Close Encounters of the Supermassive Black Hole Kind

Tidal Disruption Events and what they can reveal about Black Holes and Stars in Distant Galaxies

Ananya Bandopadhyay[1*], Julia Fancher[1], Aluel Athian[2], Valentino Indelicato[2], Sarah Kapalanga[2], Angela Kumah[2], Daniel A. Paradiso[1], Matthew Todd[1], Eric R. Coughlin[1], and C. J. Nixon[3] ,The Astrophysical Journal Letters (2024).

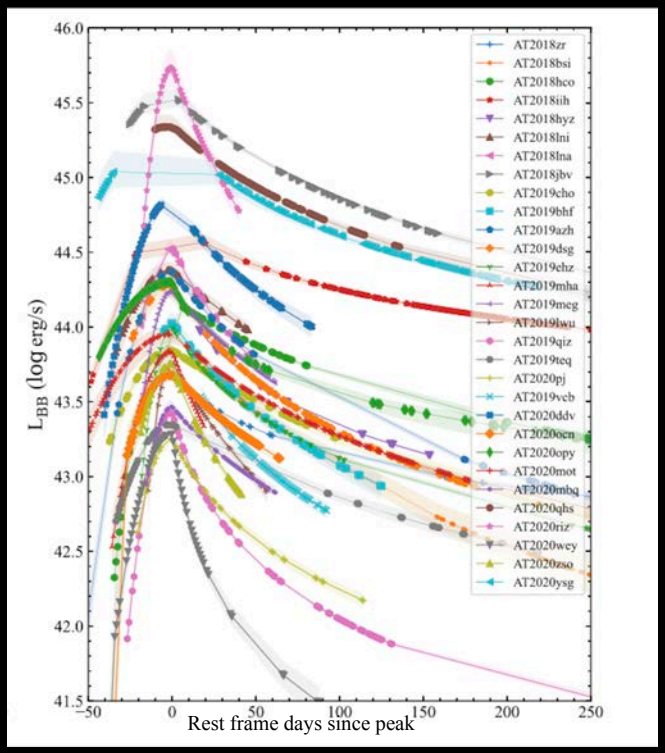
1 2 3

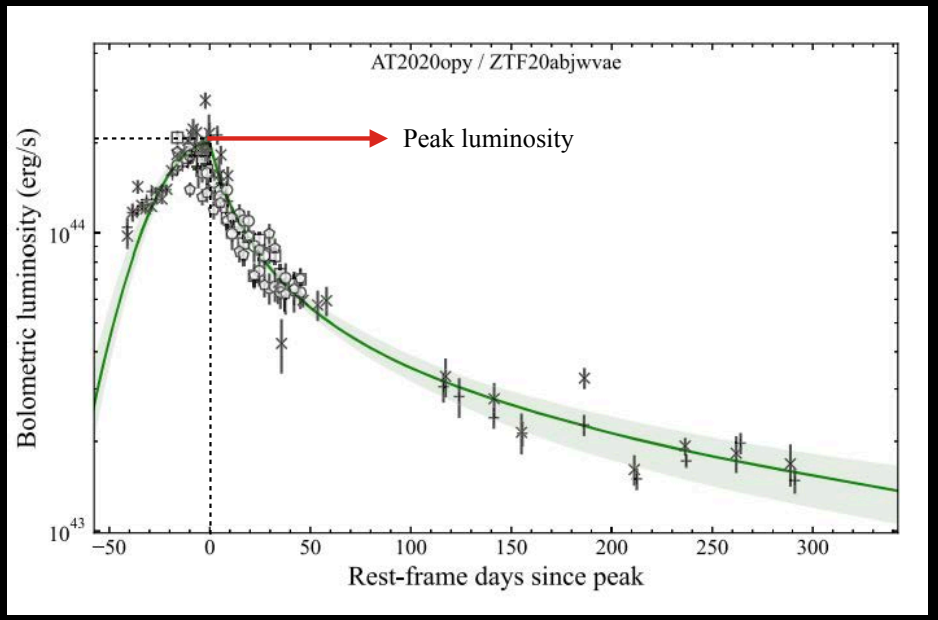
*abandopa@syr.edu

Animation credit: ESO/M. Kornmesser

TDE observations so far

~100 TDEs observed so far at multiple wavelengths from radio to X-ray, by wide-field surveys such as the ZTF, ASAS-SN, eROSITA.

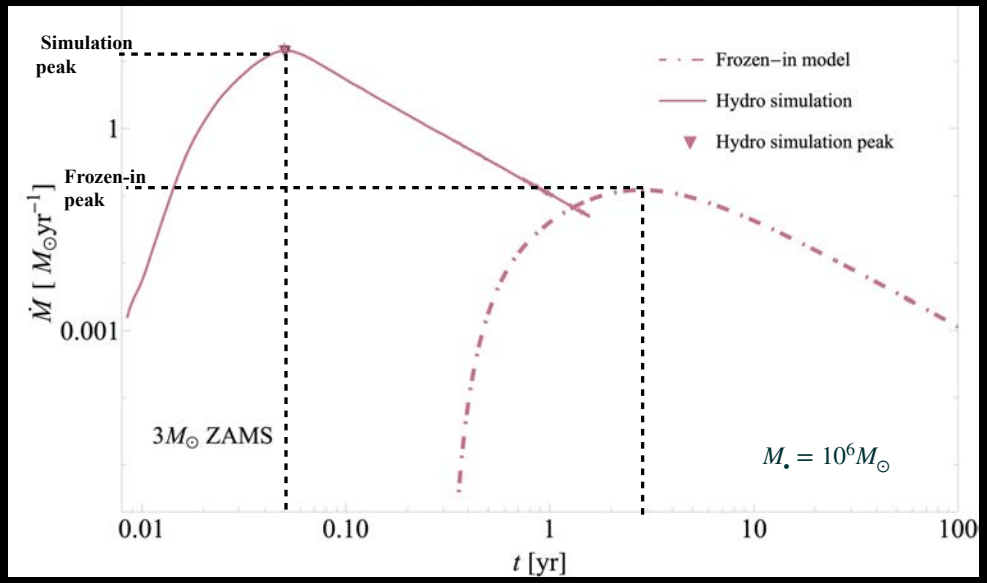


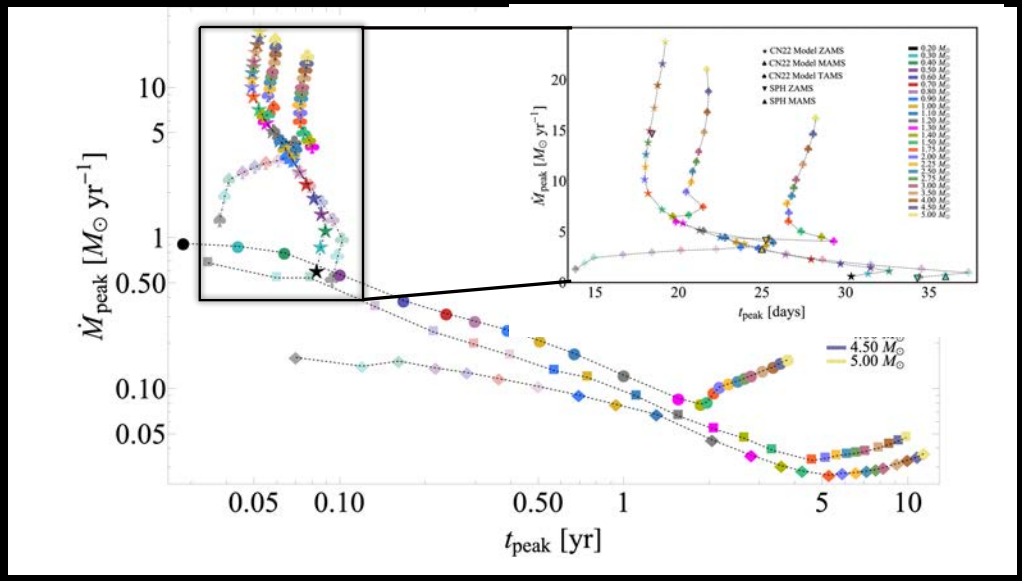


What determines the peak of the light curve and the peak timescale?

Image credit: Hammerstein, E., et al. ApJ, 942, 9 (2023).

Peak Fallback Rate of Stellar Debris





Comparison of peak fallback rate and time of peak for the "frozen-in" model, and the analytical model developed by Coughlin&Nixon (2022)*.

$$t_{\rm peak} \approx 30 \times \left(M_\bullet / 10^6 M_\odot\right)^{1/2} \text{ days}.$$

*Coughlin and Nixon, MNRAS **517**, L26(2022).

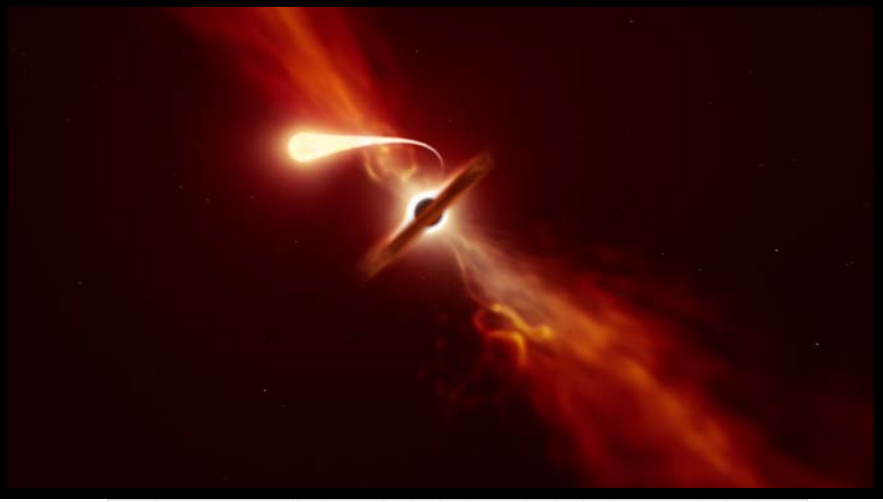
Implications — jetted TDEs

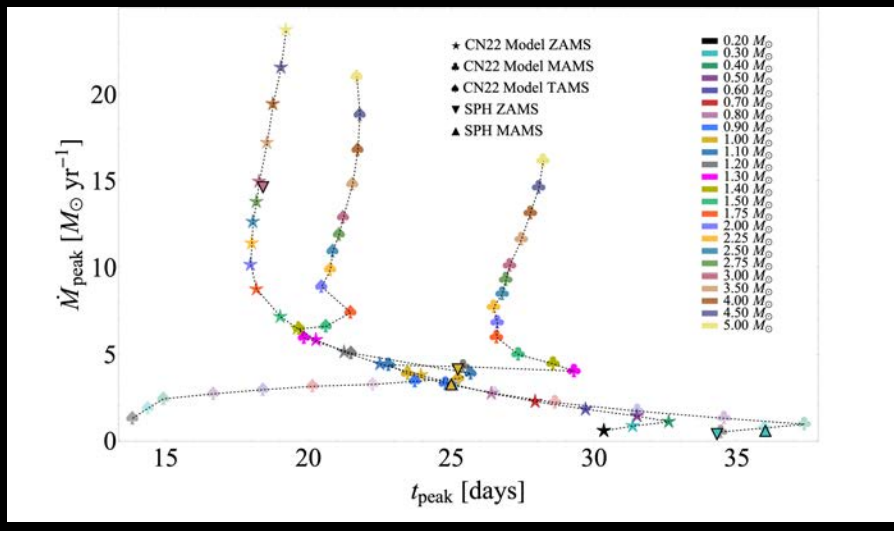
- Highly super Eddington accretion rates are likely required for the launching of relativistic jets from TDEs.

- Such high accretion rates arise from the disruption of high mass stars.

- The rarity of occurrence of high mass stars could provide a possible explanation for the rarity of observation of jetted TDEs.

- Young star-forming galaxies likely to be host galaxies for jetted TDEs.





Poster session from the Syracuse University Research in Physics (SURPh) summer research program, involving high school students from the Syracuse City School District (SCSD). They used computational tools and performed numerical simulations to test the CN22 model, serving as co-authors for the study.

Contact Info:

Ananya Bandopadhyay (abandopa@syr.edu)

Eric Coughlin (ecoughli@syr.edu ; (610) 504-7134 ; ecoughli.expressions.syr.edu)