An X-ray view of the ambiguous nuclear transient AT2019pev

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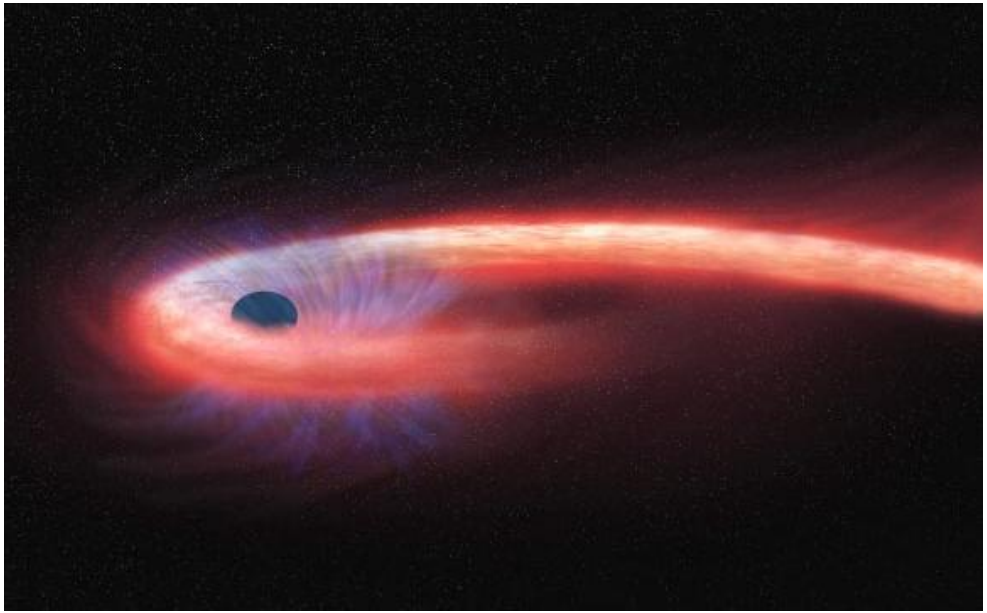
Tidal Disruption Events

- Tidal disruption events (TDEs): opportunity to study accretion onto quiescent SMBHs in real time

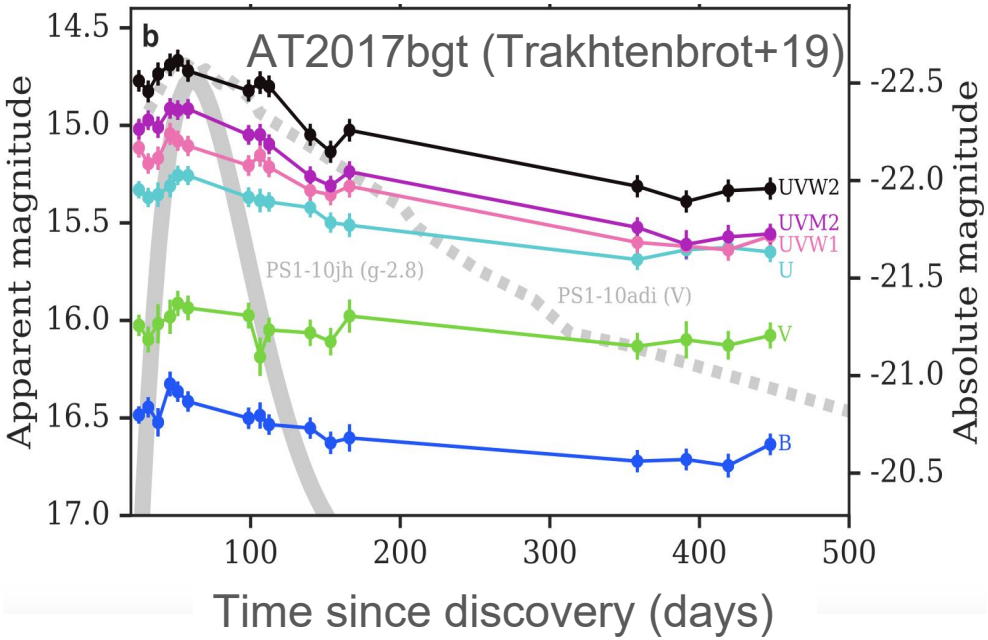
- Non-trivial to distinguish TDEs from AGN transients

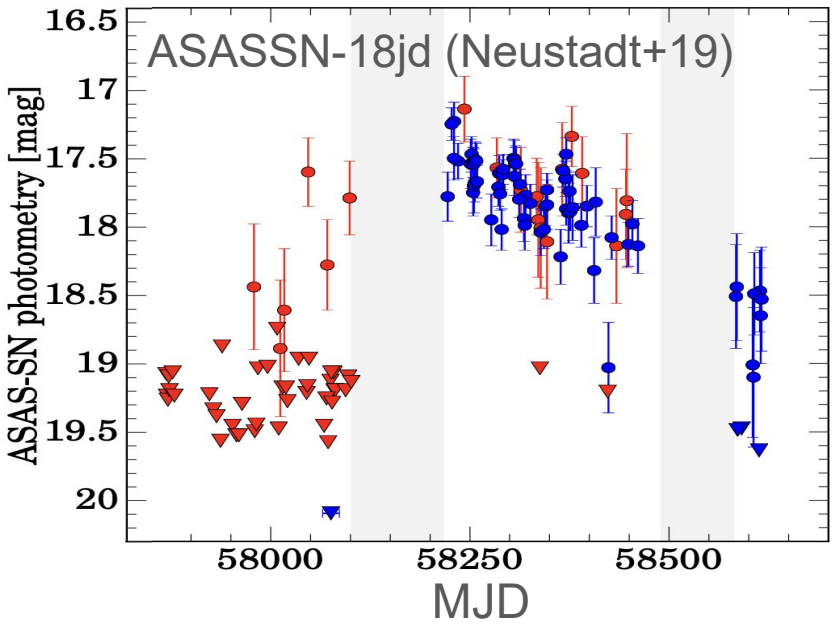


(Credit: NASA / CXC / M. Weiss.)

Ambiguous Nuclear Transients

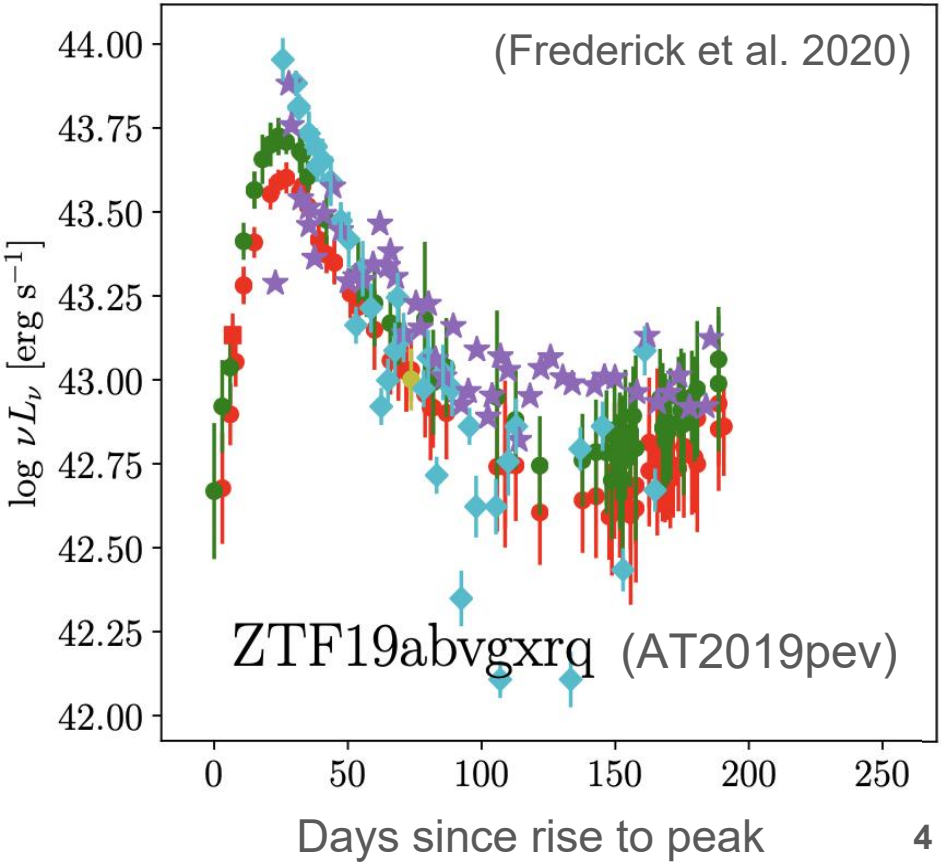
- Unusual spectral and timing features, hard to classify
- Unique laboratories for understanding extreme accretion episodes of SMBHs





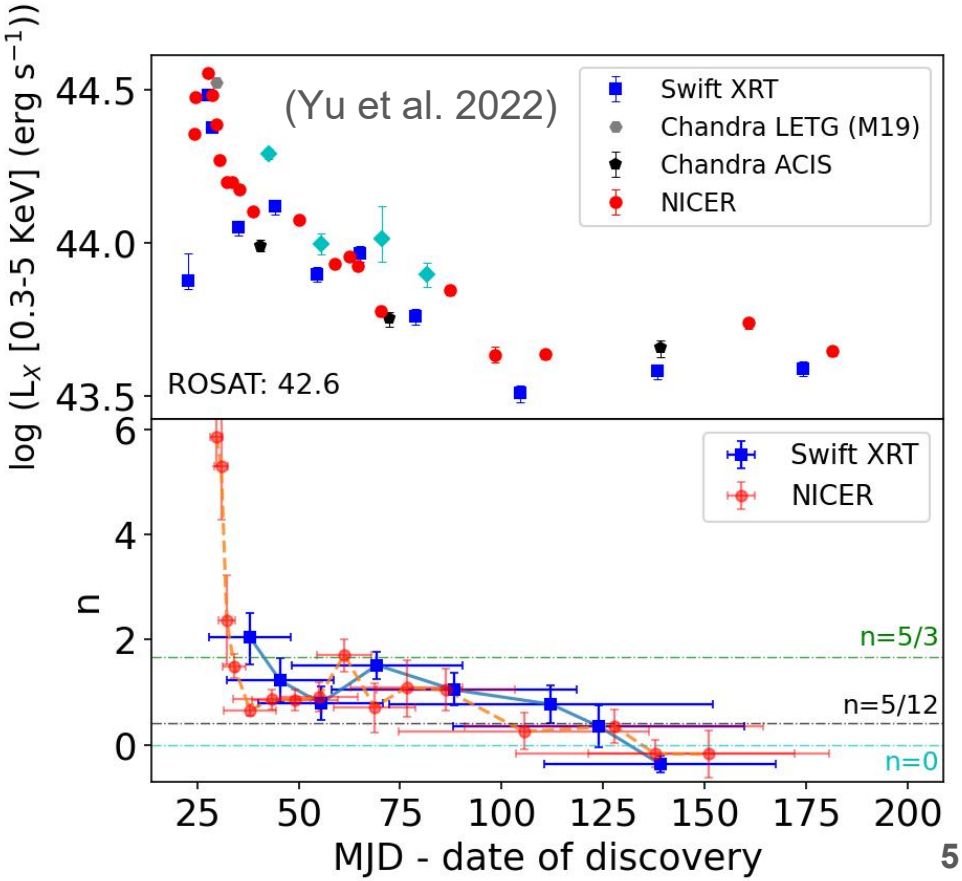
Ambiguous transient AT2019pev

- TDE candidate reported by ZTF
- TDE-like features: roughly constant g - r color, small W1 - W2, lack of Fe II, presence of He II and Bowen fluorescence features, …
- AGN-like features: small Balmer line widths, re-brightening trend, …
- Lack of detailed X-ray analysis in previous studies



X-ray lightcurve of AT2019pev

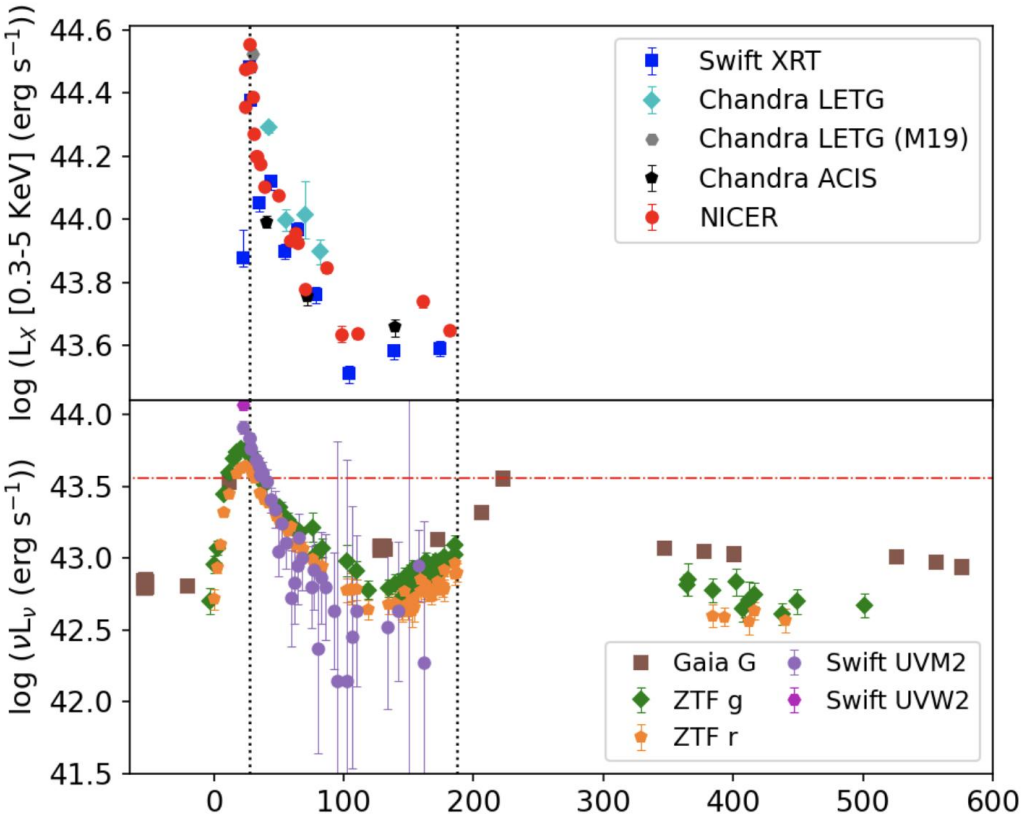
- Swift, Chandra and NICER observations over 173 days
- Steep decay after the peak; smoother at later times
- Non-coherent decay: more closely resembles an AGN



Multi-wavelength lightcurves

- UV / Optical and X-ray lightcurves show similar trend
- A sharper peak in the X-ray lightcurve

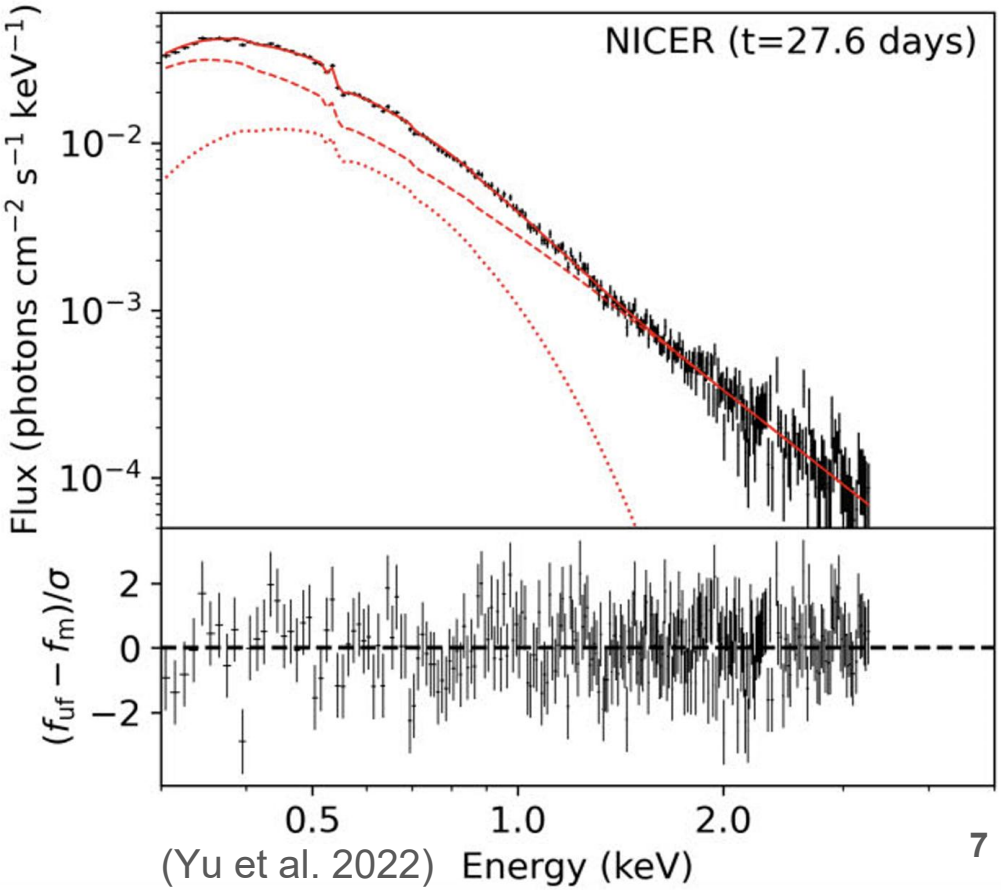
- Additional Gaia data: re-brightening toward a secondary peak
- Closer to AGN variability



(Yu et al. 2022)

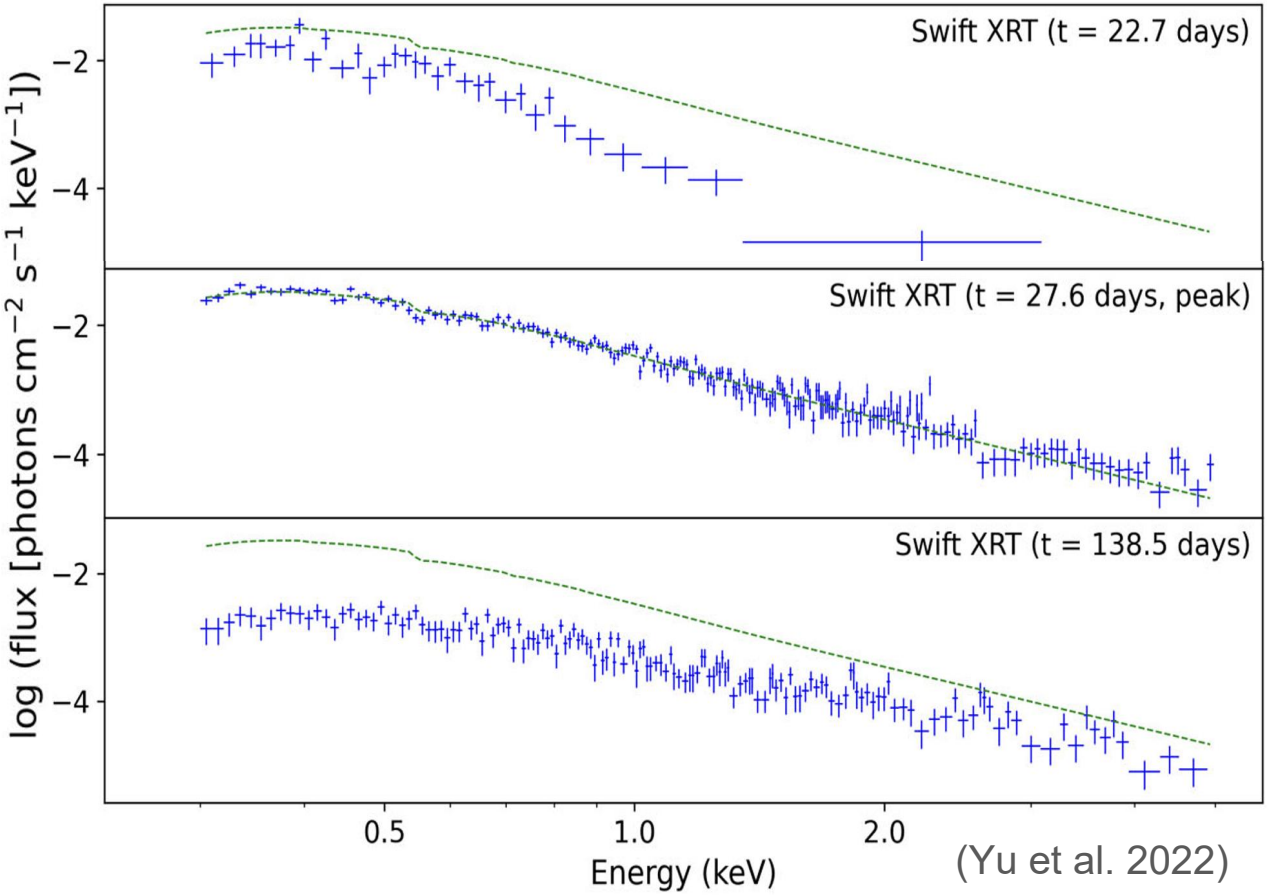
X-ray spectral analysis

- Model: ISM absorption * (power-law + black-body)
- No variability of absorption over time



(Yu et al. 2022)

X-ray spectral evolution

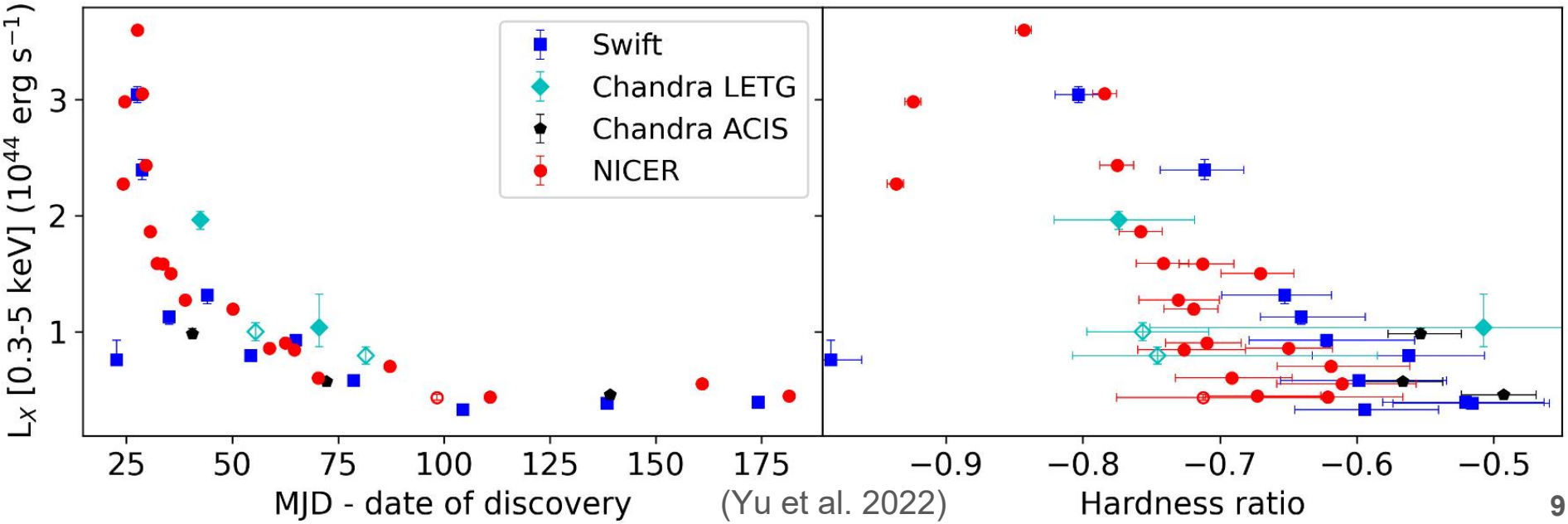


(Yu et al. 2022)

- Very soft spectrum in the earliest epoch
- The spectrum hardens as rising to the peak
- The soft end drops first during the decay

X-ray spectral evolution

- Variable hardness ratio: closer to AGN
- Inversion of evolution trend before and after the peak: potential transition of accretion states



(Yu et al. 2022)

Summary

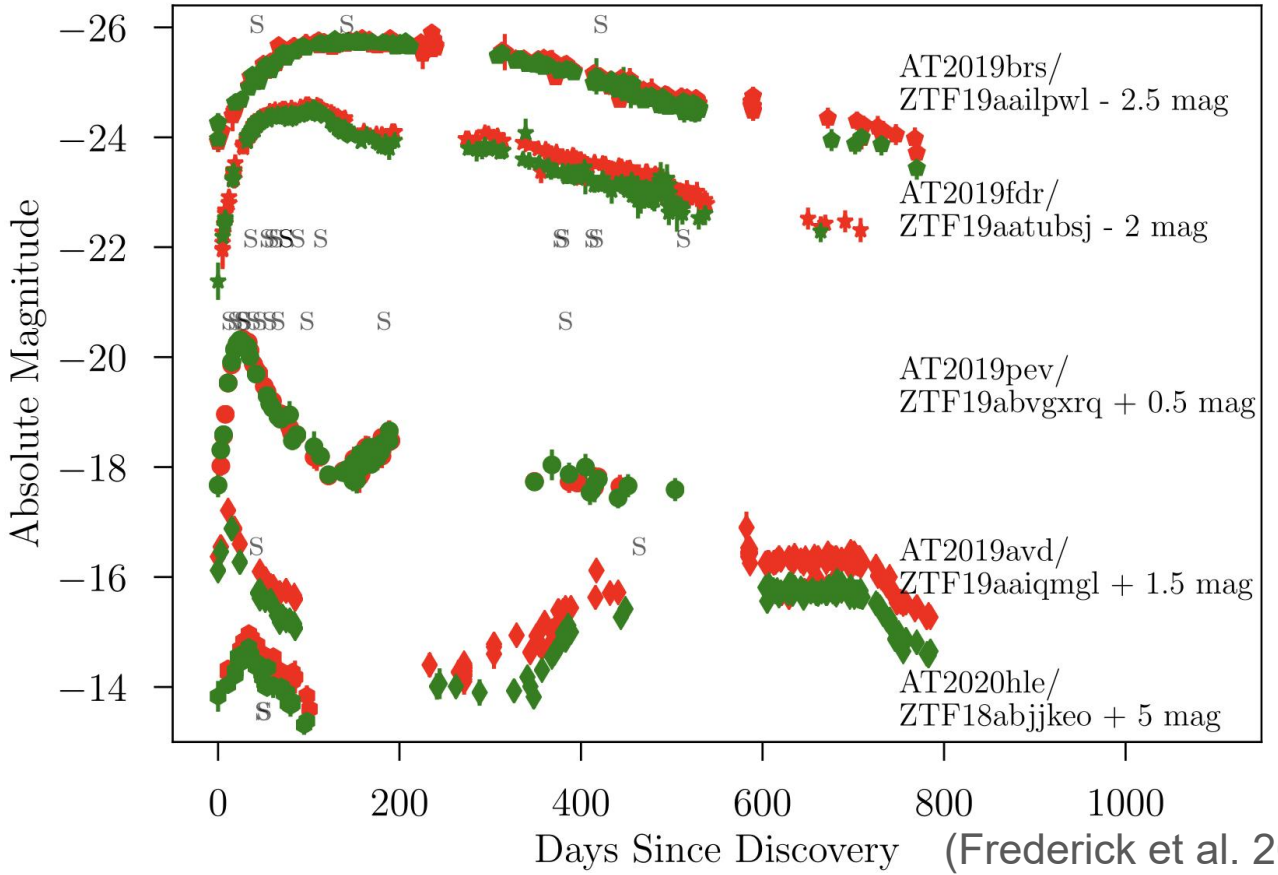
- An extensive X-ray analysis of ambiguous nuclear transient AT2019pev

- A sharp peak in X-ray lightcurve followed by non-coherent decay
- Re-brightening toward a secondary peak in optical
- Inversion of evolution trend of the X-ray hardness ratio after the lightcurve peak

- More closely resembles an AGN
- Potential transition of accretion state

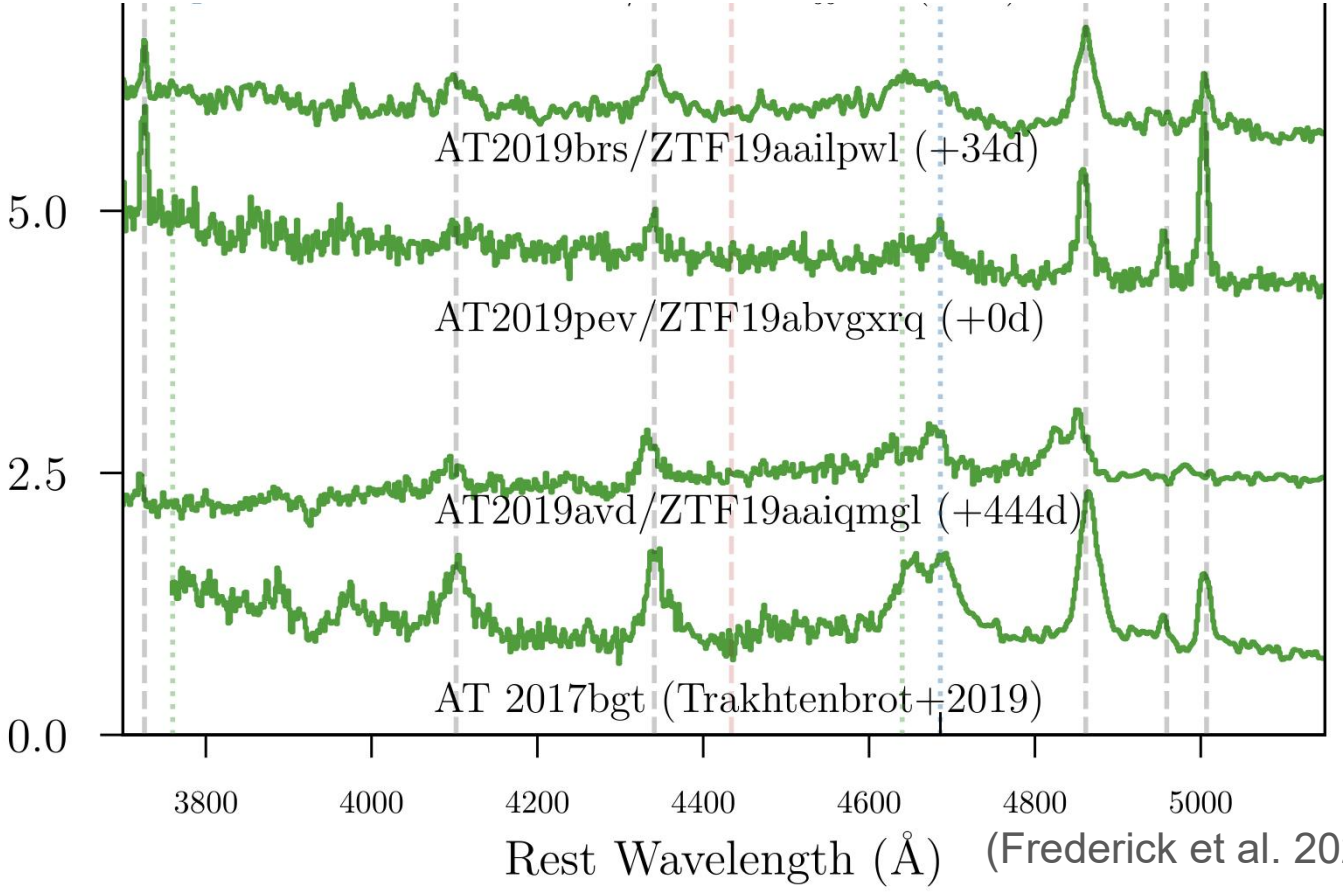
Backup Slides

Optical lightcurve



(Frederick et al. 2020)

Optical spectrum



(Frederick et al. 2020)