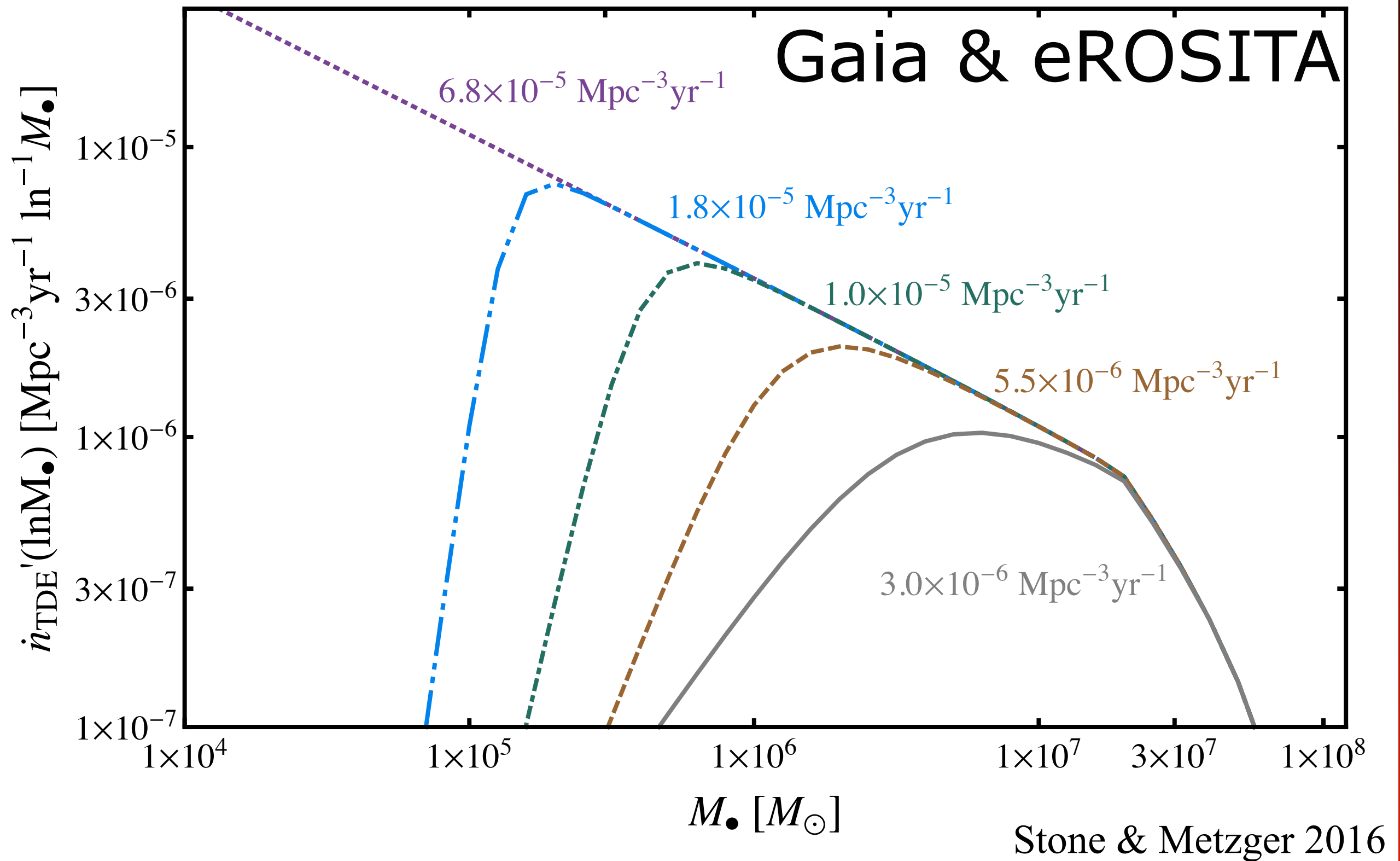
Onori et al. in prep.

Wavelength (angstroms)

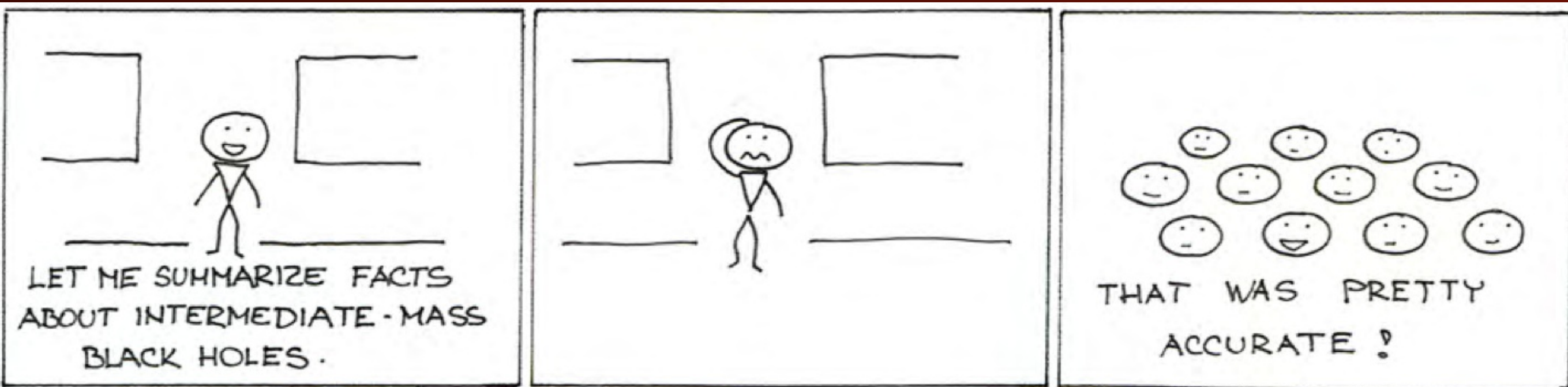
Example optical spectra of TDEs



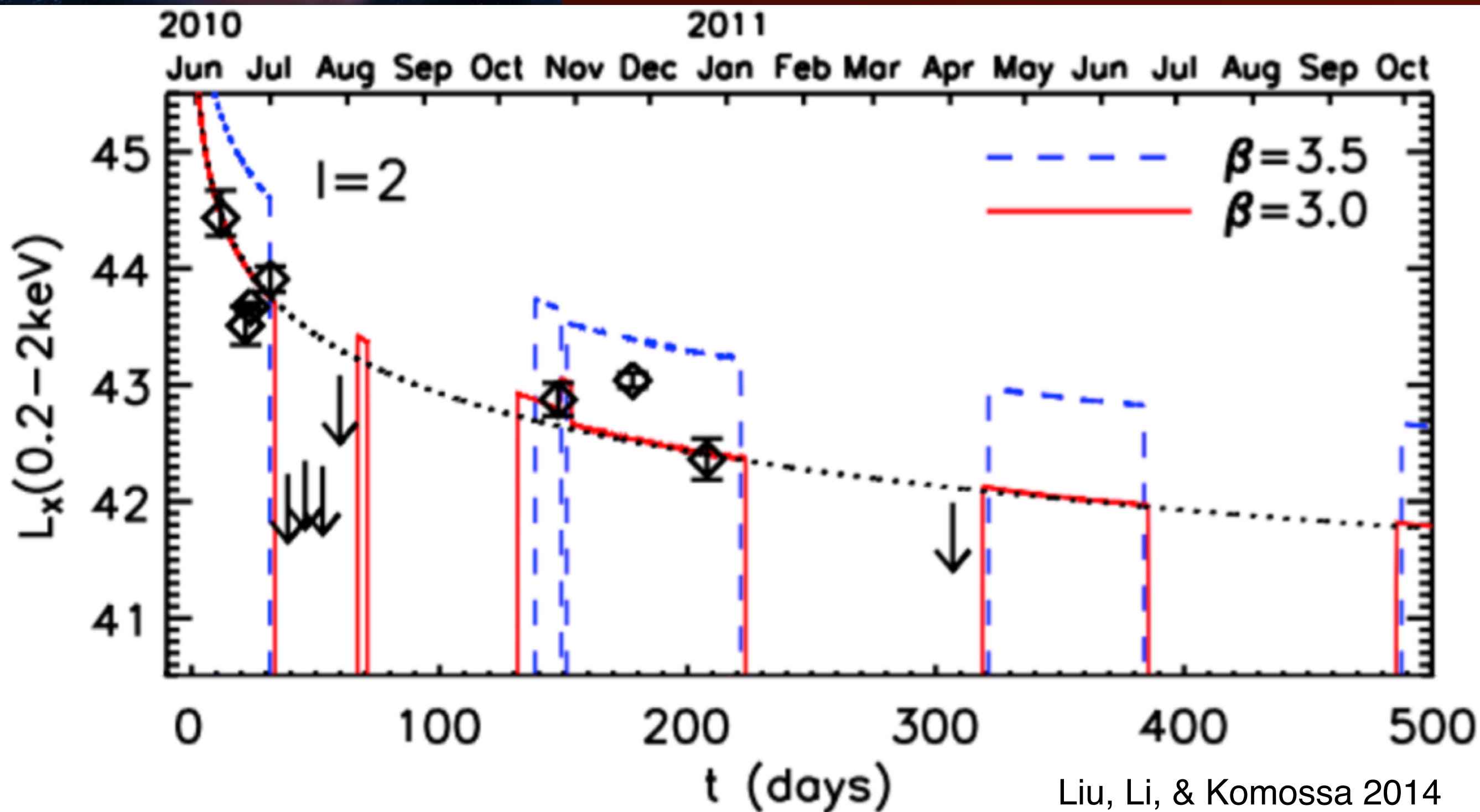
BH seed mass set tidal disruption rate



Do IMBHs exist?



About AGN & TDEs: binary SMBHs



Actively searching for TDEs



Sub image



Iair Arcavi

03:22:01.04 -01:03:12.76				(50.5043 -1.0535)	
This candidate matches a known galaxy					
Mag	S/N	FWHM	Motion	% change	Before?
17.0	5.0	3.0	0.0	1.0	0
Check SIMBAD objects				Check SDSS	
MPChecker		Check 2MASS		FITS v	Get DSS
☒ Junk ☐ Asteroid ☐ Variable Star ☐ Interesting!					
Please add any comments you might have here: 					
Submit your Contribution					



Sub image



lair Arcavi

03:23:33.26 -00:26:18.77				(50.8886 -0.4385)	
This candidate matches a known galaxy					
Mag	S/N	FWHM	Motion	% change	Before?
17.0	5.0	3.0	0.0	1.0	0
Check SIMBAD objects				<button>Check SDSS</button>	
<button>MPChecker</button>		<button>Check 2MASS</button>		FITS v	<button>Get DSS</button>
☐ Junk ☐ Asteroid ☐ Variable Star ☒ Interesting!					
Please add any comments you might have here:					
<button>Submit your Contribution</button>					

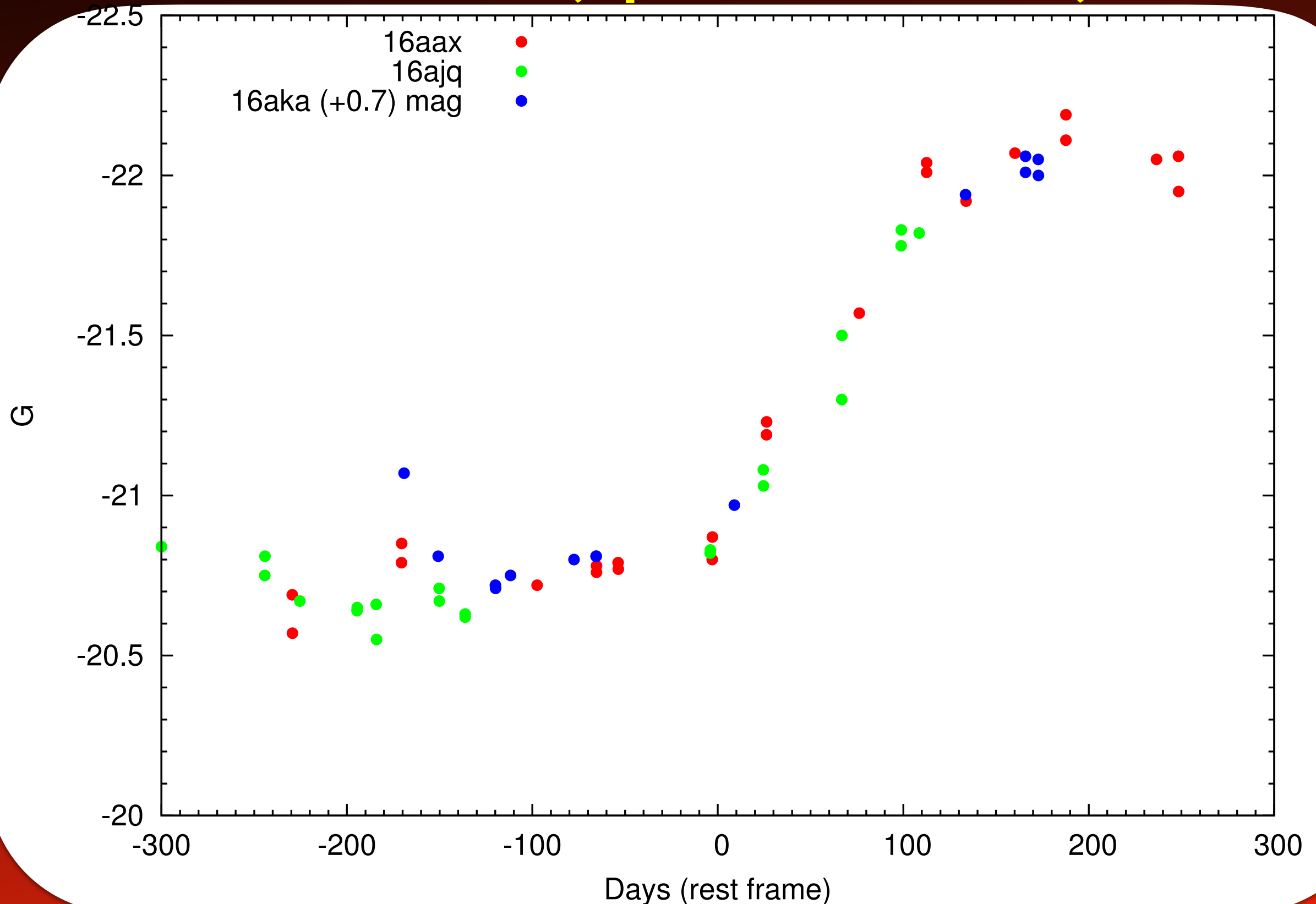
Selection effects?

so far:

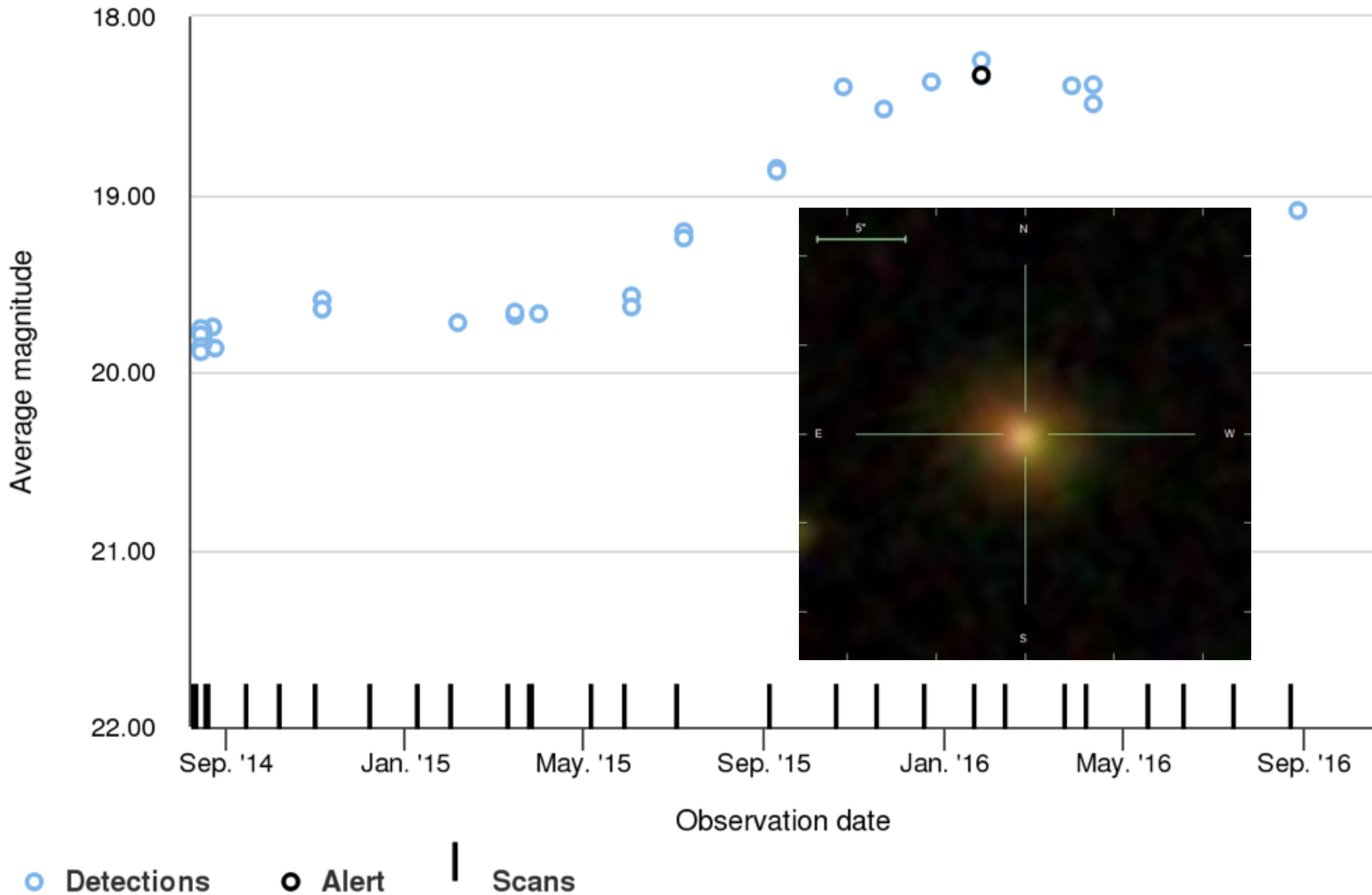
previous AGN activity $\Rightarrow$ discard as
TDE

Gaia nuclear transients

I 6aax, I 6ajq, I 6aka, I 6bjk...



Focus on I 6aax:

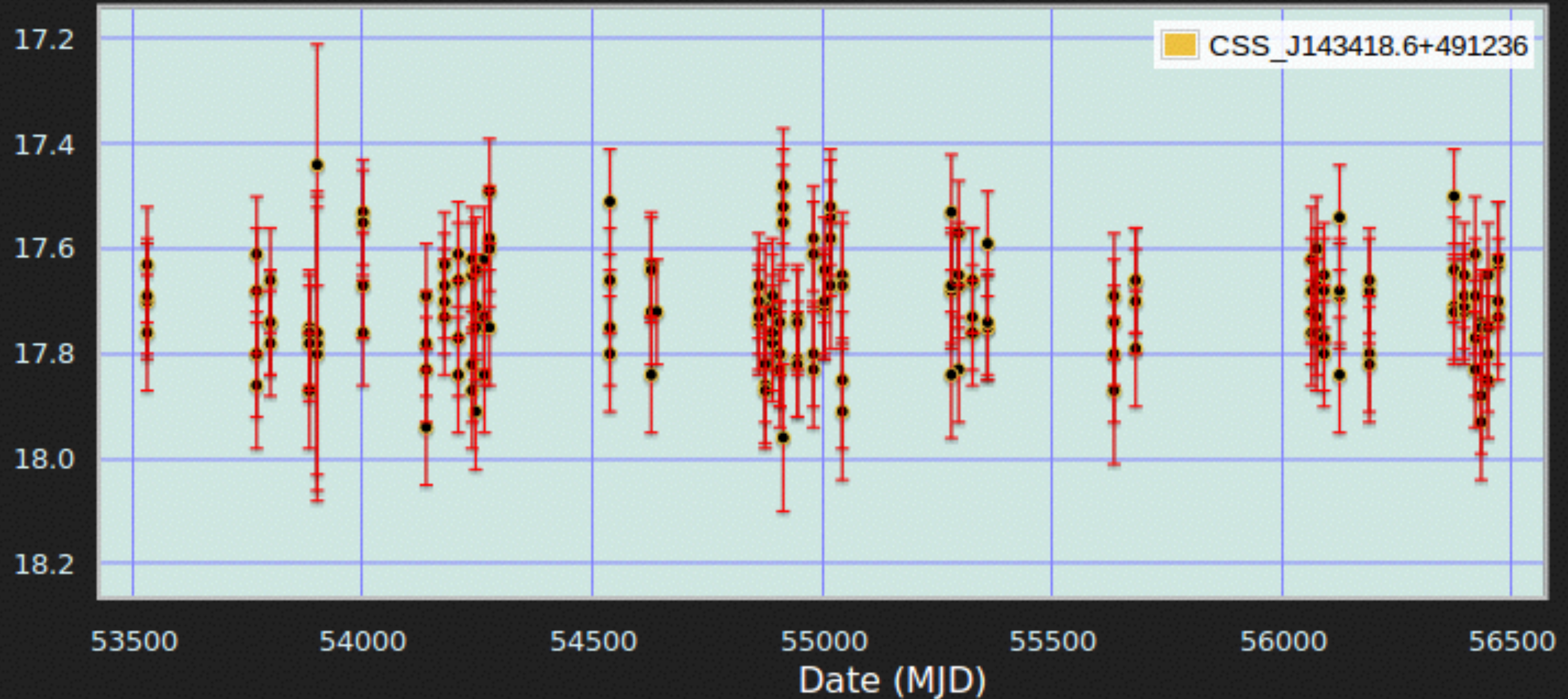


No prior strong AGN activity

Photcat DB query

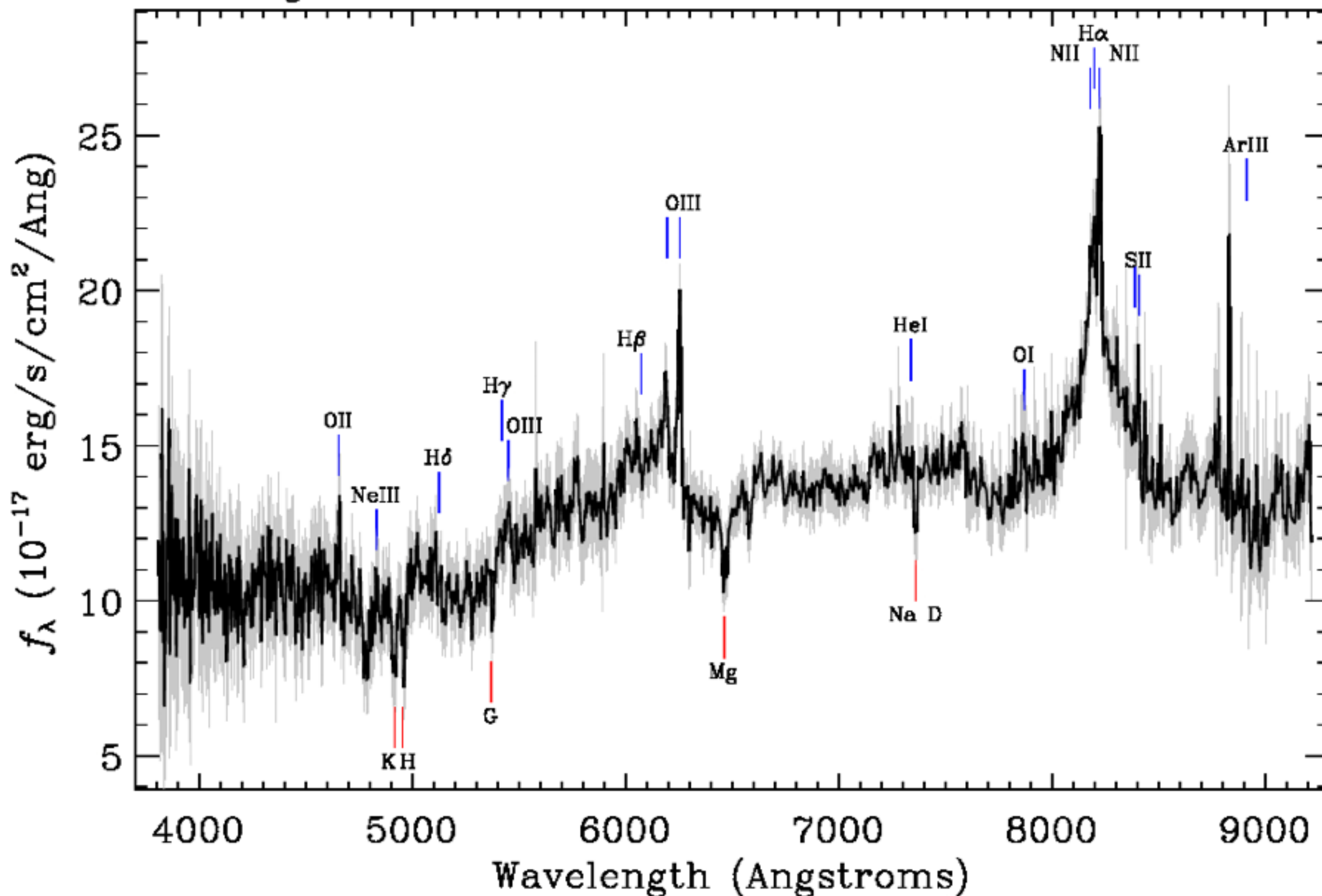
V mag

Light Curves

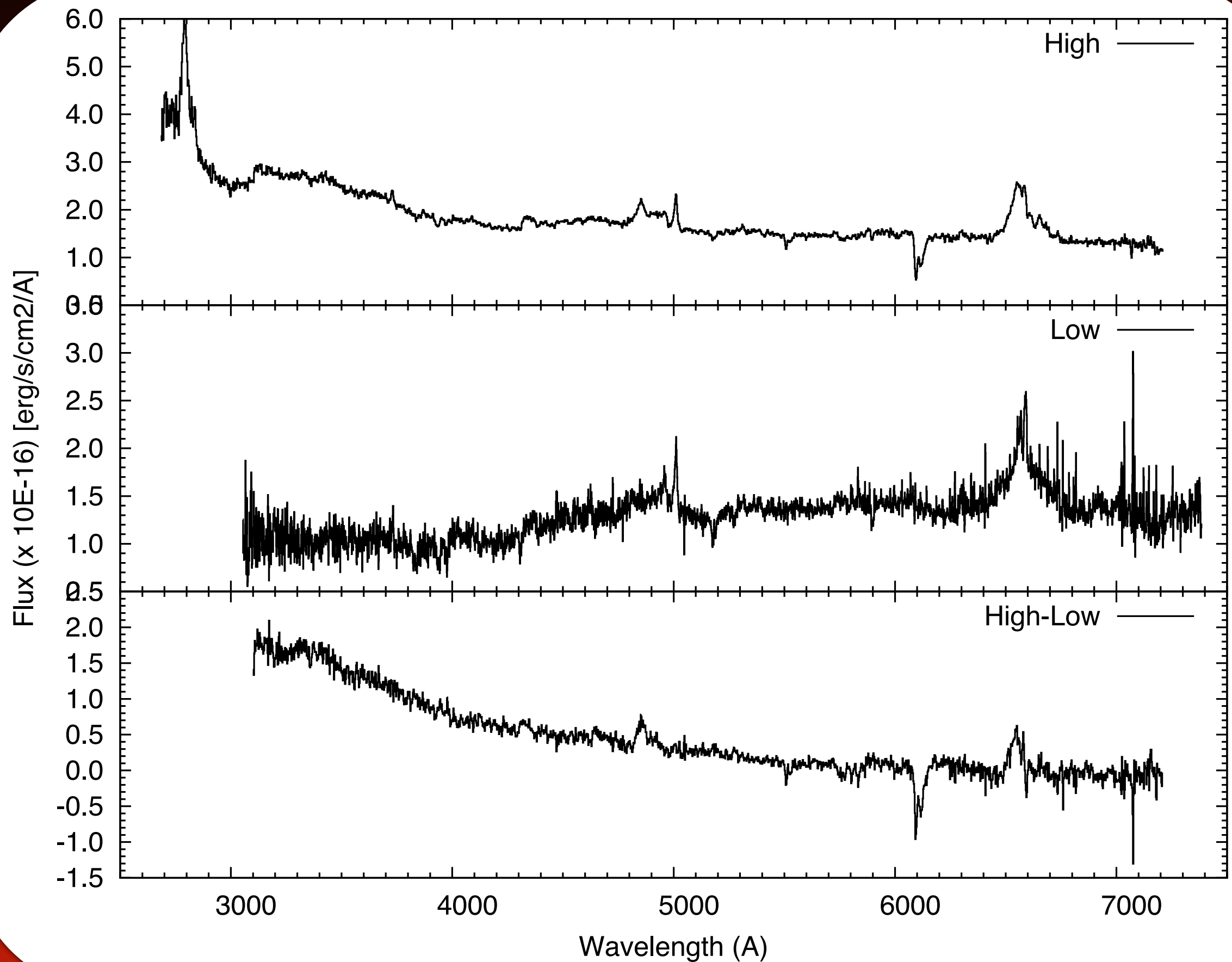


SDSS spectrum host

Survey: *sdss* Program: *legacy* Target: *QSO_CAP GALAXY ROSAT_B ROSAT_D ROSAT_E*
RA=218.57701, Dec=49.21015, Plate=1046, Fiber=54, MJD=52460
 $z=0.24854 \pm 0.00005$ Class=QSO BROADLINE
No warnings.

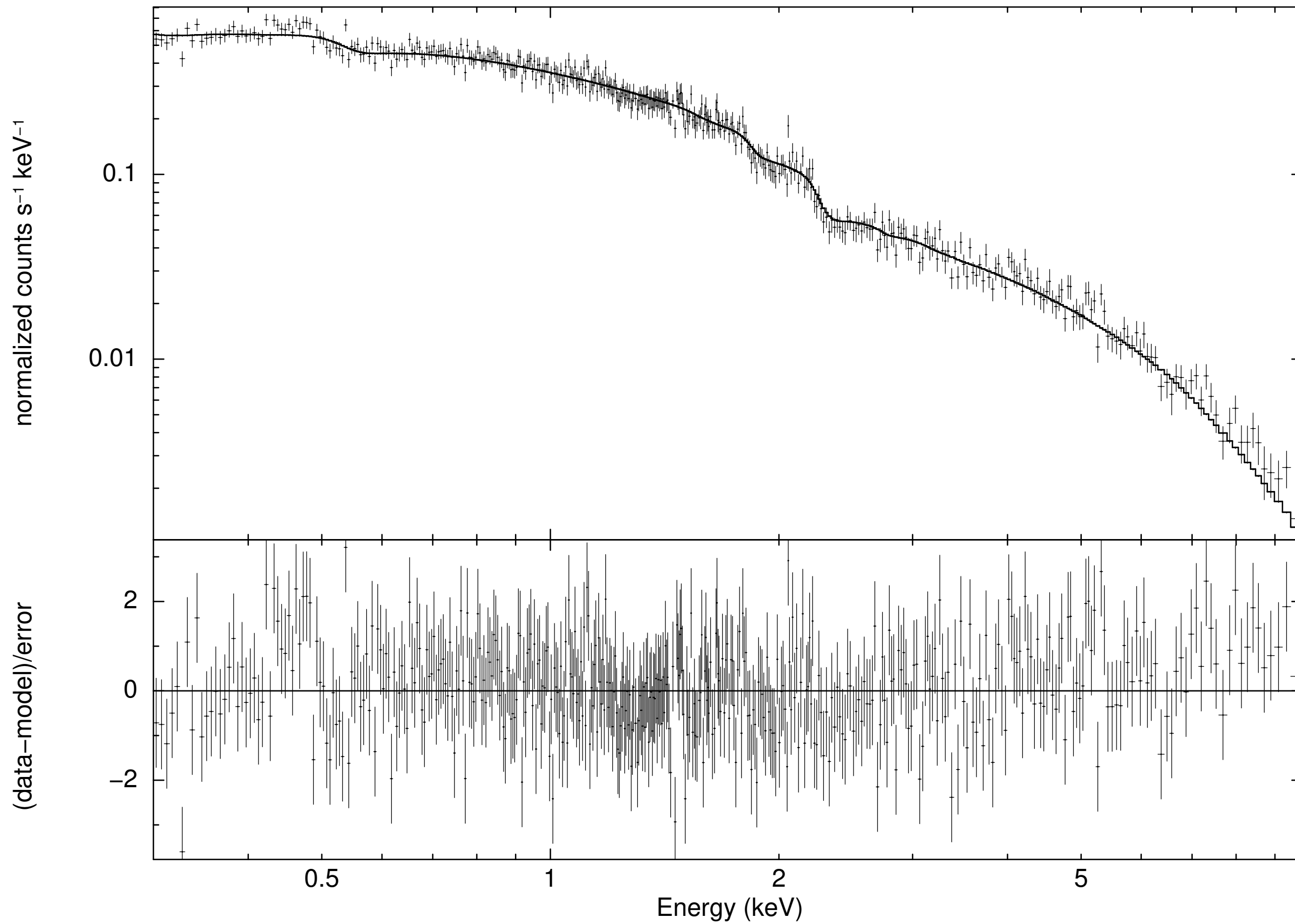


Spectral evolution:

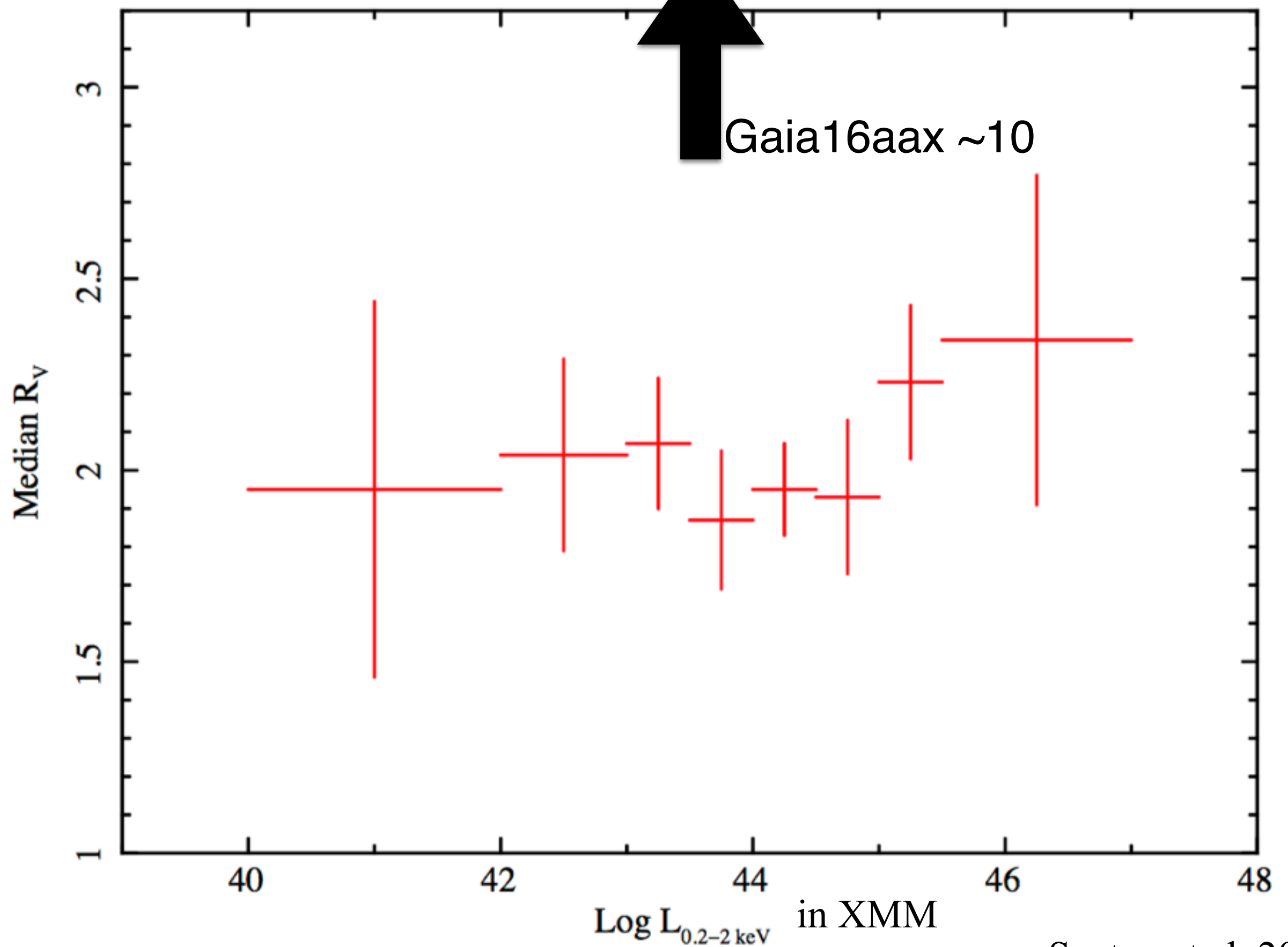


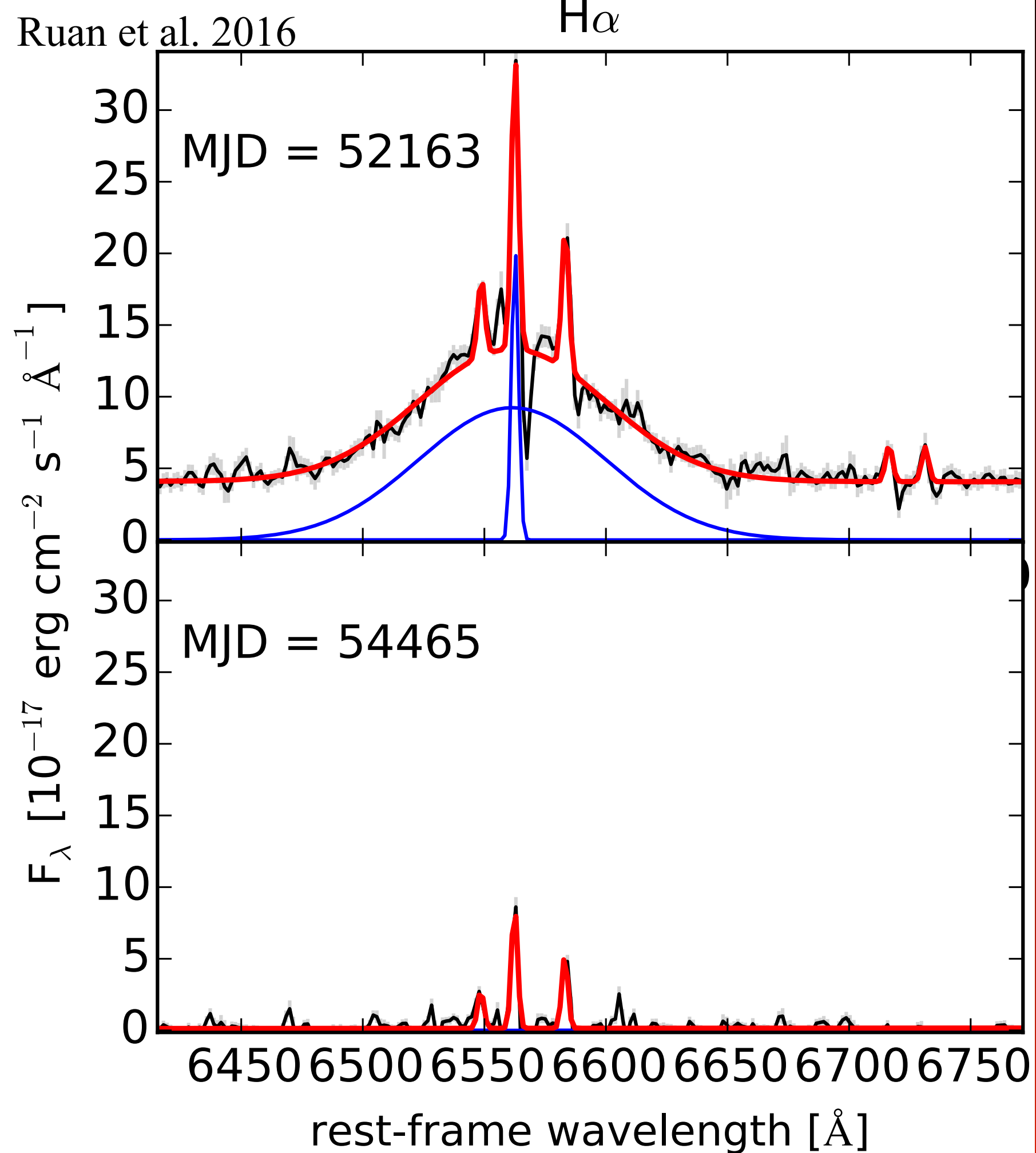
XMM DDT

data and folded model



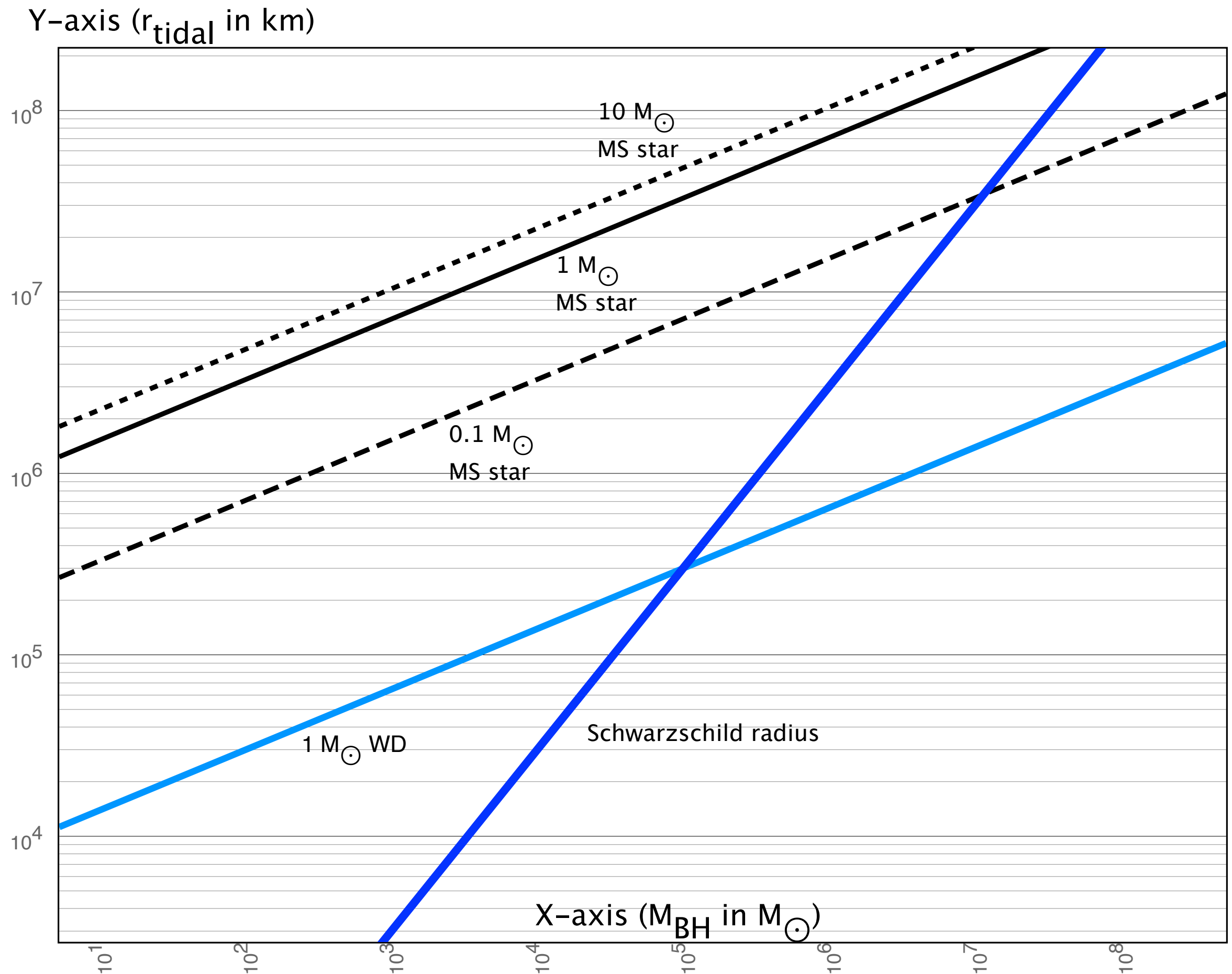
XMM DDT





Changing
look AGN?

Tidal disruption events



16aax like ASASSN15lh TDE due to fast spinning SMBH?

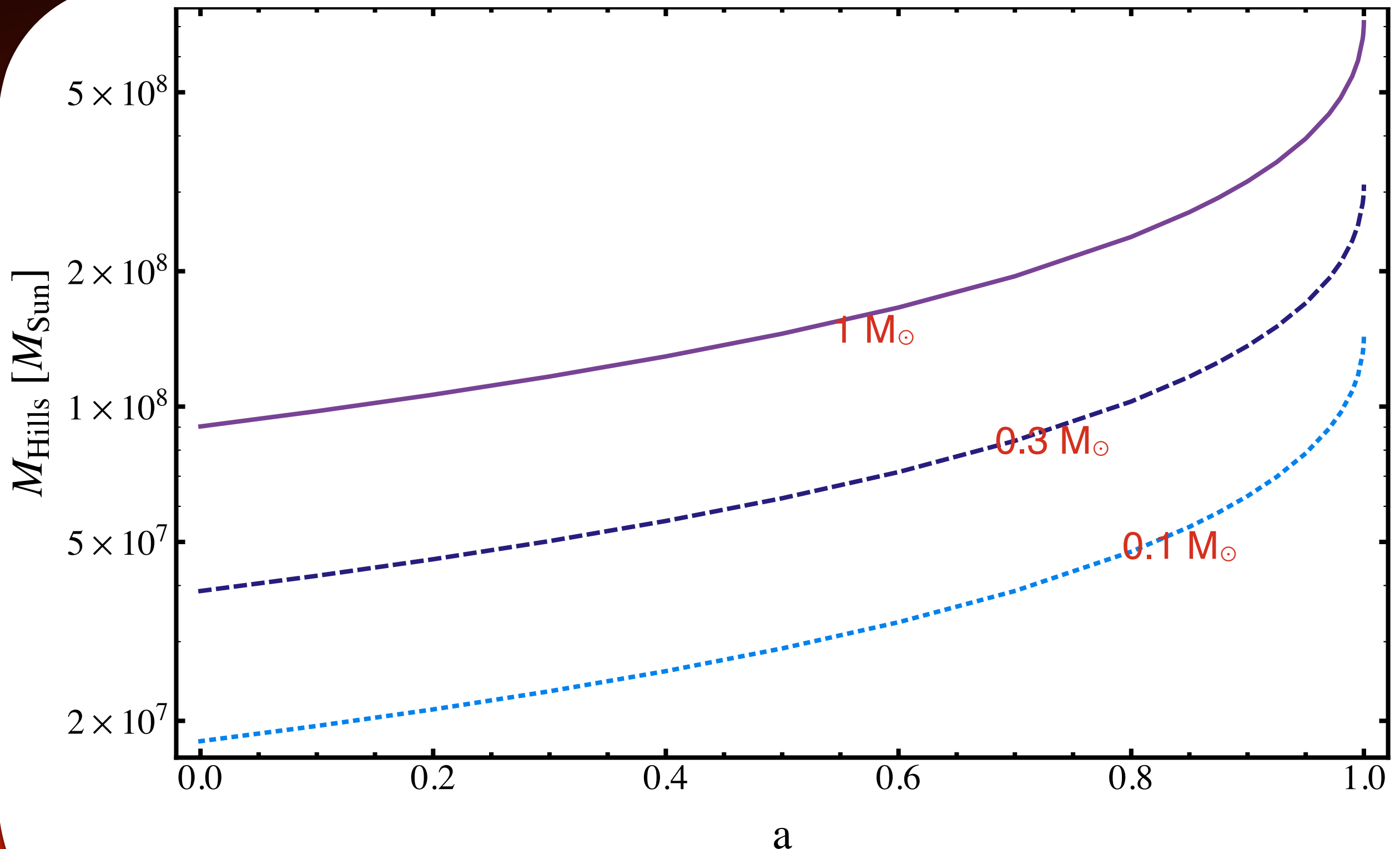


Image courtesy Nick Stone

Leloudas et al. 2017; arXiv 1609.02927

Conclusions:

Has Gaia detected TDEs
already?

If so; might help TDE rate problem &
tool to assess BH spin

If not; what is going on here?