Recent Star Formation in X-ray Tidal Disruption Event Hosts

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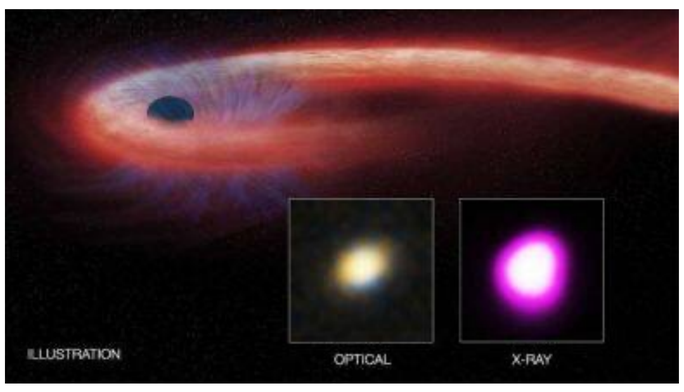
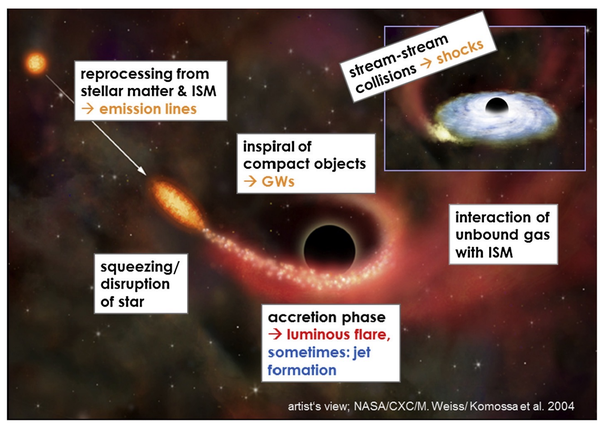
Tidal Disruption Events

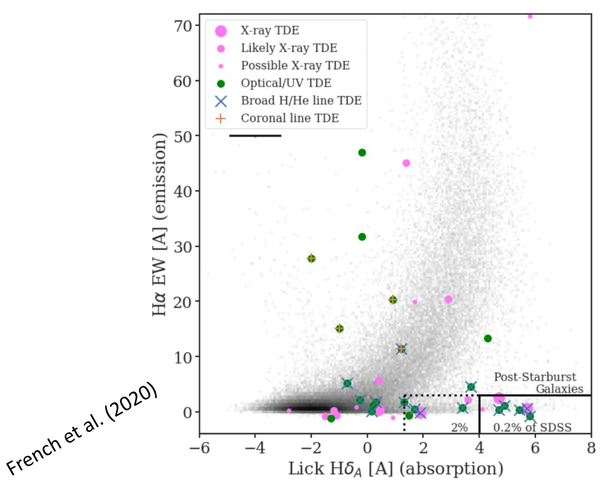
- Tidal disruption events (TDEs) occur whenever a star orbiting around a massive black hole (MBH) comes within the MBHs tidal disruption radius and is torn apart by the MBHs overwhelming tidal forces.
- Quick post-discovery follow up observations have provided a rapidly increasing list of TDEs. While the list of known TDEs is still relatively small, LSST is expected to discover ~ 6-16 TDEs each night (Bricman & Gomboc 2020).
- We utilized eROSITA (Sazonov et al. 2021) and previously known X-ray TDEs (French et al. 2020) to obtain 25 X-ray TDEs. We searched for pre-event, multi-wavelength (UV to mid-IR) photometry from the host galaxies of these TDEs. If the host galaxy had bad photometry or none, we excluded it from our sample. Ultimately, **we fit the spectral energy distributions (SEDs) for 18 X-ray TDE host galaxies to measure their host galaxy properties (i.e. star formation history (SFH), stellar mass, etc.) and investigate X-ray TDE host galaxy preferences.**



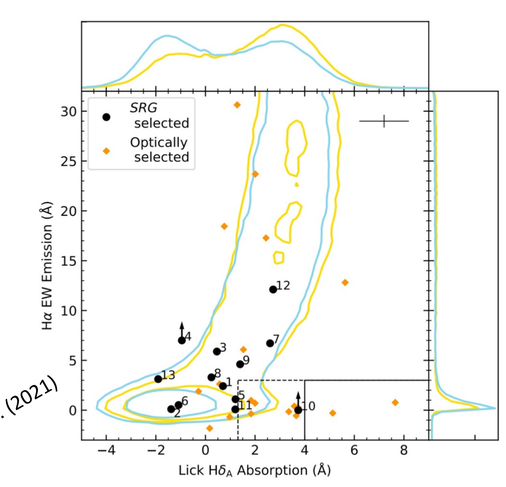


TDE Host Galaxy Preferences

- It has been shown that optical TDEs largely prefer post-starburst galaxies (French et al. 2017; French et al. 2020)
- However, Sazonov et al. (2021) shows that this phenomenon is less enhanced for X-ray TDEs
- Understanding TDE host galaxy preferences will greatly enhance our capability to pick them out from the transients that will be discovered each night with LSST.
- Note: Lick Hδ_A is sensitive to star formation within 1 Gyr, while Hα EW is sensitive to star formation within 10 Myr.



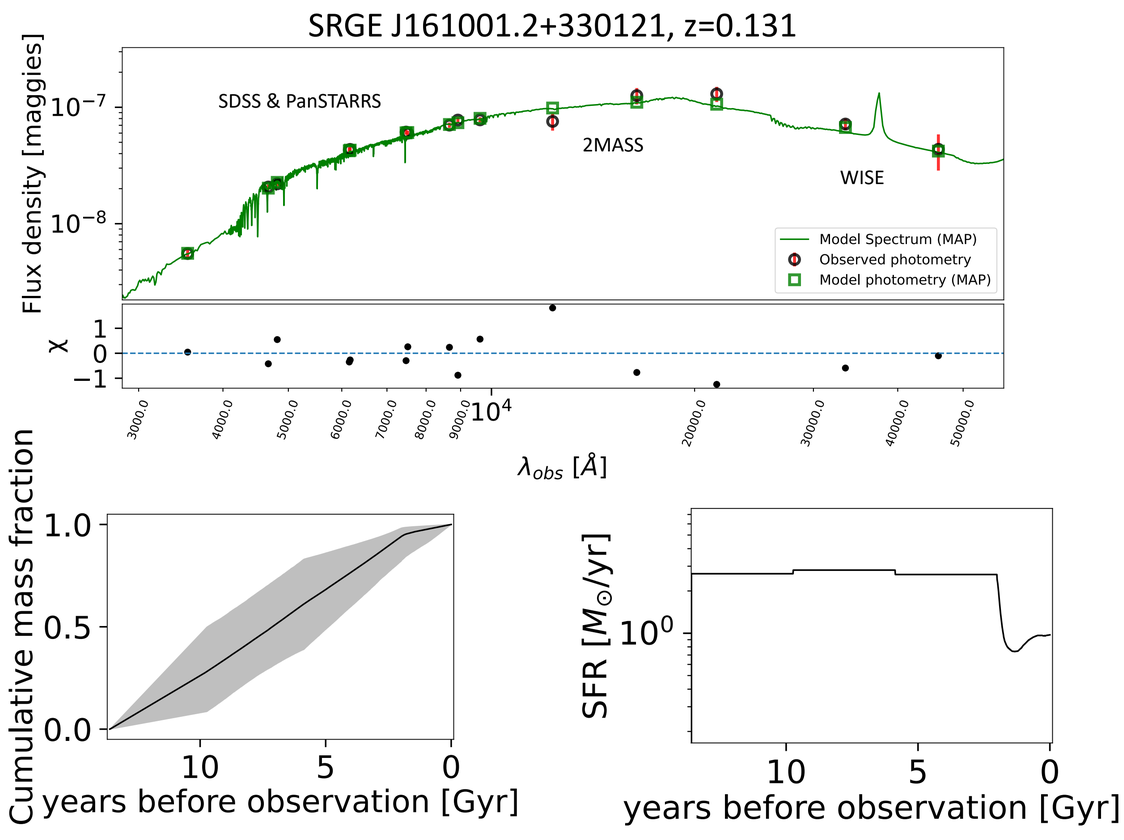
French et al. (2020)



Sazonov et al. (2021)

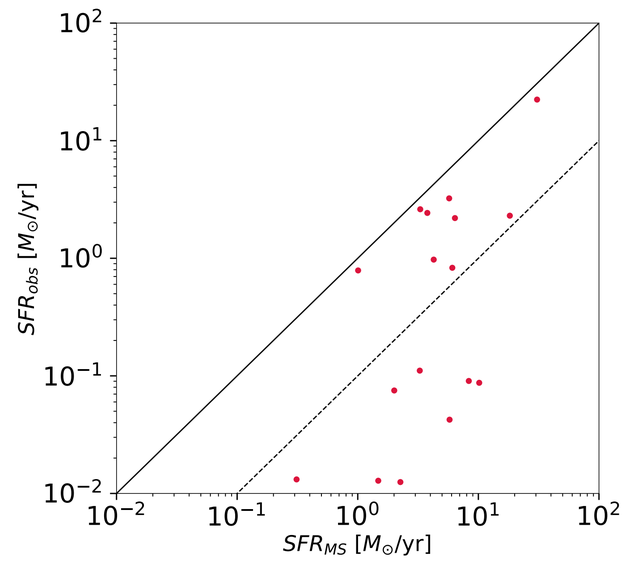
SED Fitting

- We utilize the Prospector-α model (Leja et al. 2017) to do the SED fitting.
- We adopt a SFH model designed to accurately measure recent SFHs for (post-) starburst galaxies (see Suess et al. 2021; Suess et al. 2022).

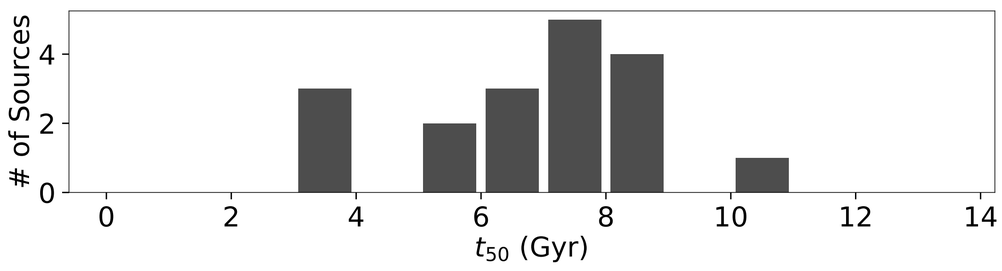


Host Galaxy Properties

- A typical X-ray TDE host galaxy's star formation rate (SFR) is lower than what the galaxy star-forming main sequence predicts
- X-ray TDEs generally prefer non-star-forming galaxies
- ½ of our sources lie within 1 dex of the main sequence predicted SFR, while the other ½ lies below 1 dex of the predicted SFR



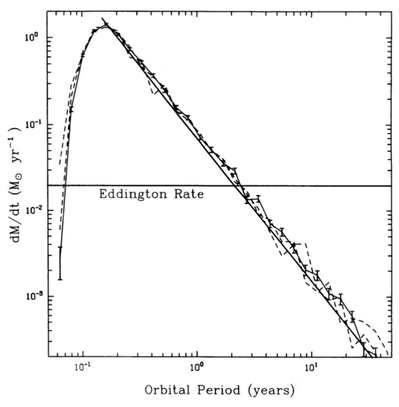
- t_{50} → lookback time at which 50% of current stellar mass was formed
- X-ray TDEs prefer galaxies in which most of the stellar mass was formed longer ago.
  - 2/3 (12/18) of our sources prefer a host with t_{50} between 6-9 Gyr



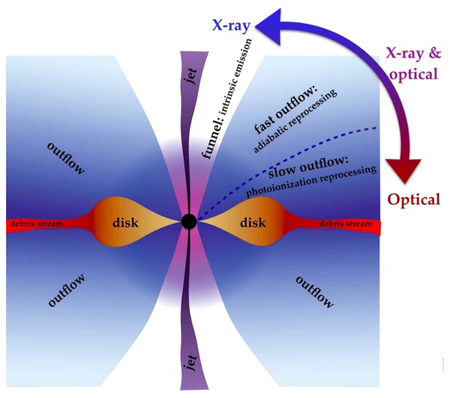
- Generally, X-ray TDEs prefer older host galaxies with lower star formation rates than typically observed in other galaxies with similar stellar mass. In contrast, optical TDEs prefer post-starburst galaxies with t_{50} ~ 1 Gyr.
- This may indicate that more physics linking the TDE type and TDE hosts, not considered in the unified model, are yet to be discovered.

A Unified Model

- Dai et al. (2018) proposed a unified model for TDEs after pairing the super-Eddington outflows from TDEs with the bright electromagnetic flares produced by TDEs.
  - Like that of AGNs by viewing angle dependence
  - Based on idea that all TDEs are intrinsically the same
- Our results suggest that X-ray TDEs and optical TDEs are **NOT** intrinsically the same.
- Older galaxies → less gas and dust obscuration → more X-ray emission from event?



Evans et al. (1989)



Dai et al. (2018)

Future Work

- Several more X-ray TDEs have been identified since this work was completed, so it would be beneficial to create an even larger sample of X-ray TDEs from which to study host galaxy properties.
- Our work provides crucial a priori host galaxy information for X-ray TDEs that will help enable reliable TDE selection from the millions of transients LSST will find.

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