

Tidal Disruptions of Binary Stars

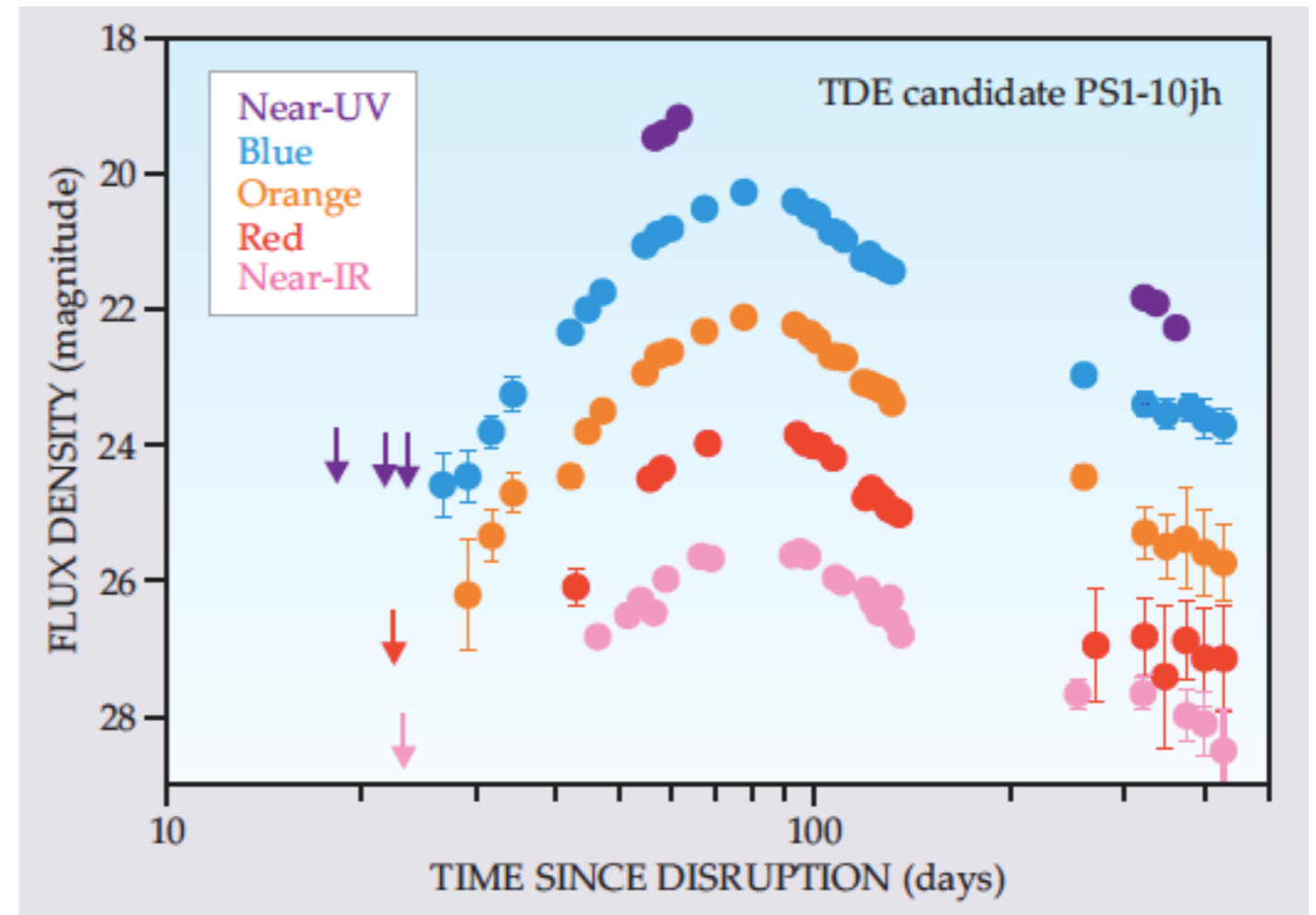
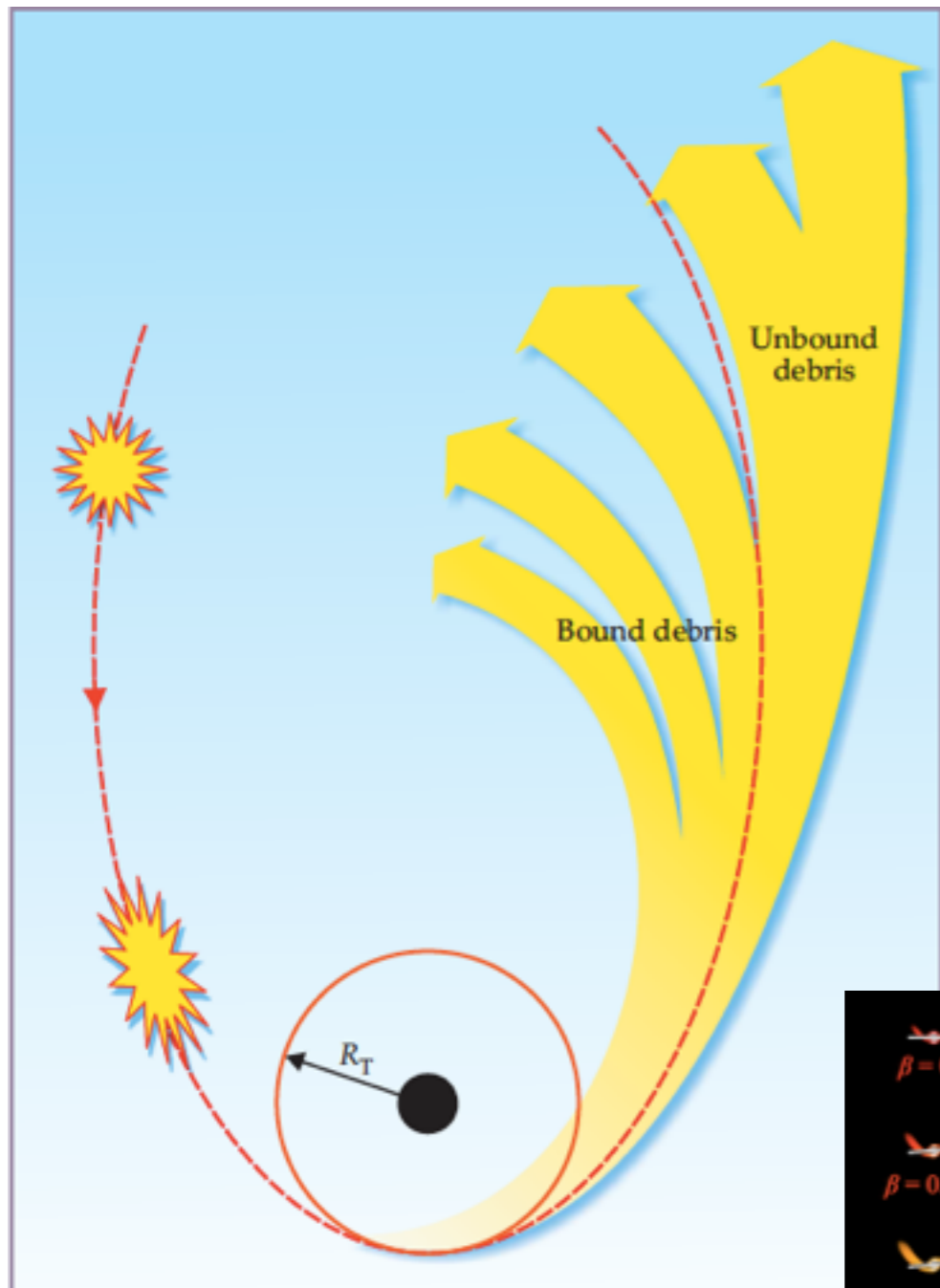
Ilya Mandel

University of Birmingham, UK (and Monash University, Melbourne)

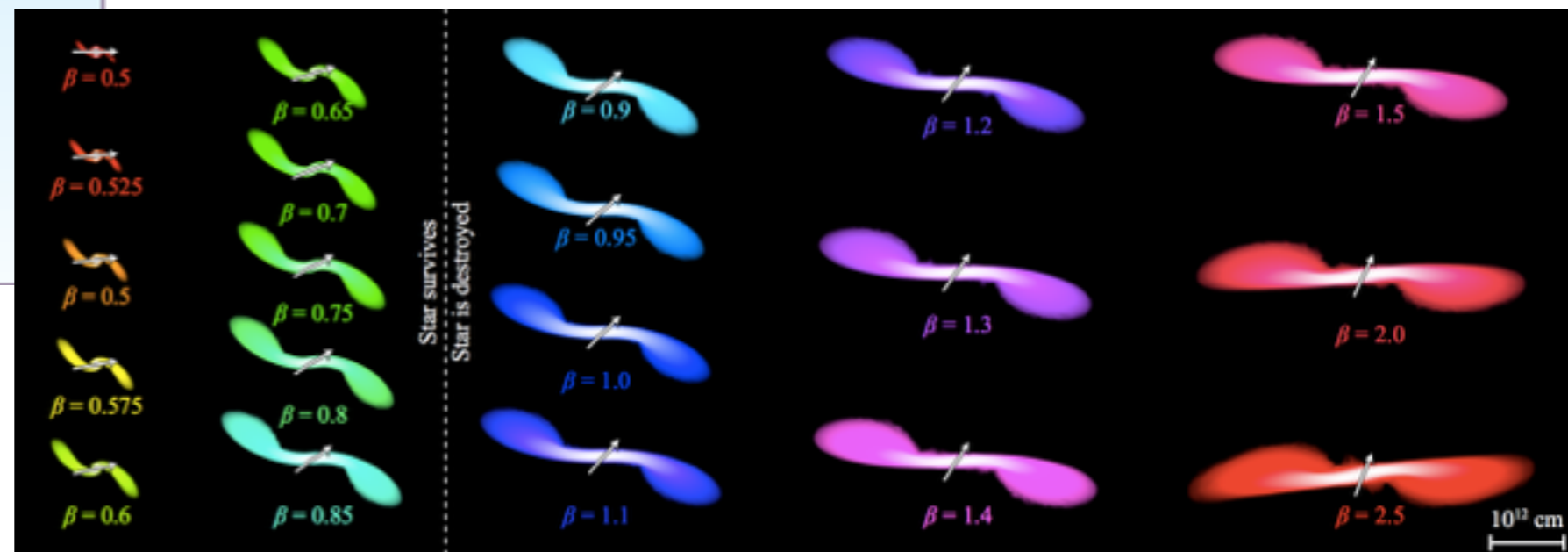
Collaborators: Yuri Levin (Monash), Ben Bradnick (Birmingham)

Aspen, 2/11/2016

Tidal disruption



[Rees, 1988; Gezari, 2014; Guillochon & Ramirez-Ruiz, 2013]



<https://tde.space>

THE OPEN TDE CATALOG













[TDE CATALOG](#)[TDEFIT](#)[ABOUT](#)[LINKS](#)

This catalog is intended to be a "catch-all" list of possible tidal disruption events (TDEs) that have been claimed over the years in the literature, even for events in which the favored interpretation is not a tidal disruption.

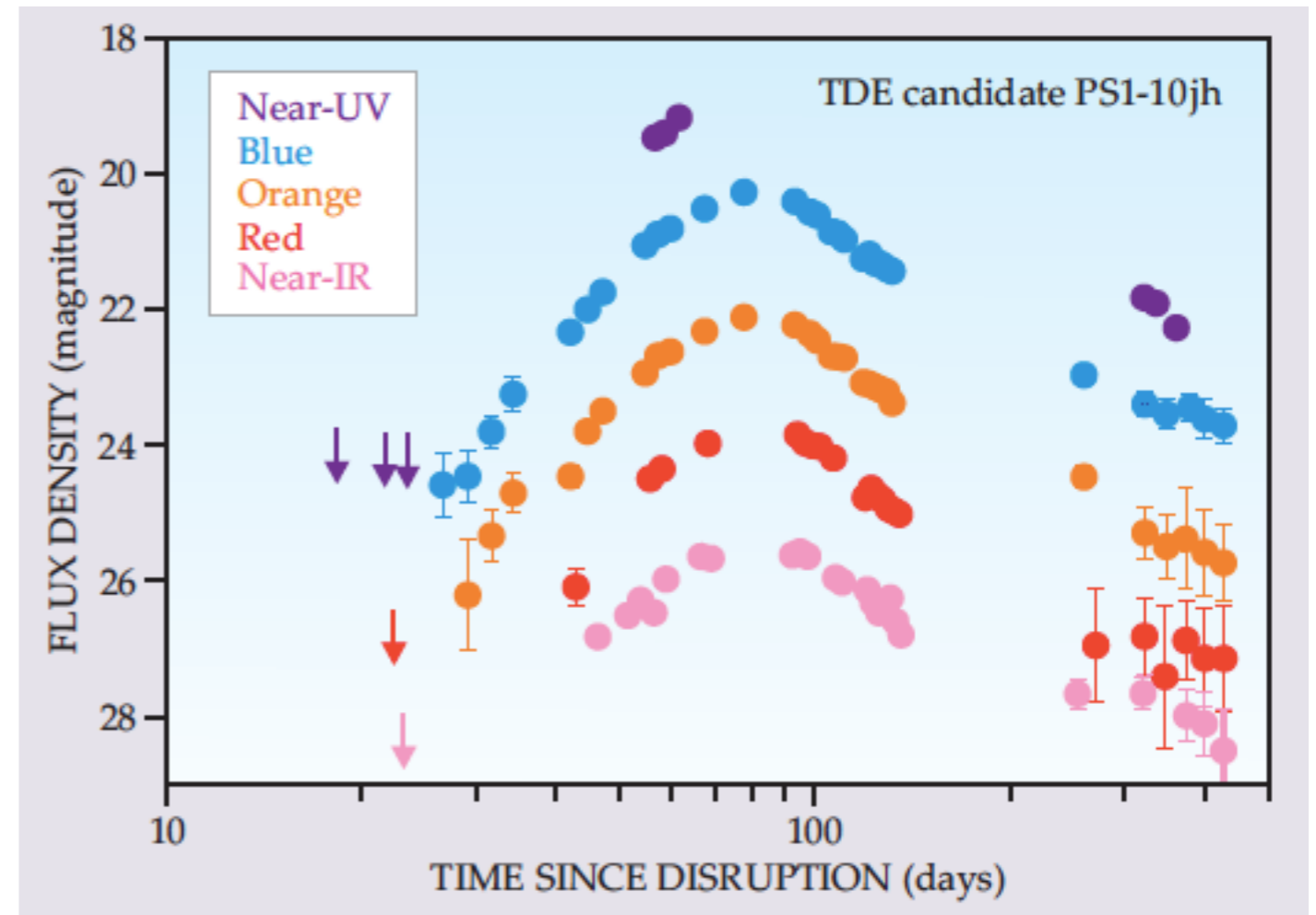
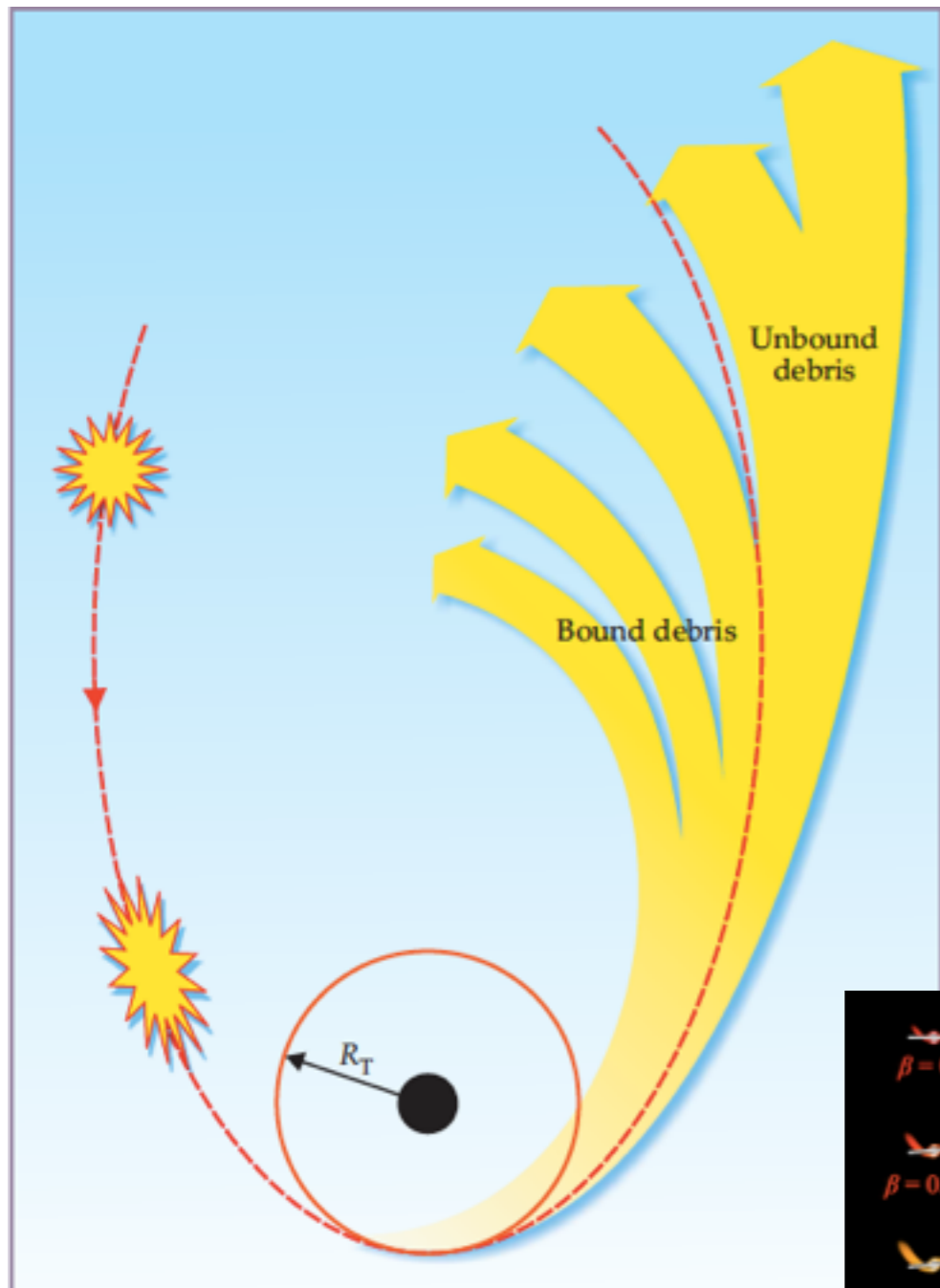
The catalog is a continual work in progress, and is likely missing a few events and may have a few mistakes. Please e-mail one of the maintainers of this catalog (currently [James Guillochon](#) and [Katie Auchetti](#)) if you'd like to add any missing events or correct any of the entries, or if you'd like to suggest ways that the catalog can be improved.

The table below is auto-updated from a [BitBucket repository](#) which encodes the data on each event as a series of ASCII files in [TDEFit](#) format.

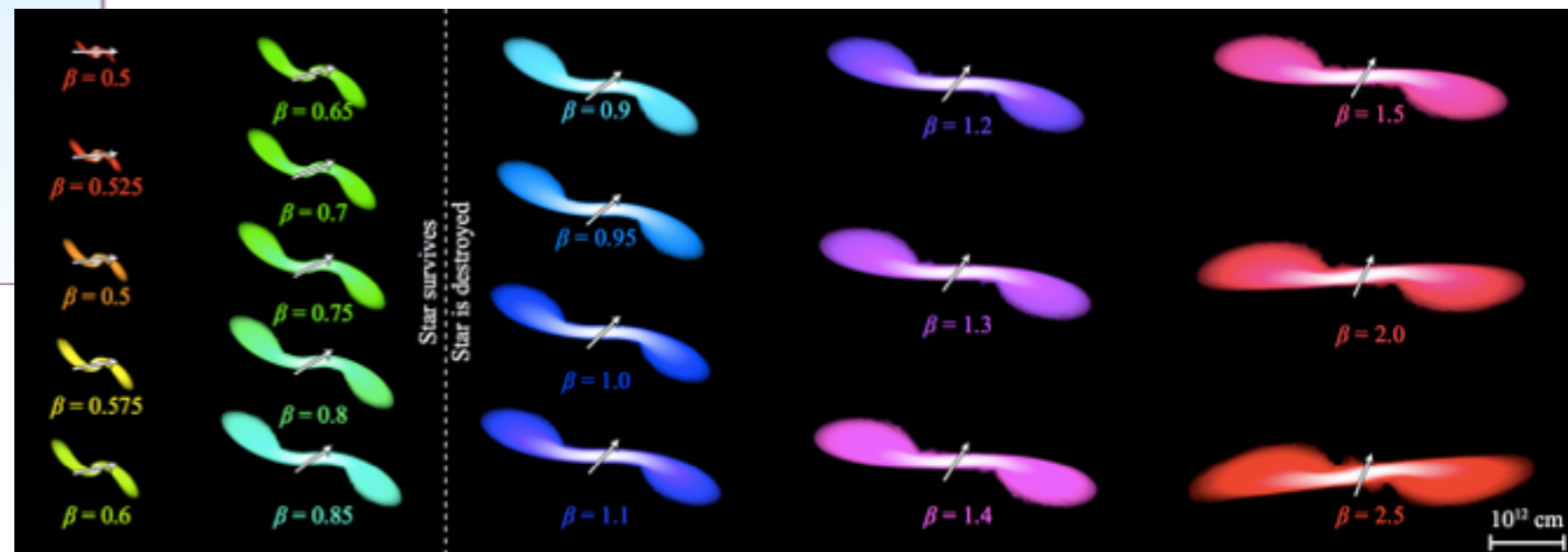
The data provided on this page is culled from published works. If you use this data, please reference the relevant works, and please reference this webpage. Thanks!

Select all	Deselect all	Column visibility	Export selected to CSV	Search:						
Name	Disc. Date	m_{\max}	Host Name	Instruments/Bands	z	Claimed Type	Phot.	Citations		
<input type="checkbox"/>	ASASSN-14li	2014/11/11	15.8	SDSS J124815.23+174626.4	Bessel (V), UVOT (M2, W1, W2, U, B, V), XRT (hard, soft)	0.0206	TDE	 437	Holoien et al. 2015*	
<input type="checkbox"/>	ASASSN-14ae	2013/01/25	16.47	SDSS J110840.11+340552.2	Bessel (V), SDSS (u, g, r, i, z), UVOT (M2, W1, W2, U, B, V)	0.0436	TDE	 228	Holoien et al. 2014*‡	
<input type="checkbox"/>	PTF-09ge	2009/05/07	17.61	SDSS J145703.17+493640.9	PTF 48-Inch (g, r), PTF 60-Inch (g, r, i)	0.064	TDE	 132	Arcavi et al. 2014*‡	
<input type="checkbox"/>	PS1-10jh	2009/05/23	19.18	SDSS J160928.27+534023.9	Chandra (z), GALEX (NUV), Pan-STARRS1 (g, r, i, z), XMM (NUV)	0.1696	He + SMBH, MS + SMBH	 113	Gezari et al. 2012*‡ , Guillochon et al. 2013‡	
<input type="checkbox"/>	PS1-11af	2010/12/30	21.35	SDSS J095726.82+031400.9	GALEX (NUV), Pan-STARRS1 (g, r, i, z)	0.4046	MS + SMBH	 74	Chornock et al. 2013*‡	
<input type="checkbox"/>	TDE1	2005/11/19	20.74	SDSS J081201.12+012300.9	GALEX (FUV, NUV), SDSS (u, g, r, i, z)	0.136	TDE	 73	Van Velzen et al. 2011‡	

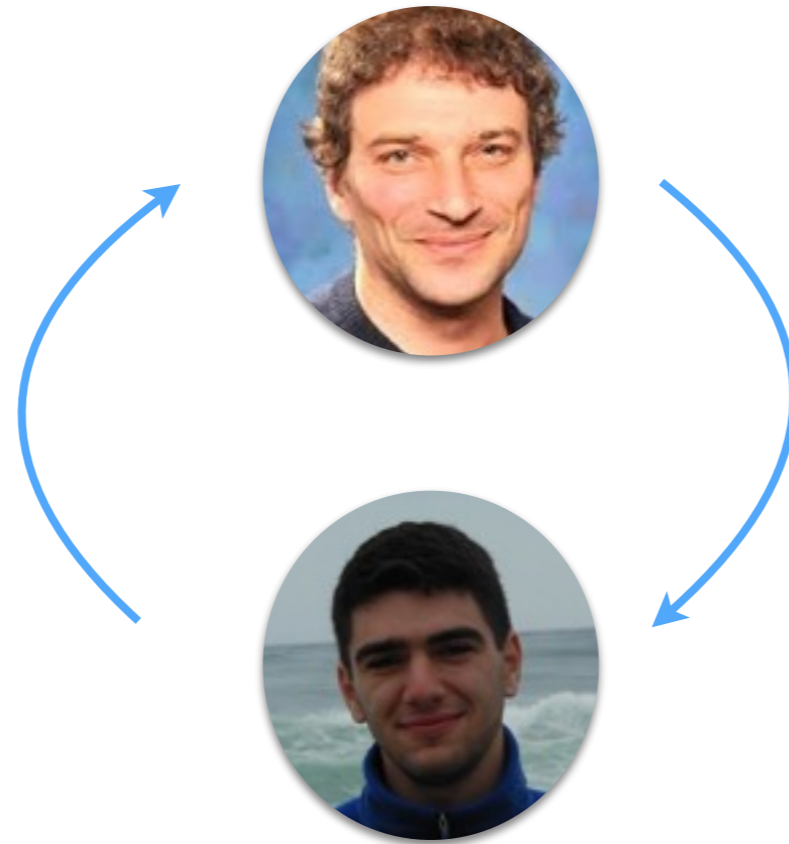
Tidal disruption



[Rees, 1988; Gezari, 2014; Guillochon & Ramirez-Ruiz, 2013]

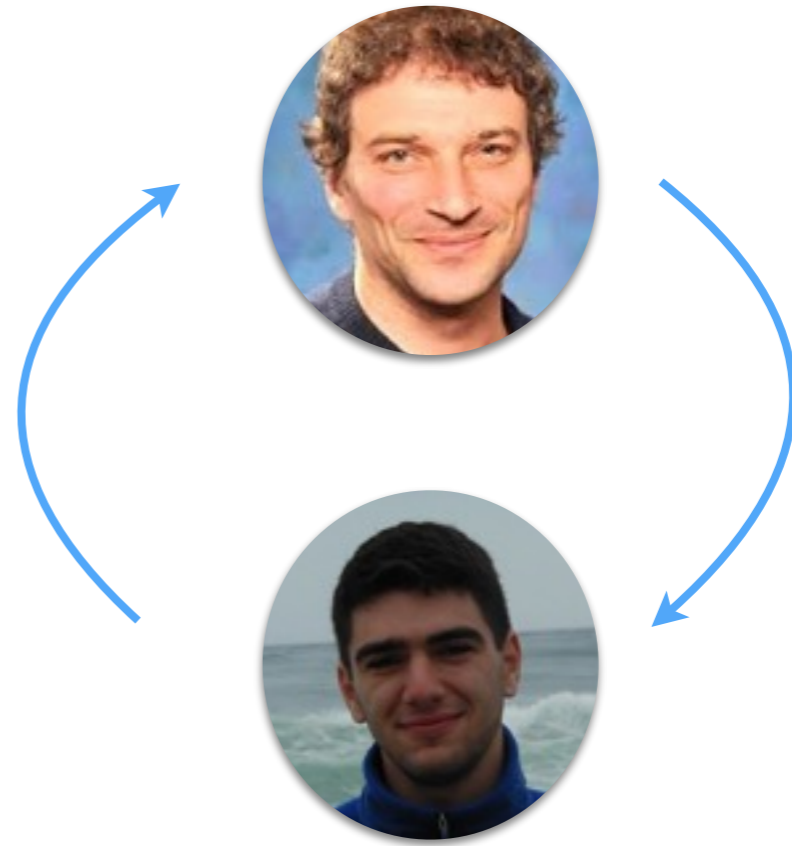


Binary tidal disruptions

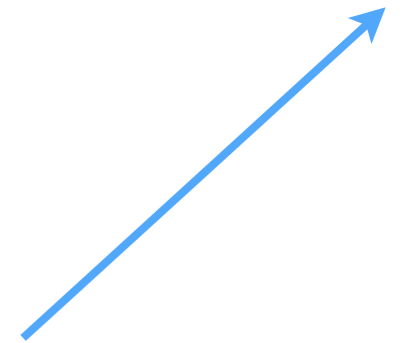
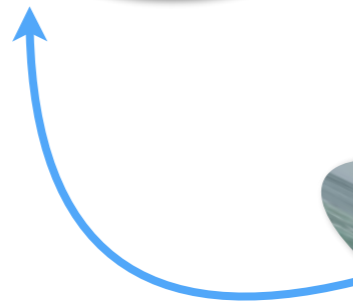


[I. Mandel and Y. Levin. 2015.
Double tidal disruptions in galactic nuclei.
ApJ Letters, 805, L4. arXiv:1504.02787]

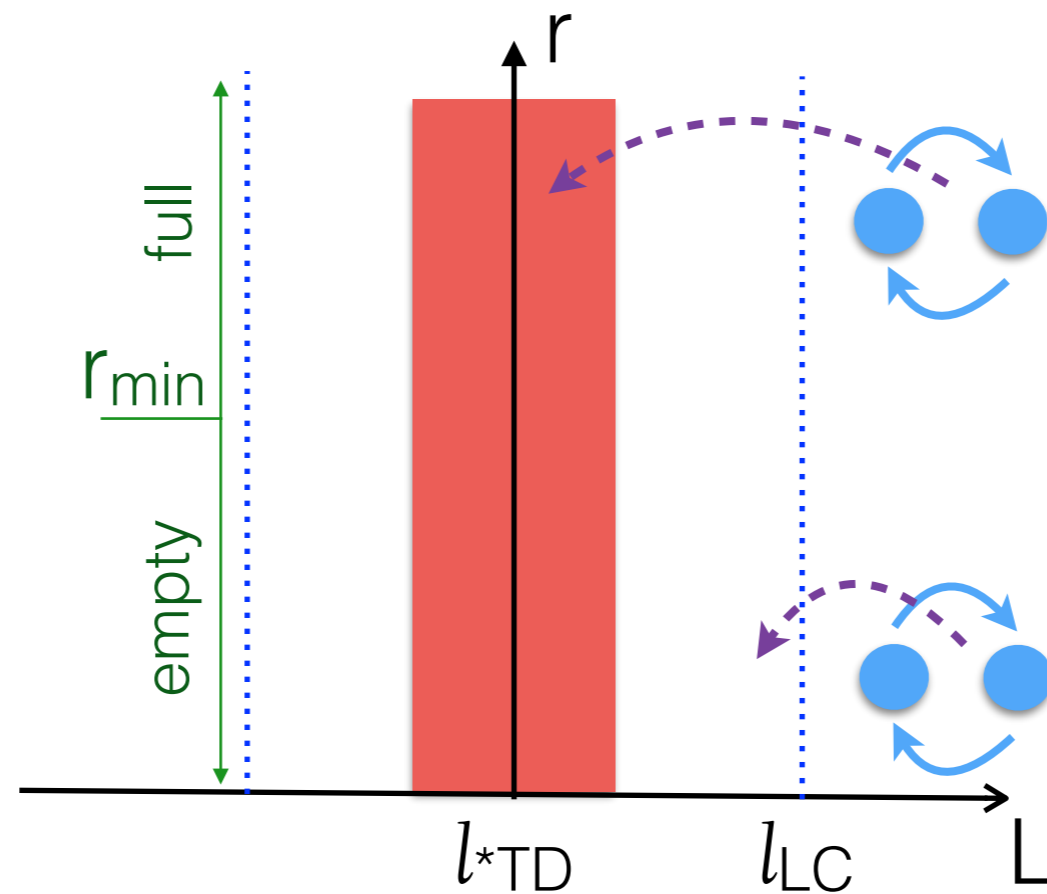
Binary tidal disruptions



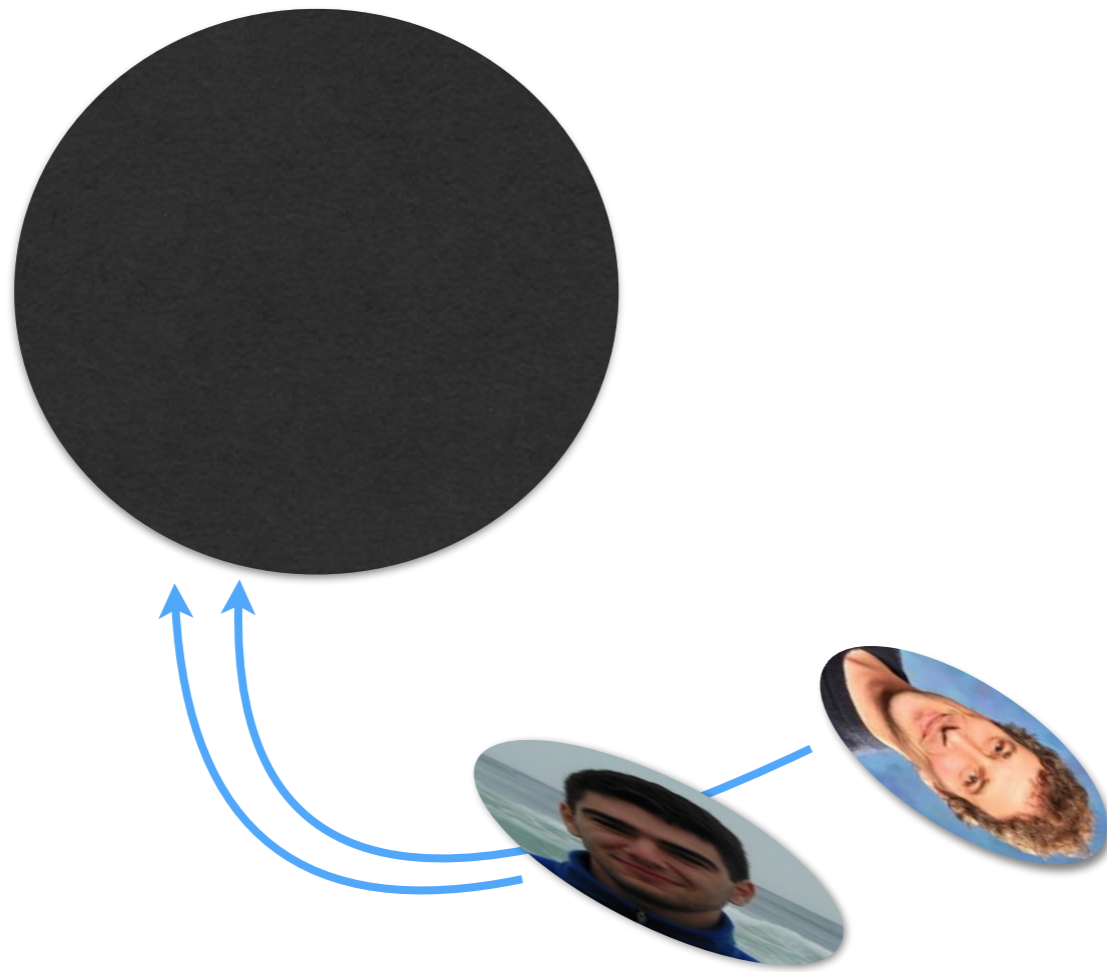
Binary tidal disruptions



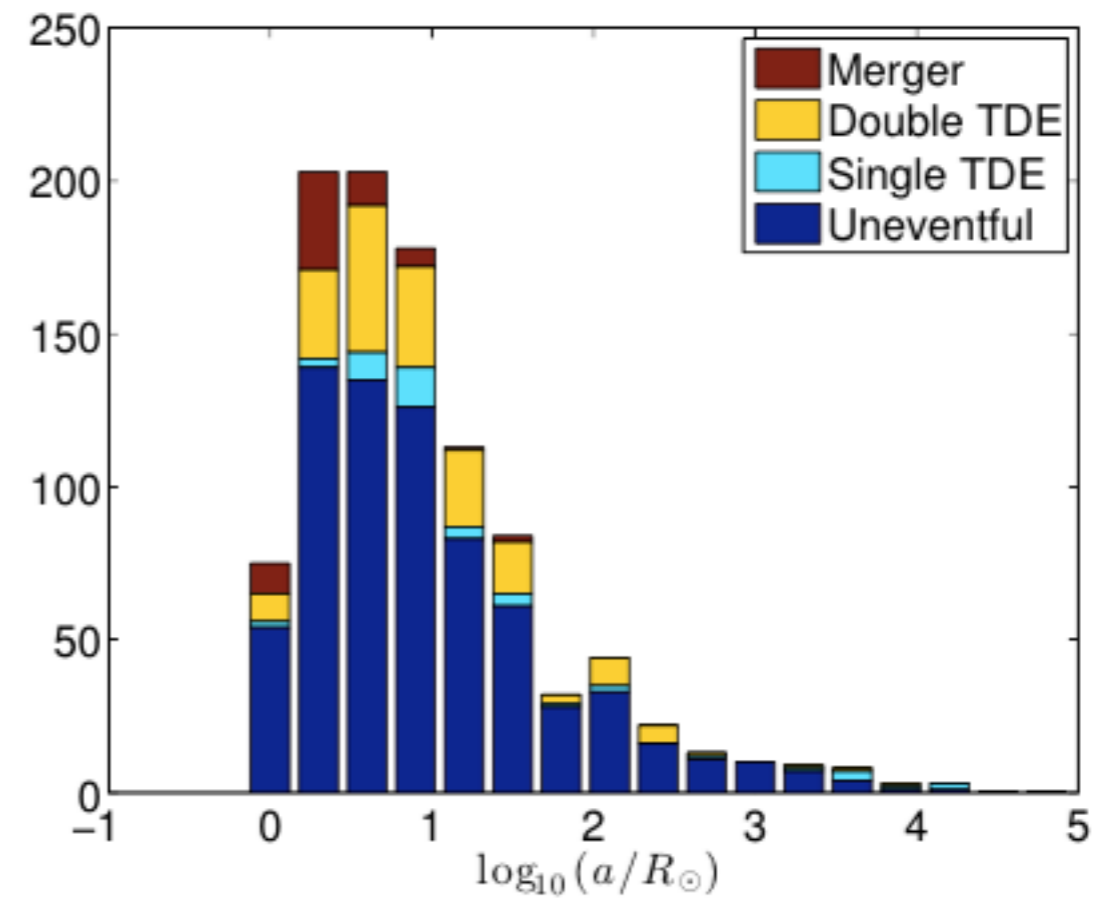
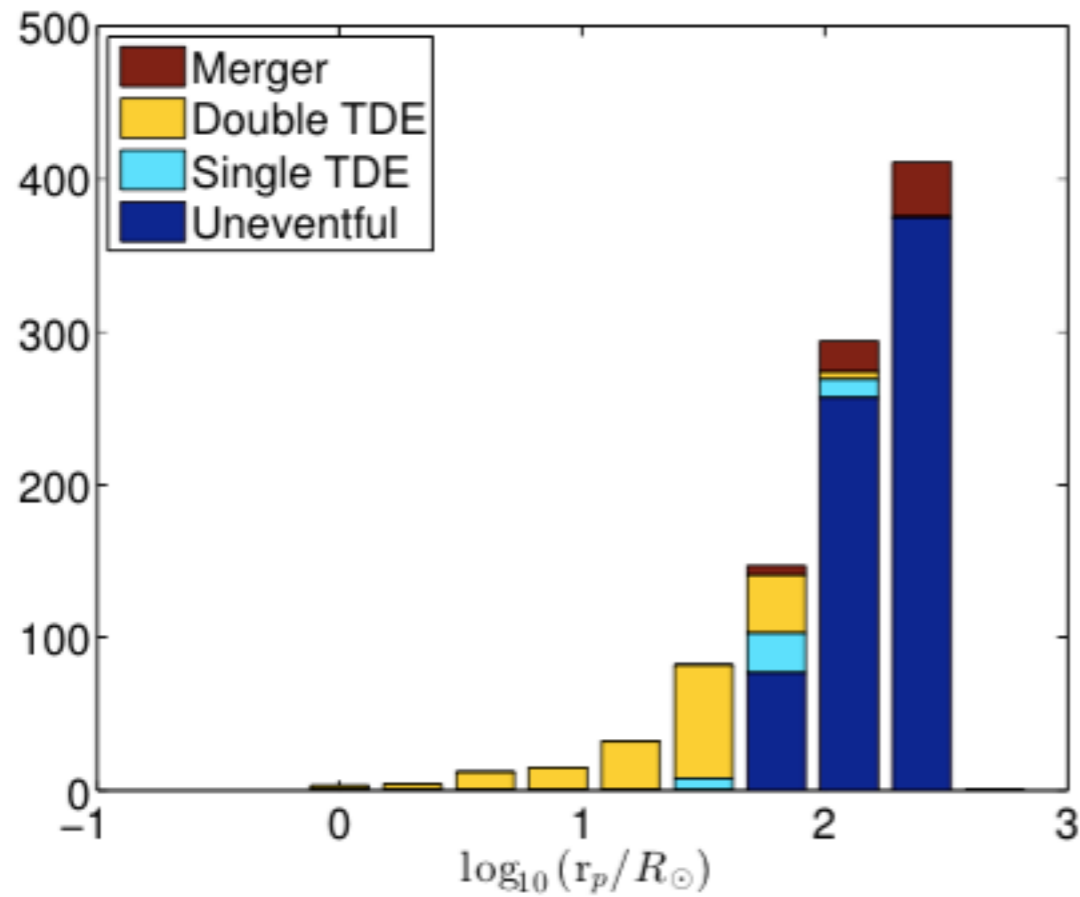
Loss cone physics



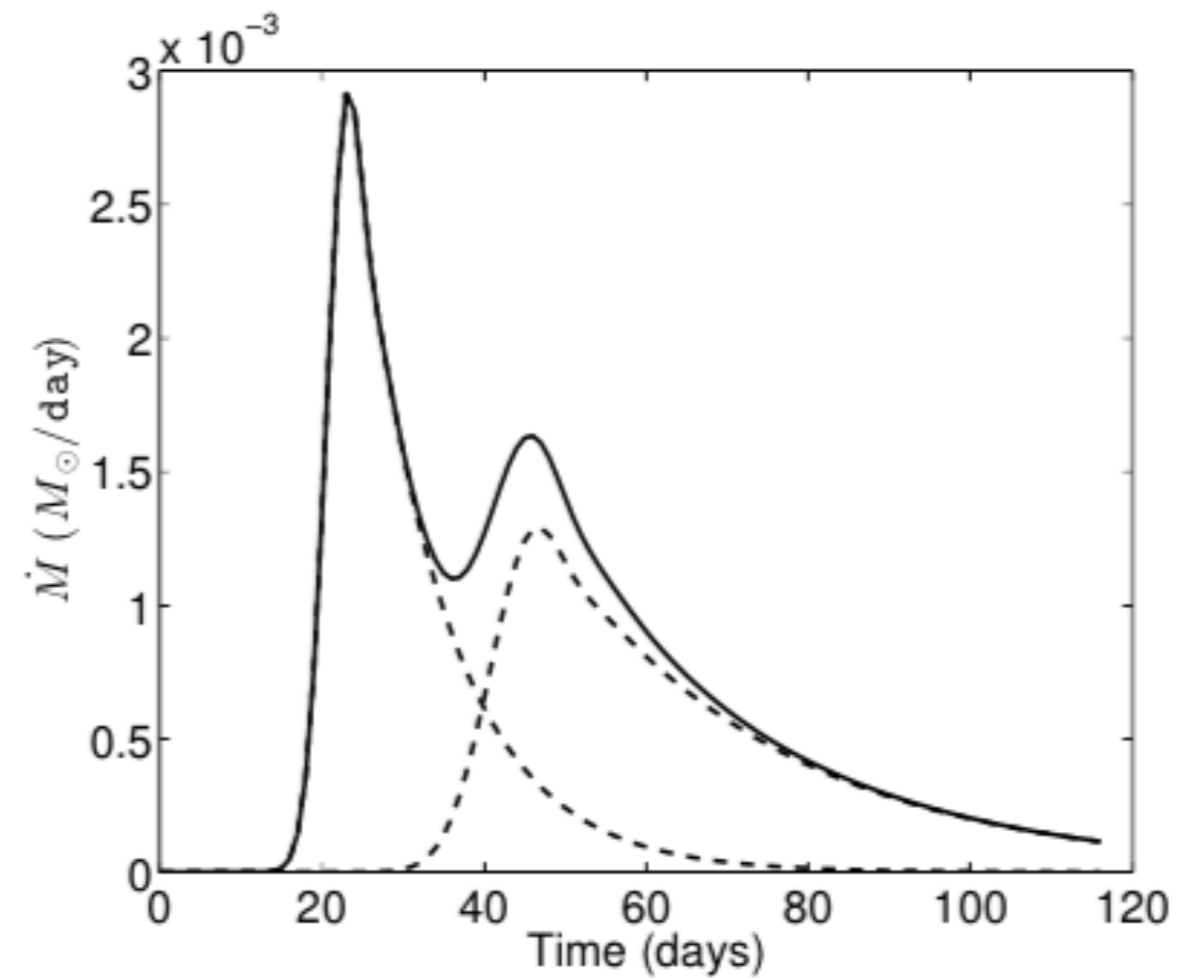
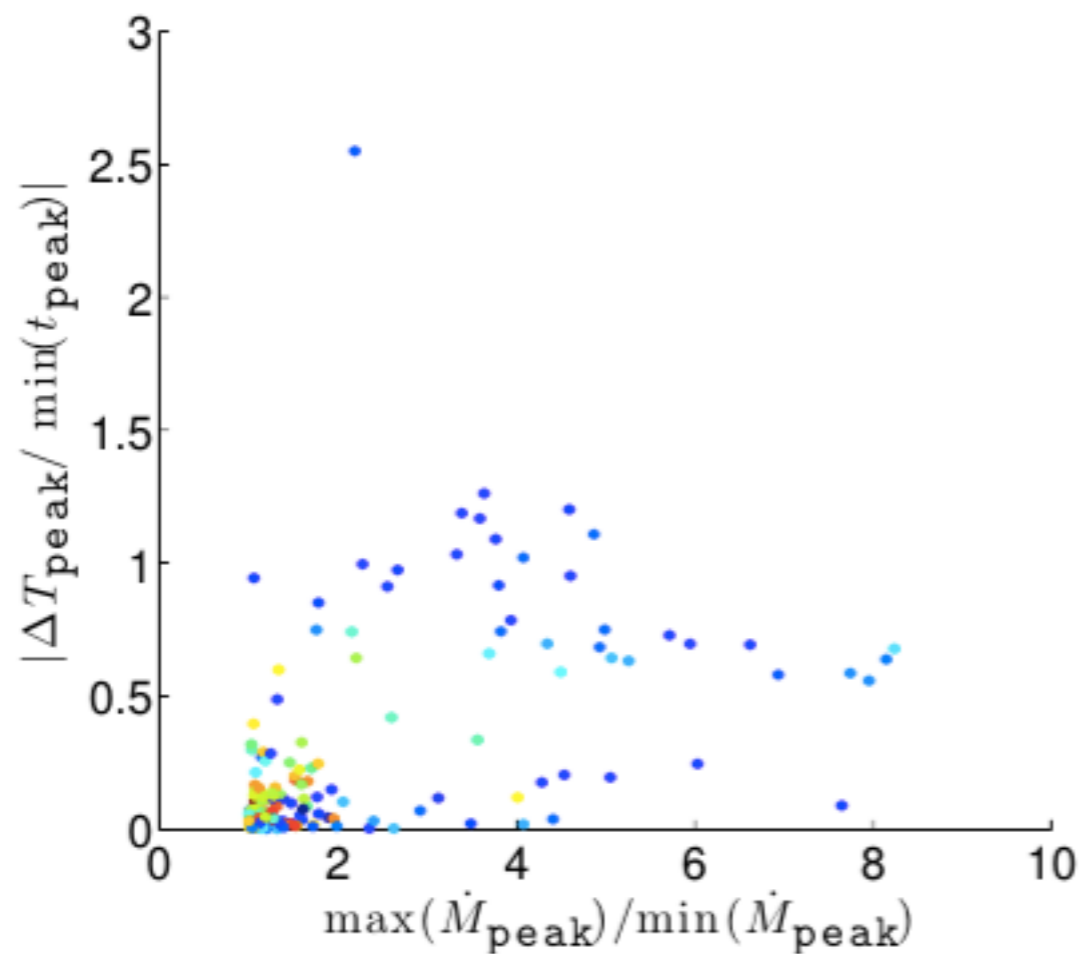
Double tidal disruptions



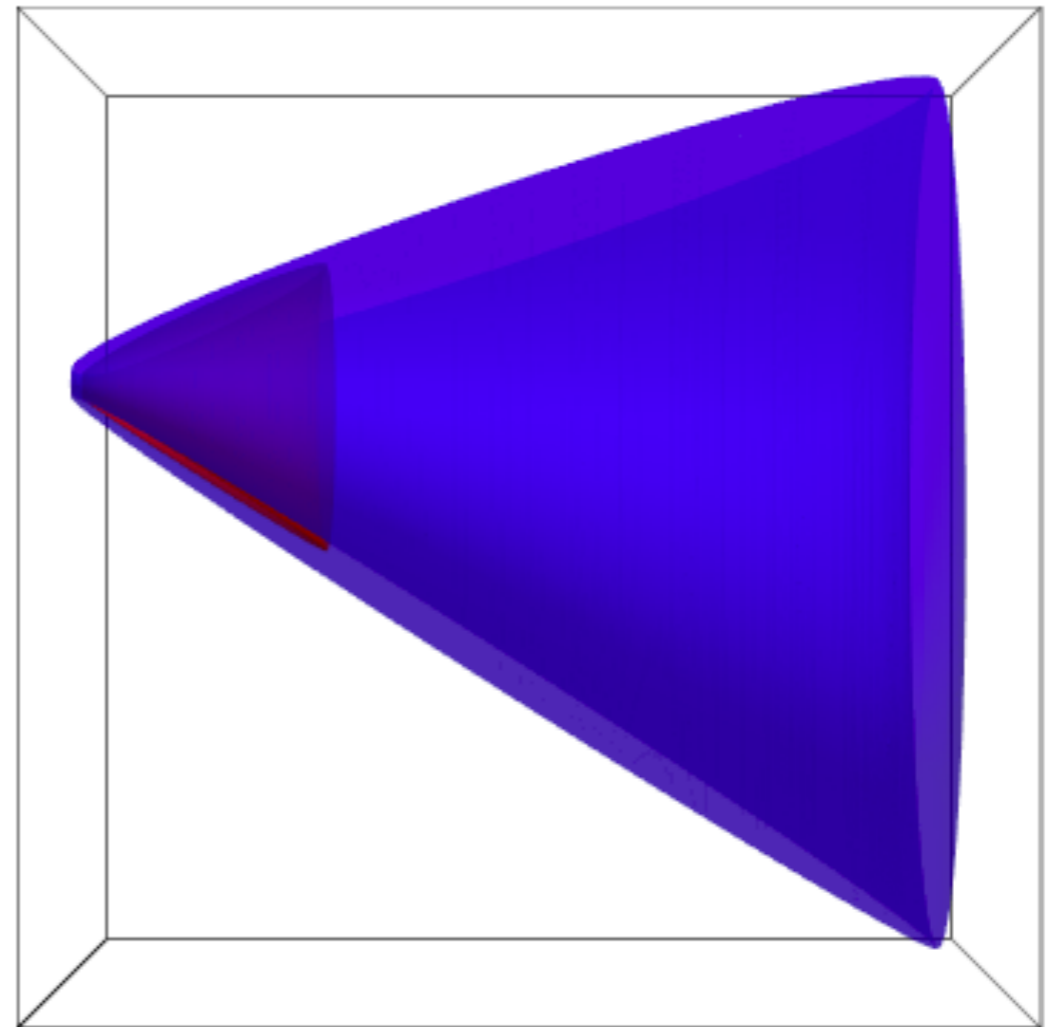
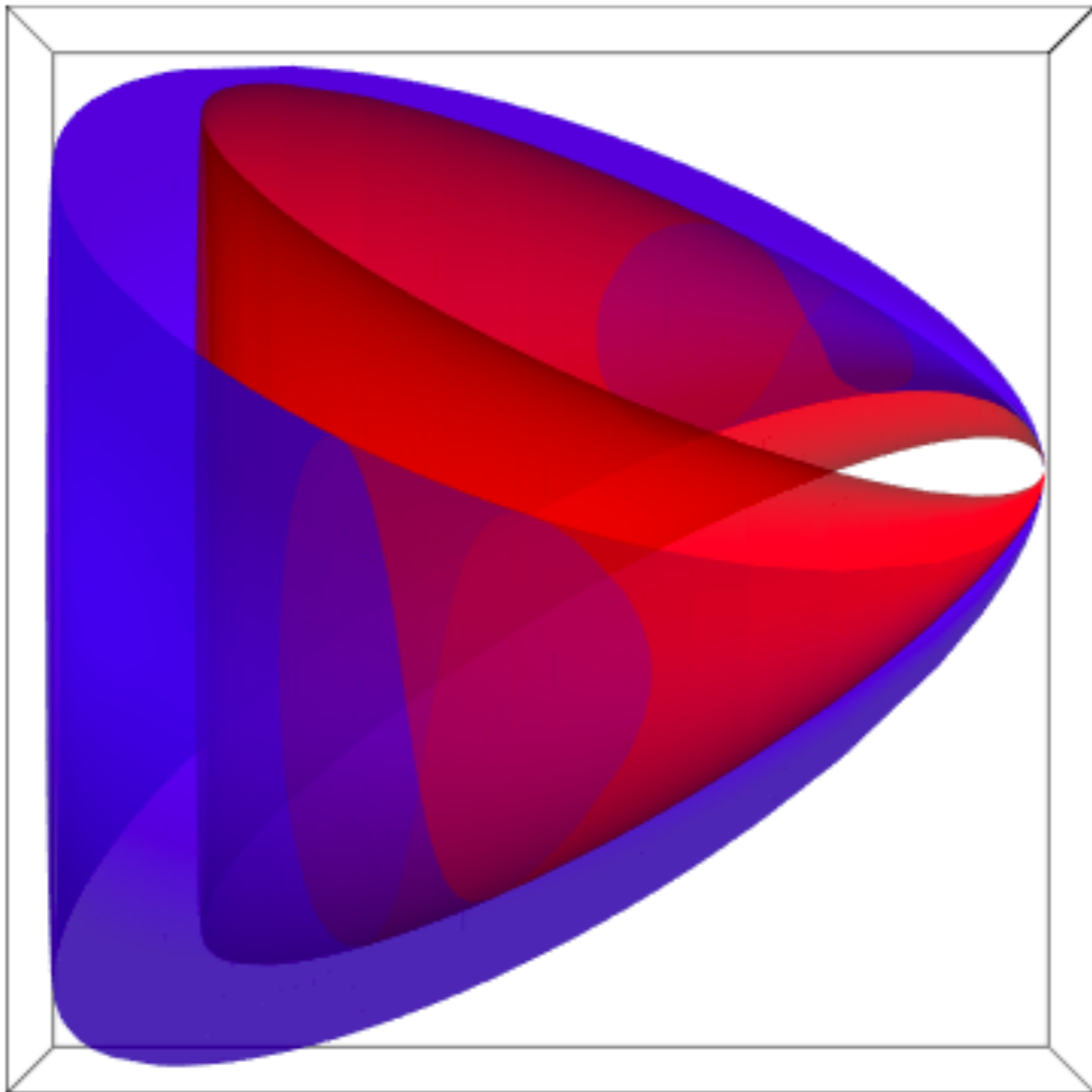
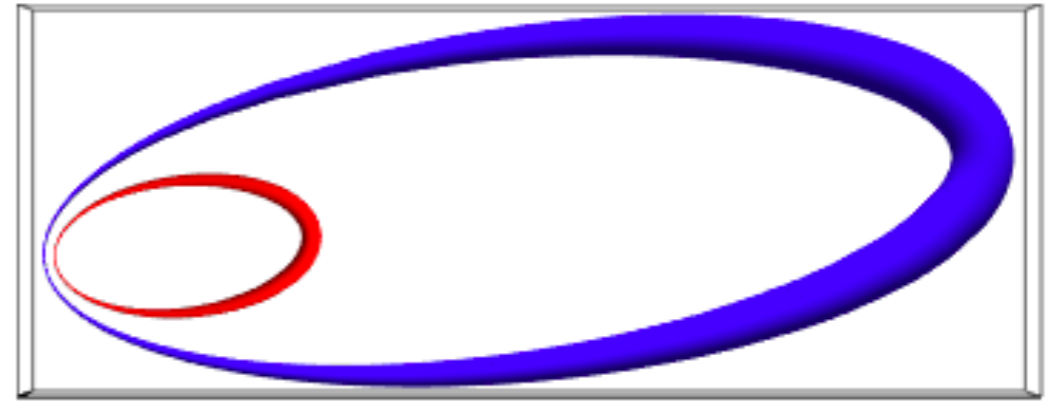
Double tidal disruptions, I



Double tidal disruptions, II

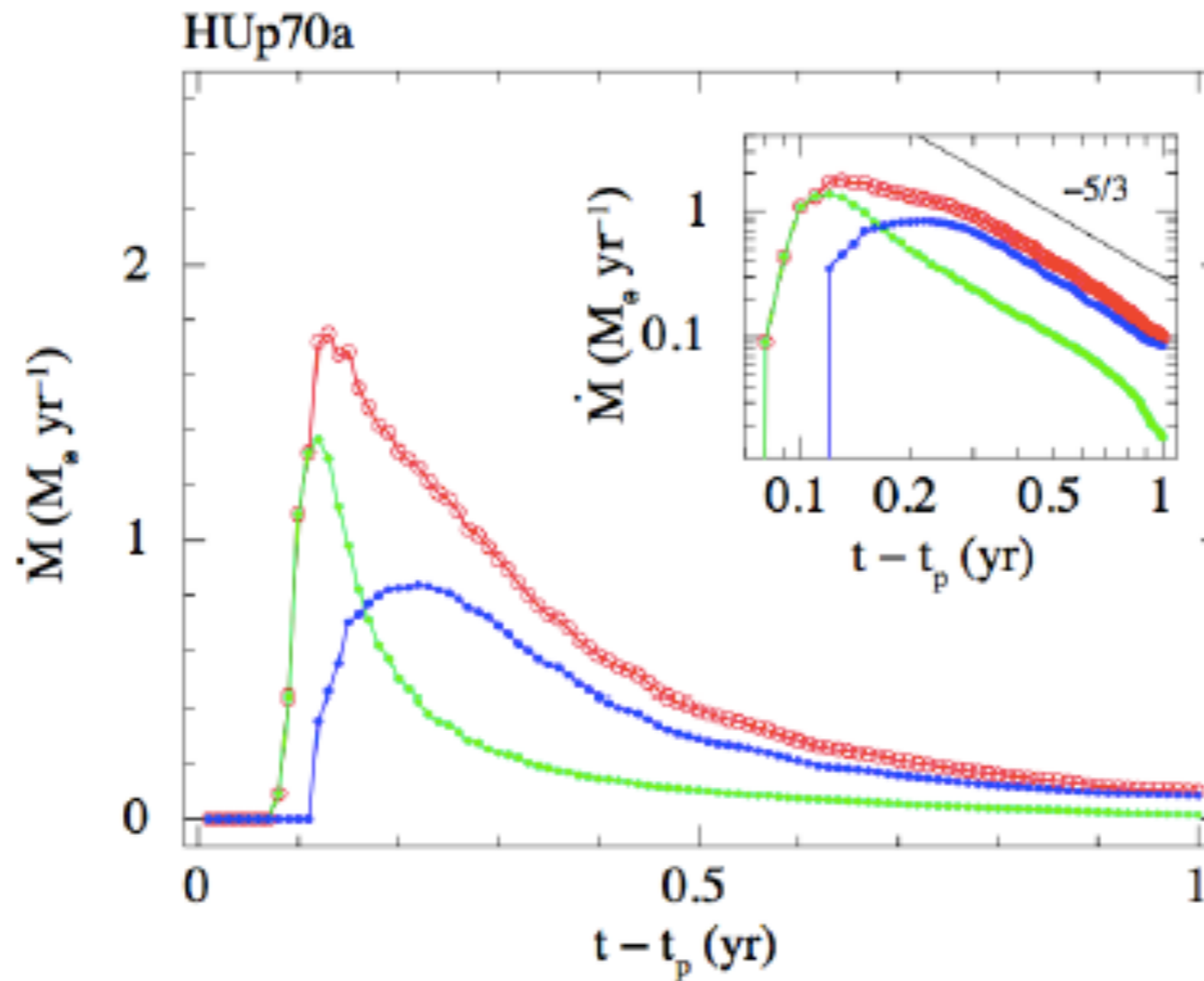


Visualizations



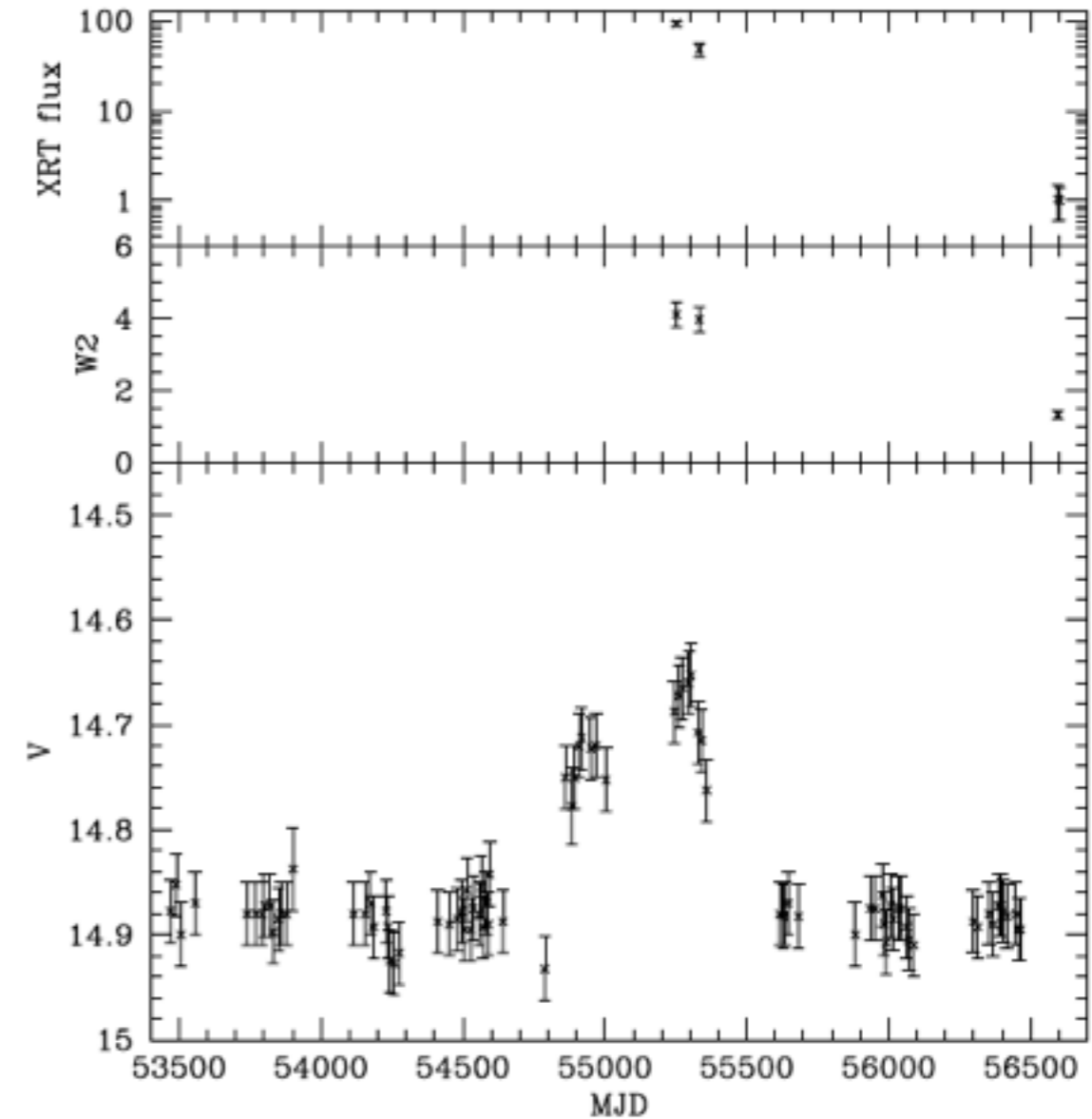
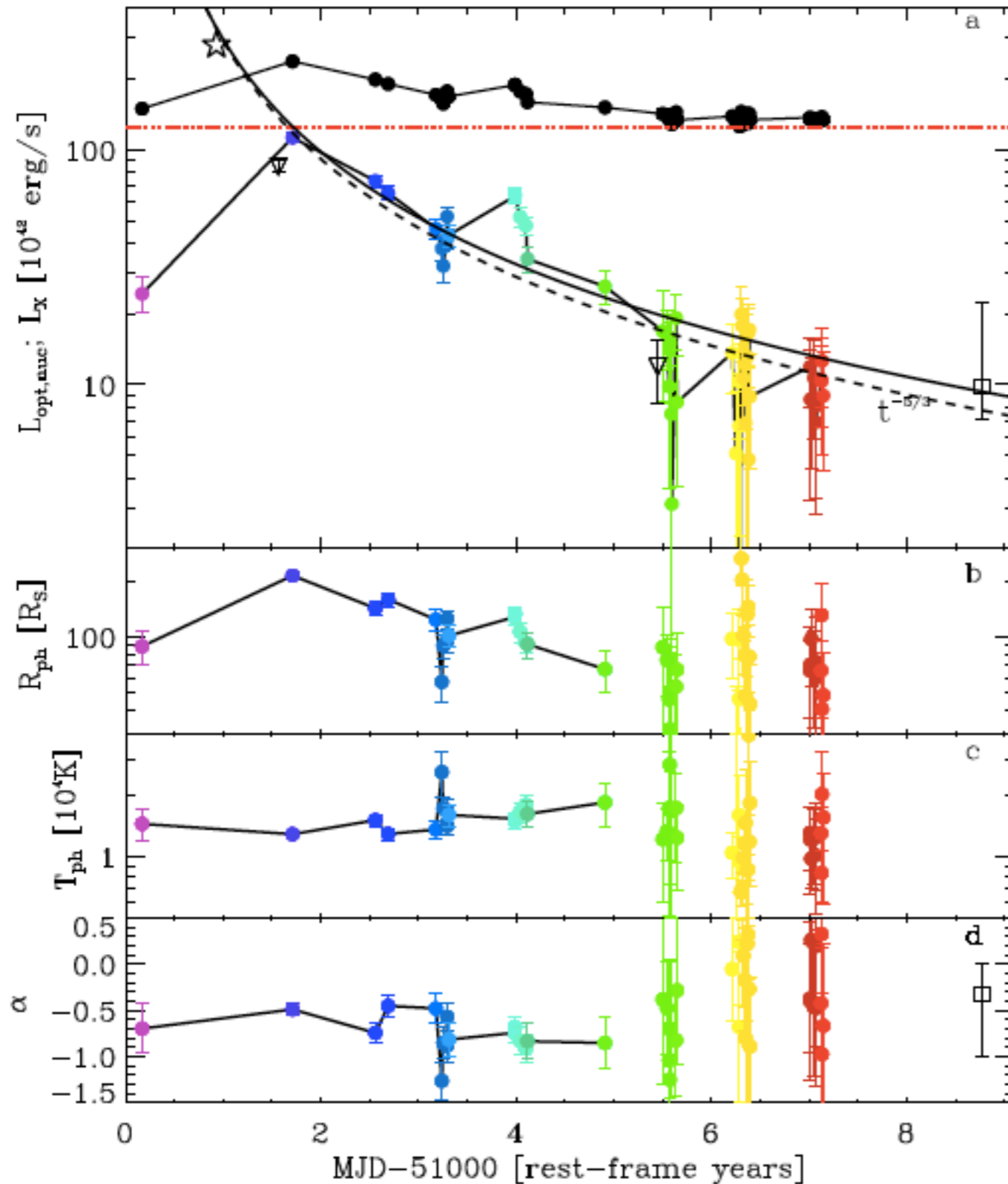
[visualizations courtesy of James Guillochon]

Simulations



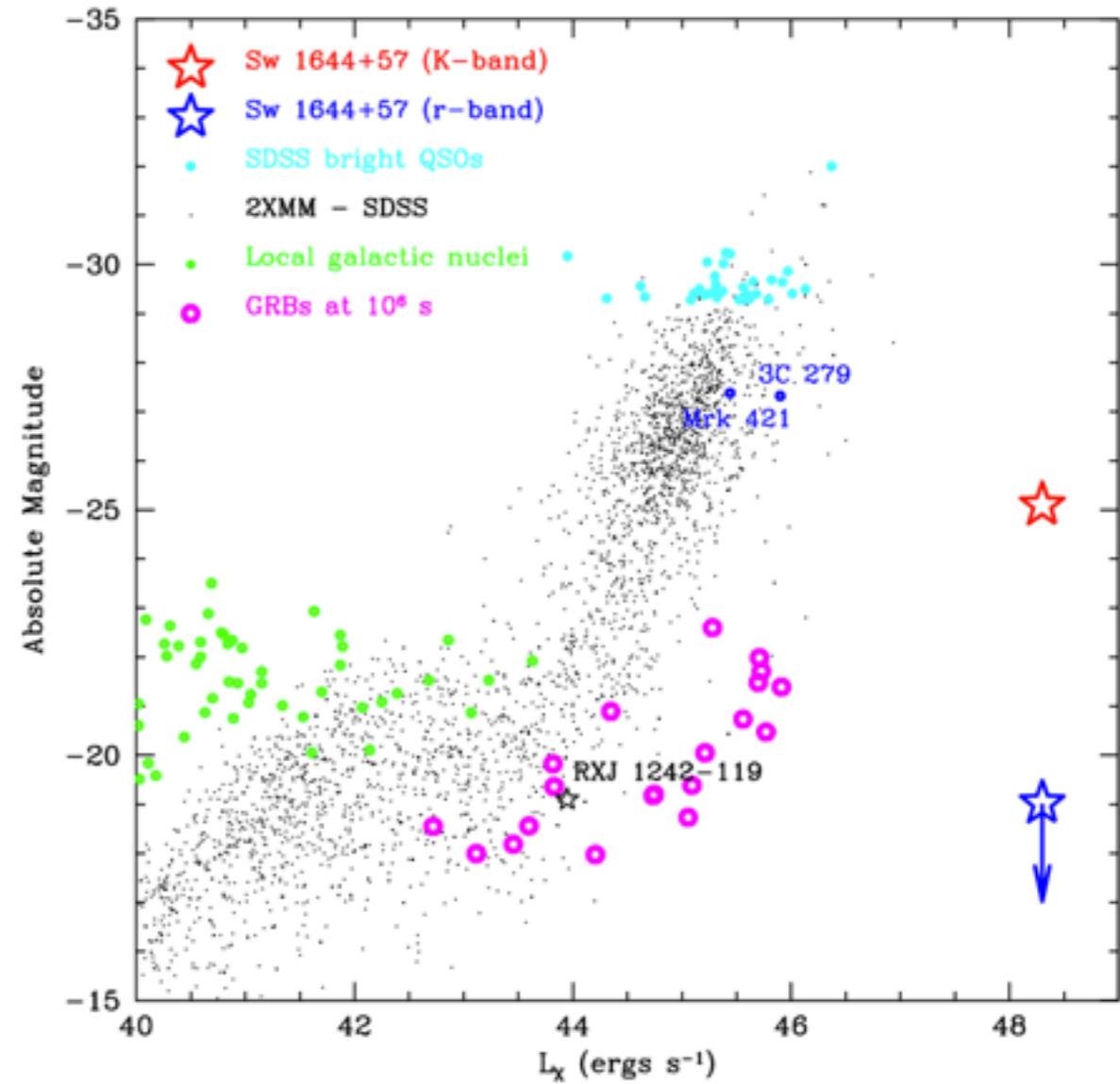
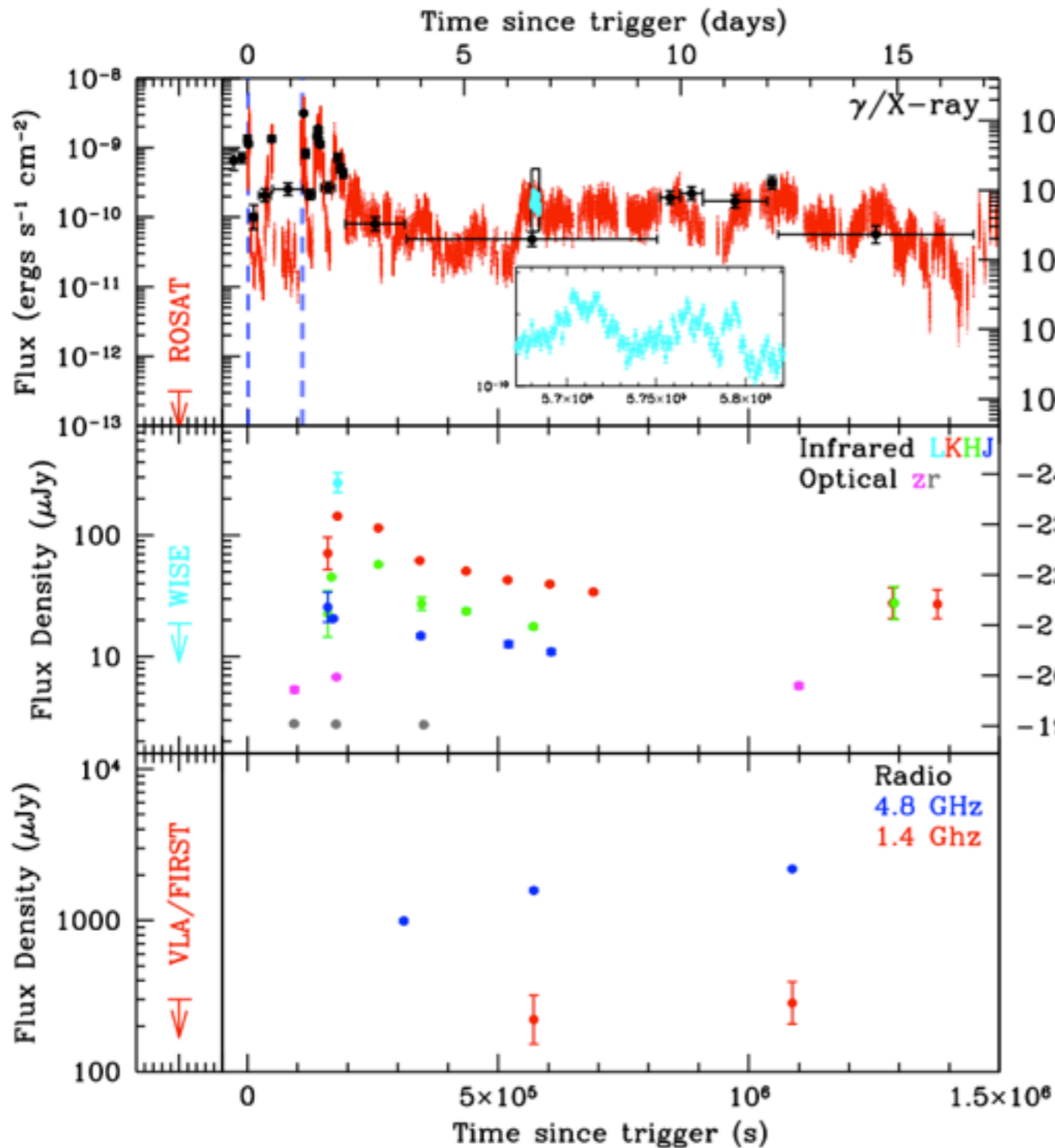
Mainetti et al., arXiv:1601.05478

More unusual tidal disruptions?



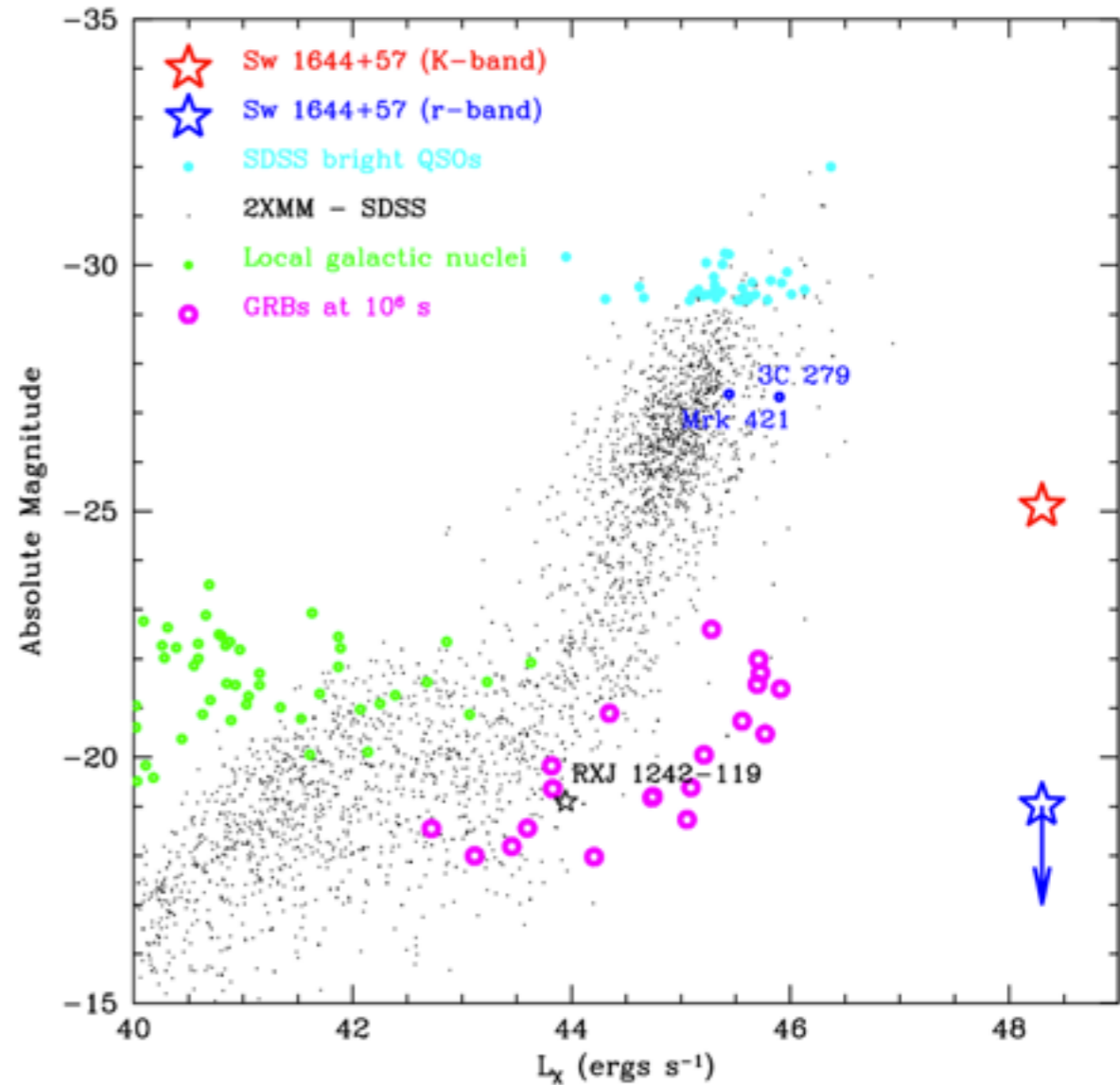
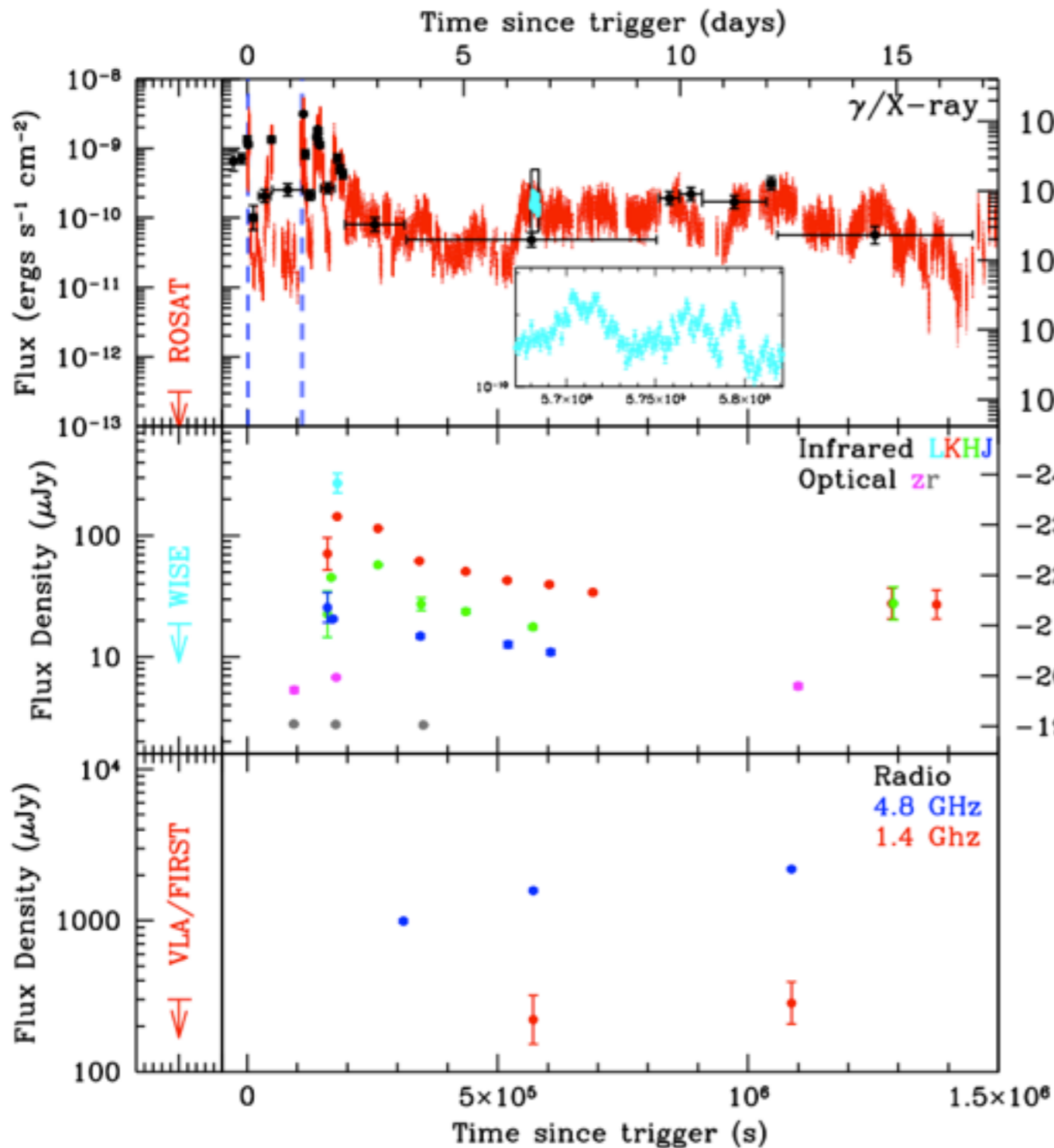
[Merloni et al., 2015, ArXiv:
1503.04870
Grube et al., 2015, ArXiv:
1504.01389]

Tidal disruption + jets



[Bloom et al., 2011, Science, 333, 203; Levan et al., 2011, Science, 333, 199; also Burrows et al., 2011, Nature; Zauderer et al., 2011, Nature]

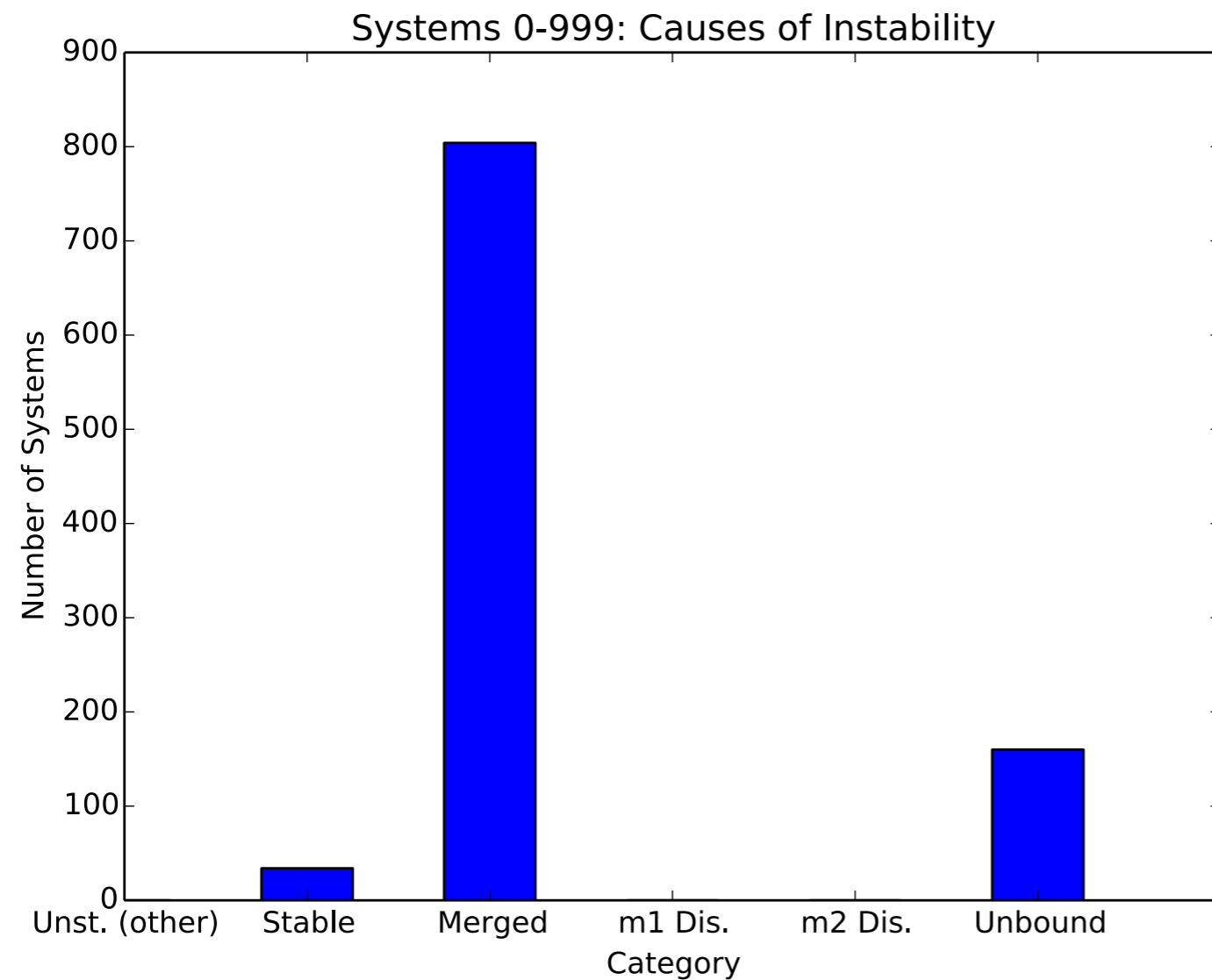
Tidal disruption + jets



[Tchekhovskoy et al., 2014, MNRAS, 437, 2744:
prompt jet requires magnetic flux $> 10^{29}$ G cm²]

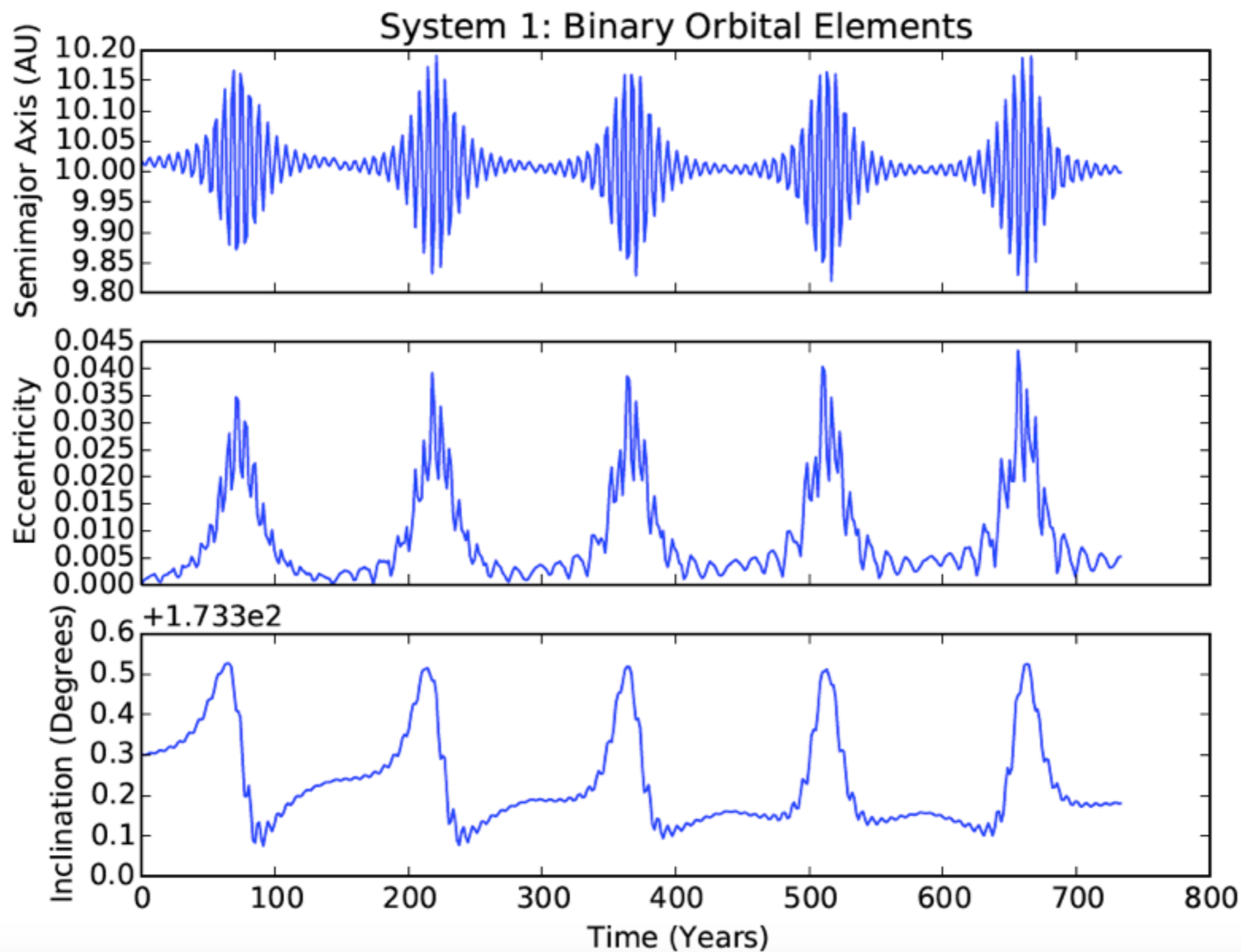
[Bloom et al., 2011, Science, 333, 203; Levan et al., 2011, Science, 333, 199;
also Burrows et al., 2011, Nature;
Zauderer et al., 2011, Nature]

What about the empty loss cone?

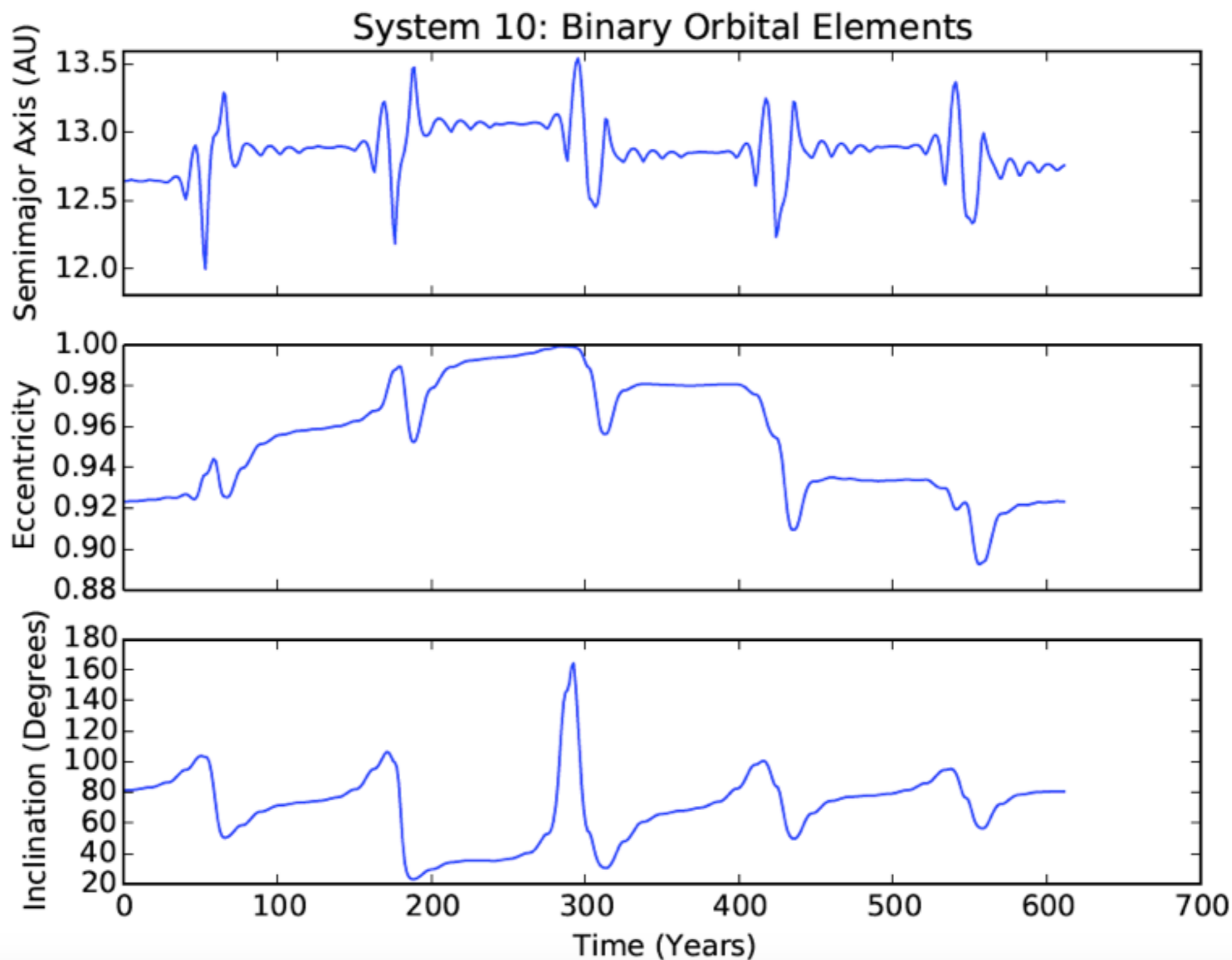


Bradnick, Levin, Mandel, in prep.

What about the empty loss cone?



What about the empty loss cone?



Conclusions

- Around 5—10% of all TDEs are double TDEs of binaries
 - » How important is the self-interaction of the tidal streams?
 - » What would the spectrum look like?
 - » Are these easy distinguish?
- Tens of percent of binaries in the empty loss cone regime may merge before the merger product is tidally disrupted
 - » What is the distinguishing observational signature?
 - » Could the enhancement of the magnetic field due to recent merger power prompt jet formation?