Utilizing Maximum Variability to Discern TDE Emission from AGN Flares

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NASA's Physics of the Cosmos Workshop

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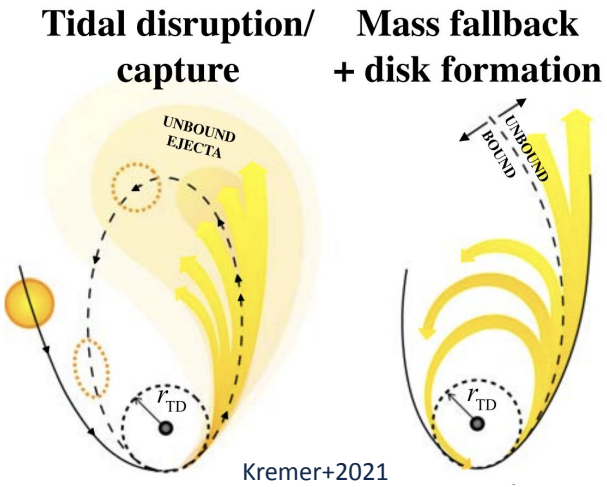
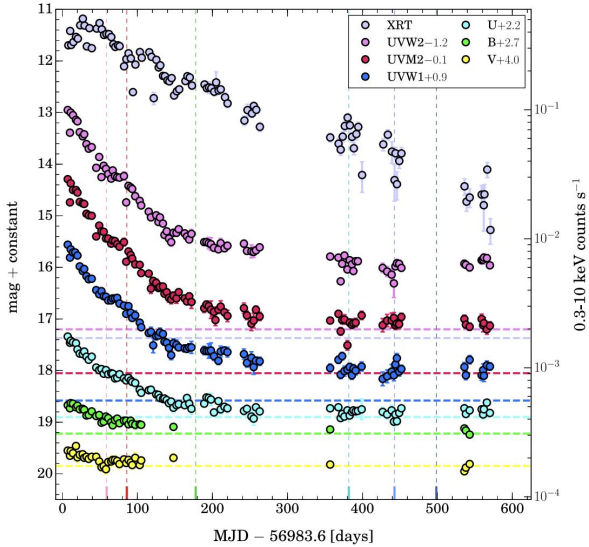
Tidal Disruption Events

- Tidal disruption of a star by a SMBH
- Follows a sharp rise and a Power-law decay



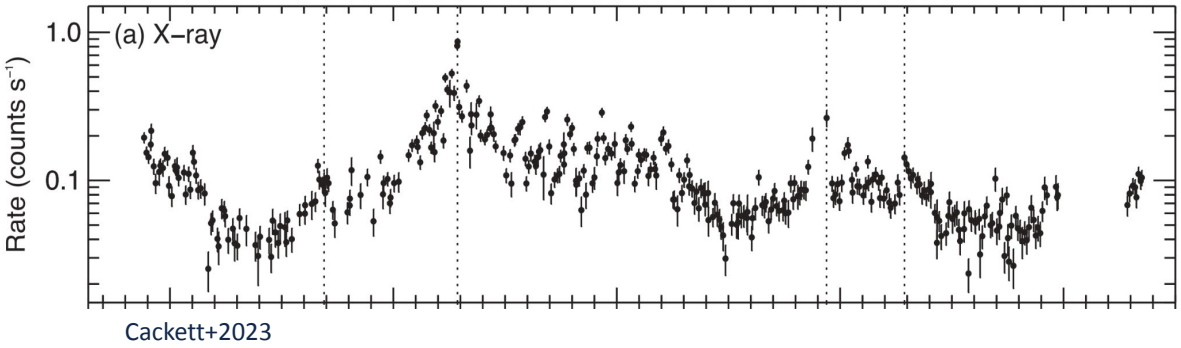
Kremer+2021

Brown+2017



AGN Variability

- AGN variability is stochastic in nature
- Show large-scale variation with a rise and decay like shape



Cackett+2023

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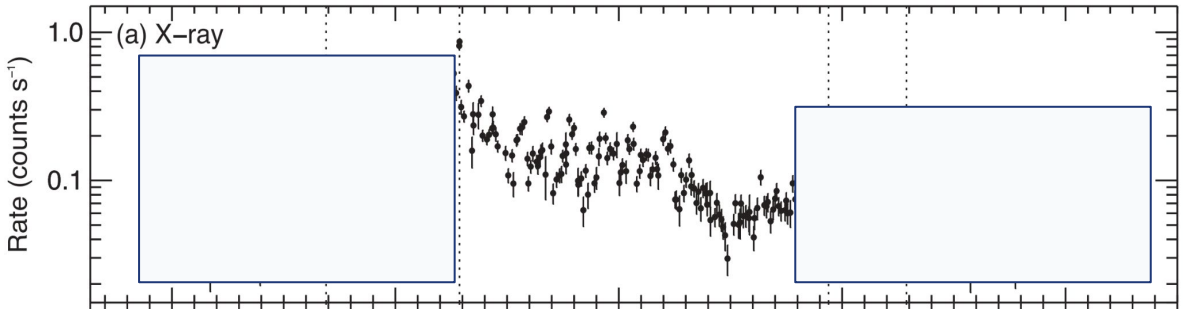

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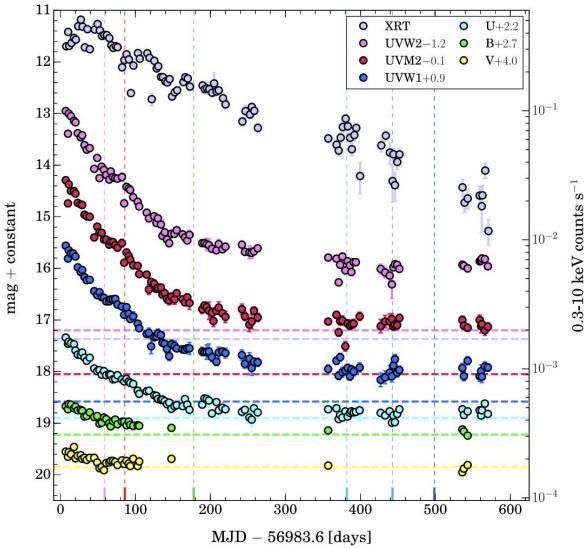
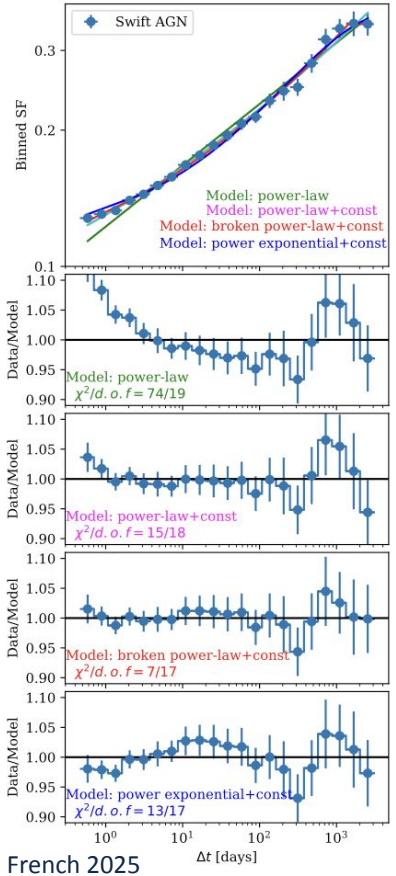


AGN Structure Function

- Swift-XRT and MILLIQUAS catalog match resulted in 11500 AGNs with more than two detections
- Measure AGN variability through ensemble-averaged AGN SF
- SF is best described by models with a break at ~950 days
- Simulate light curves to quantify the rate of AGN flare with a strength similar to TDEs



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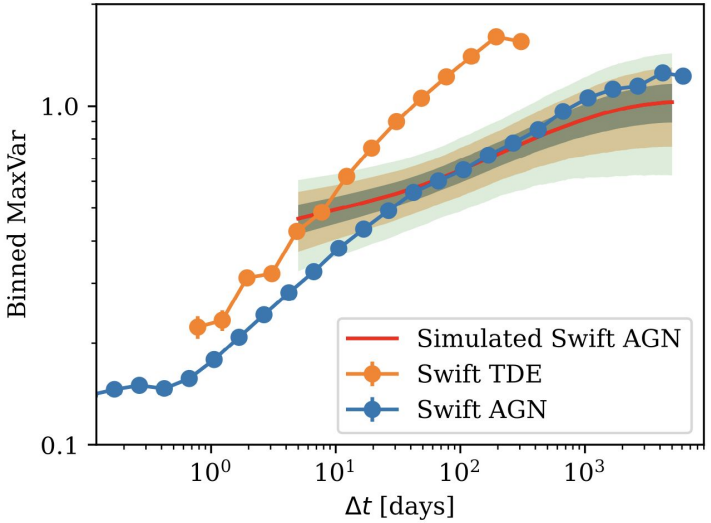
AGN and TDE Maximum Variation

- AGN flares and TDEs can have similar order variation at small time scales
- Simulation show time scale below 20 days AGN flares variation are similar or higher than TDEs



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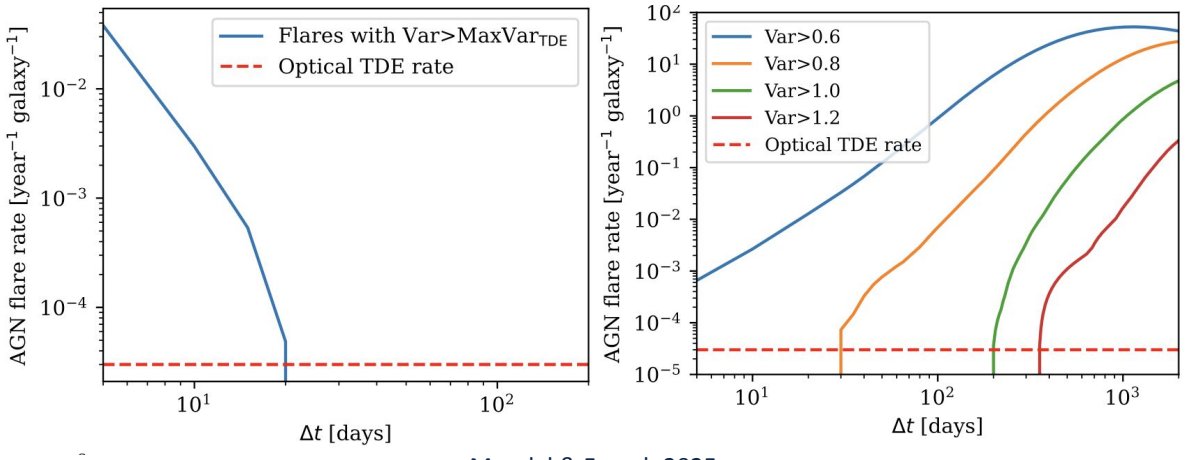
AGN Flare Rate

- AGN flare rate from simulated light curves using the best fit SF model
- Time scale <20 days AGN flare will contaminate significantly
- A variation of >0.6, >0.8, and >1.2 dex on time scales <30, <200, and <300 days, respectively, then unlikely from AGN flare.



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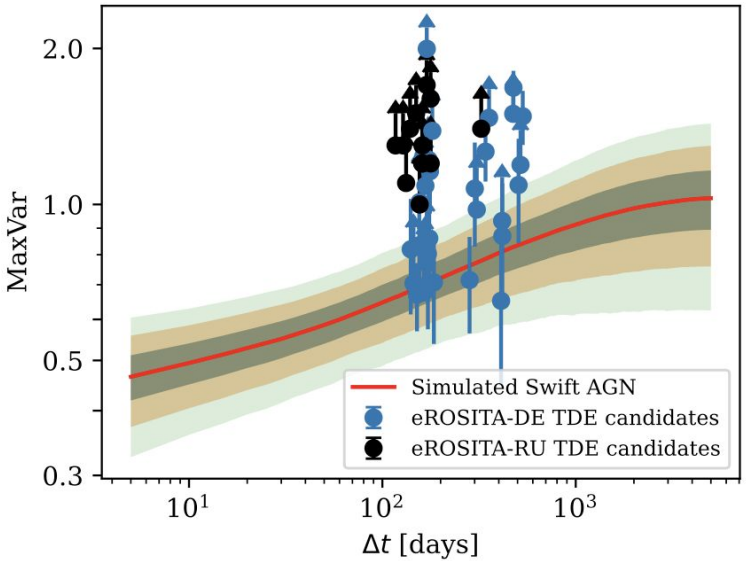
Conclusions

- Many eROSITA-DE TDE candidates are consistent with AGN flares, follow-up observation is required
- AGN SF shows a break at ~950 days
- Longer time scale of 20 days or more will have less AGN flare contamination in TDE searches unless a variation of >0.6 dex is observed



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