

# Finding IMBHs with X-ray & optically discovered TDEs

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## Disrupting a white dwarf around a massive BH

- Star enters tidal radius of BH: differential gravity leads to disruption A
- fraction of the material remains bound and accretes onto the BH

Typical fallback timescale (Lodato & Rossi, 2011):

$$t_{peak} \sim 41 \times m_{star,\odot}^{-1} \times r_{star,\odot}^{1.5} \times M_{BH,6days}^{1/2} \quad (1)$$

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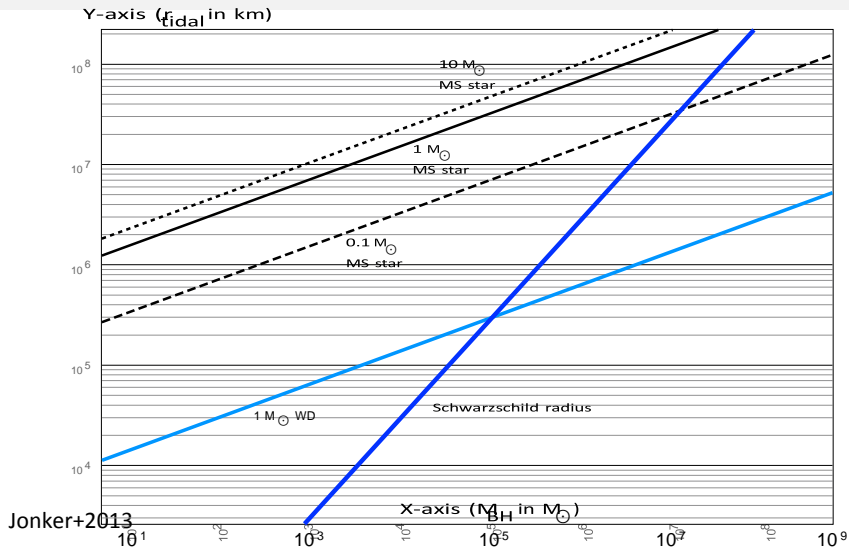
$$t_{peak} \sim 41 \times m_{star,\odot}^{-1} \times r_{star,\odot}^{1.5} \times M_{BH,6days}^{1/2} \quad (1)$$

For a 0.6 MWD:

- tens - 1800 sec for  $M_{BH} \sim 100 - 10^5 M_{\odot}$

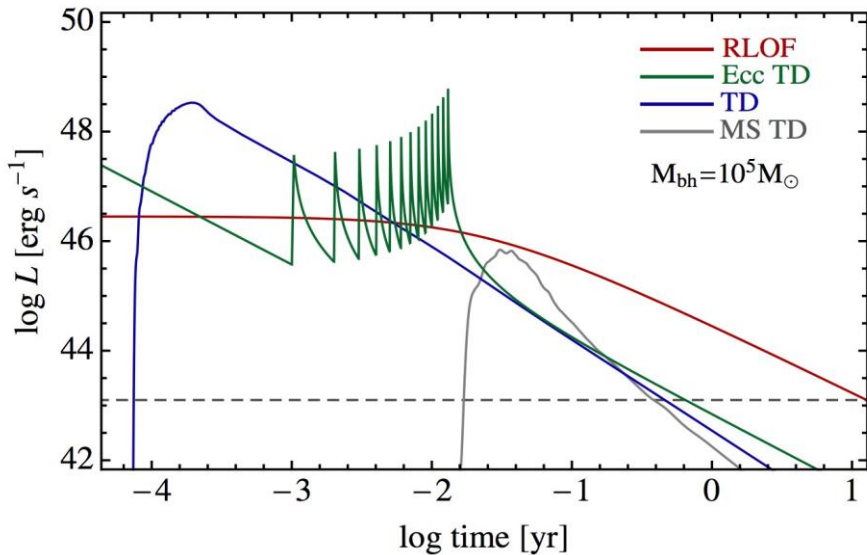
# Tidal disruption events & IMBHs

# Fast X-ray transient XRT000519: WD disrupted by IMBH?



# IMBH disrupting a WD: theoretical predictions

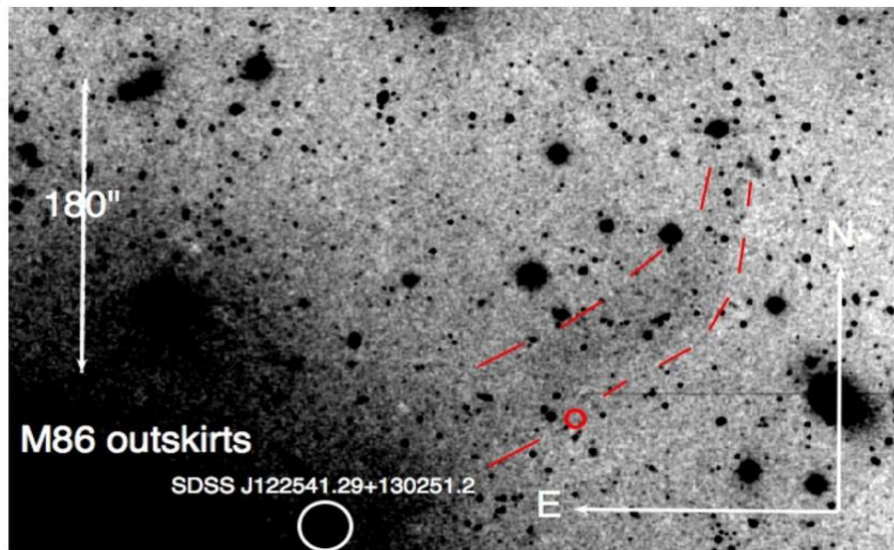
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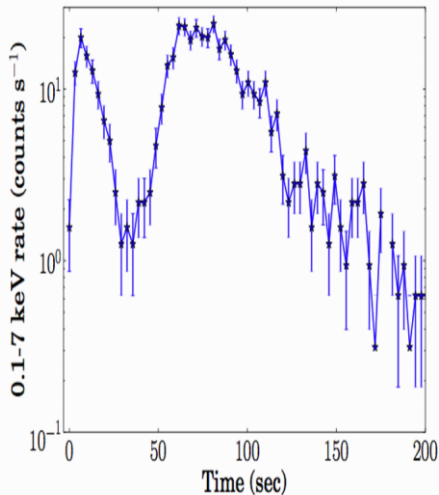
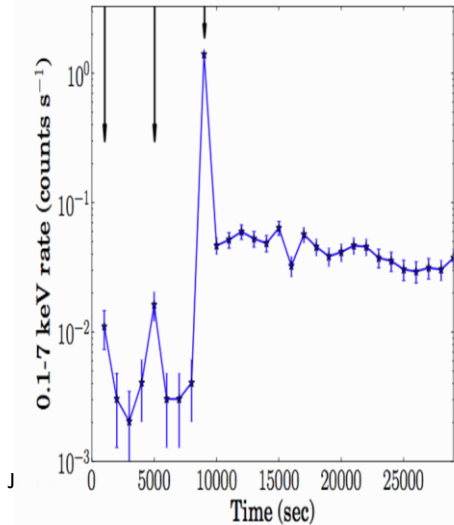


Macleod+2014

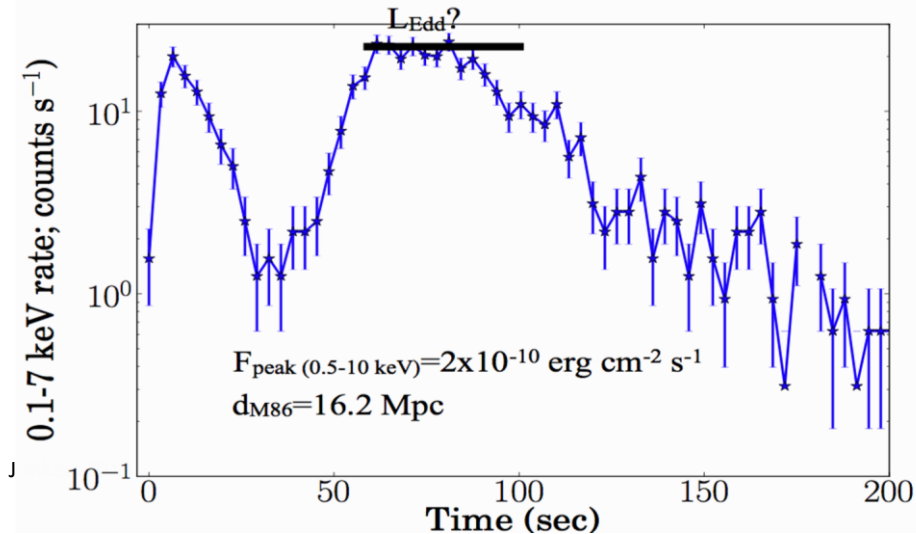
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Can explain precursors

Can explain soft X-ray spectrum

- Peak flux (at M86)  $6 \times 10^{42}$  erg/s  $\Rightarrow M_{BH} \sim 4 \times 10^4 M_{\odot}$
- Optical data consistent with globular cluster
- 
-

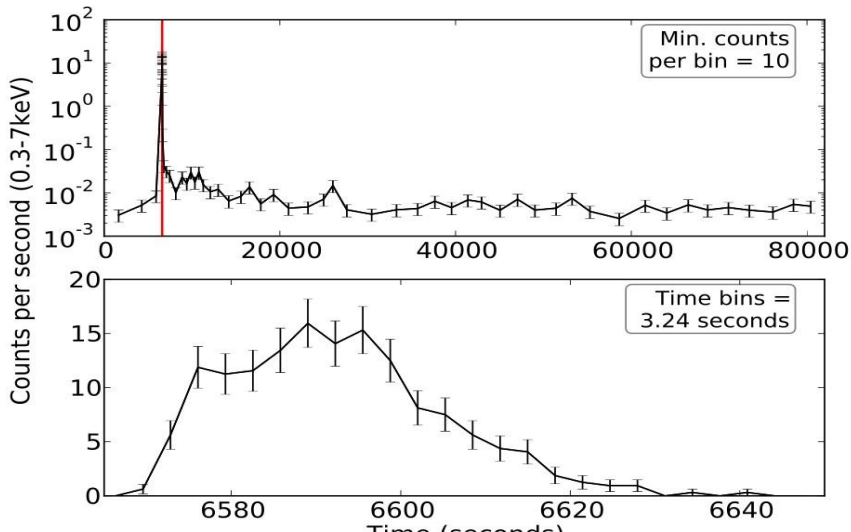
## White dwarf disrupted by IMBH?

- Can explain precursors
- Can explain soft X-ray spectra
- Peak flux (at M86)  $10^{40}$  erg/s  $\Rightarrow M_{BH} \sim 4 \times 10^4 M_{\odot}$
- Optical data consistent with globular cluster

- Foreground neutron star accreting an asteroid Off-axis short GRB / X-ray flash?

Cannot explain the precursor events!

Fast X-ray transient XRT110103: WD disrupted by IMBH?

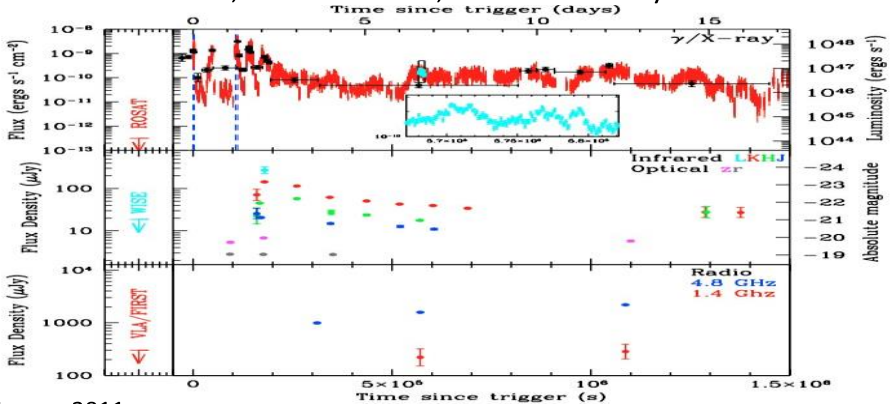




Glennie+, submitted

# Fast X-ray transients: observational diversity

● SwiftJ1644+57, SwiftJ2058+05, CDF-S fast X-ray transient

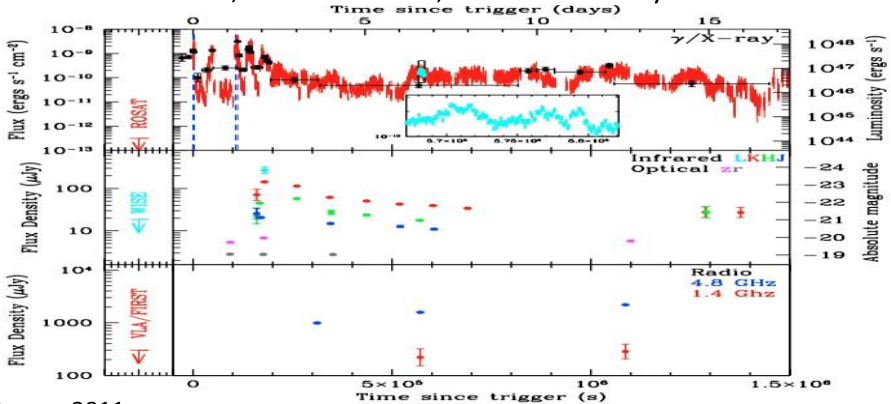


Levan+2011



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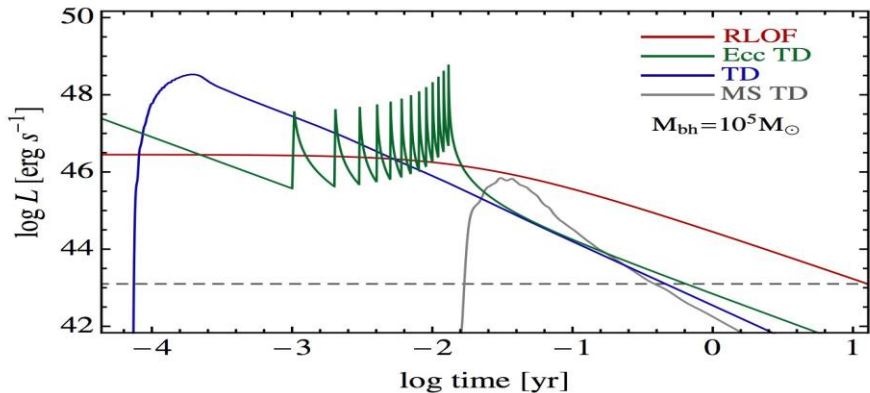


Levan+2011

X-ray detection  $\Rightarrow$  optical follow-up

# Optical emission from TDE around IMBH

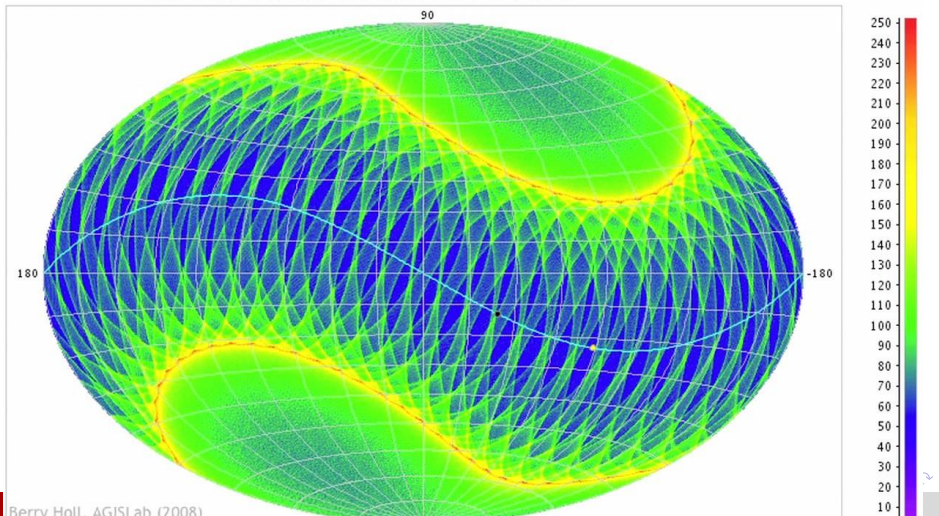
- Precursor events?
- Prompt emission?
- Short timescale optical data can provide critical information!



# Gaia: all-sky optical survey

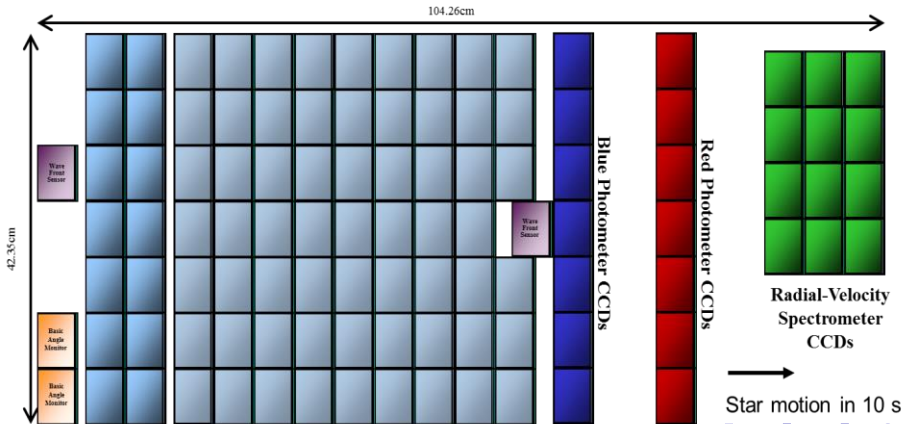


## NSL field transits in ICRS after: 5 years

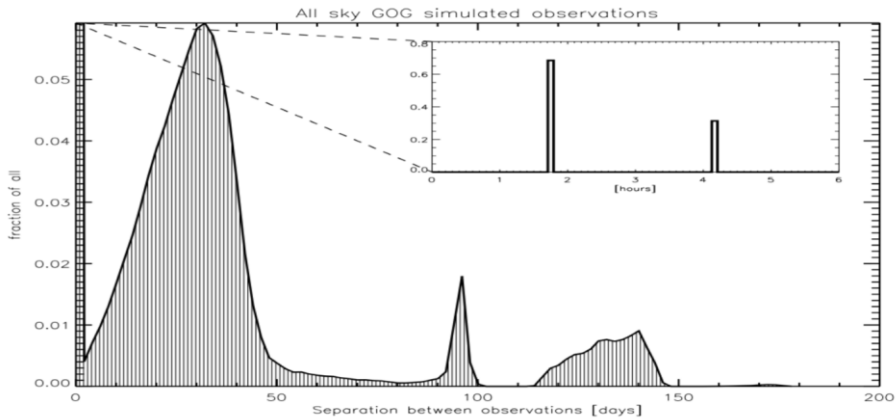


# Gaia focal plane

# Focal Plane



- 10 4.4 s CCD integrations (AF)
- Subsequent FoV transit: 106.5 min
- Time between successive scans: 6 hours



## Summary

- Multiple fast X-ray transients  $\sim 100$ s of seconds in Chandra
- Good candidates for WD disruption around IMBH!
- Likely also in other X-ray surveys (e.g. ROSAT, XMM)

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- Multiple fast X-ray transients  $\sim 100$ s of seconds in Chandra
- Good candidates for WD disruption around IMBH! Likely
- also in other X-ray surveys (e.g. ROSAT, XMM)
  
- Optical emission of such events?
- Search for fast optical transients with Gaia (all-sky,  $V \sim 21$ )
- Typical lightcurve  $\sim 600$  datapoints (70 visits) over 5 years
- Can trigger multi-wavelength follow-up if potential IMBH

