A new type of changing look AGN with extreme X-ray properties

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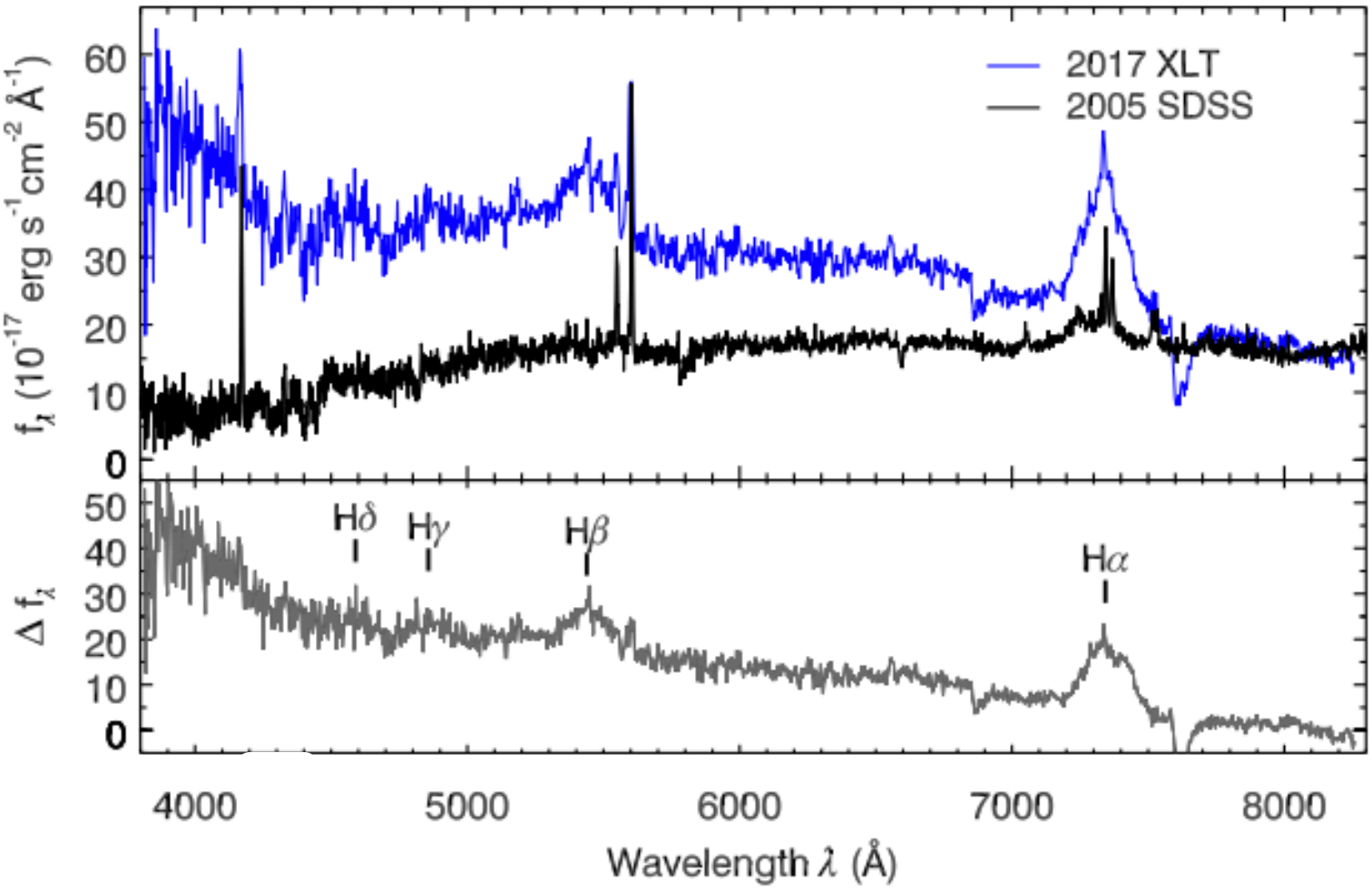
Changing-look or Changing-state AGN

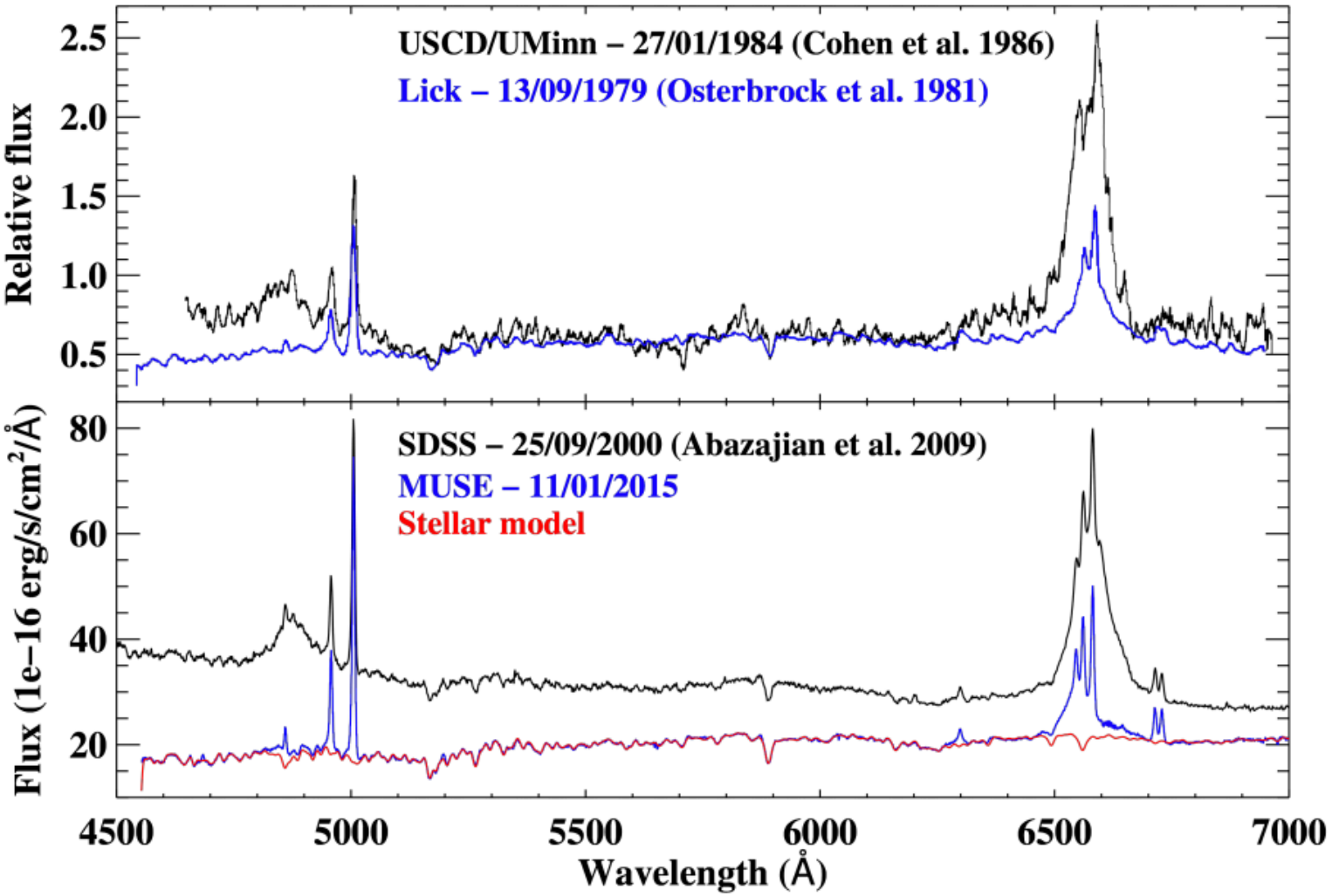
Type 1 <—> Type 2



Yang et al. (2017)

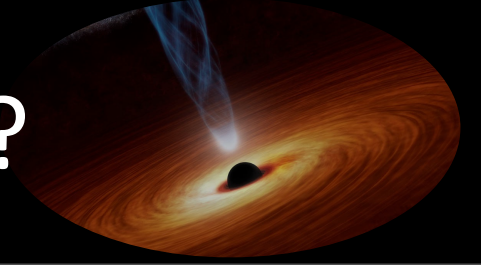
Changing-look or Changing-state AGN

Mrk 1018

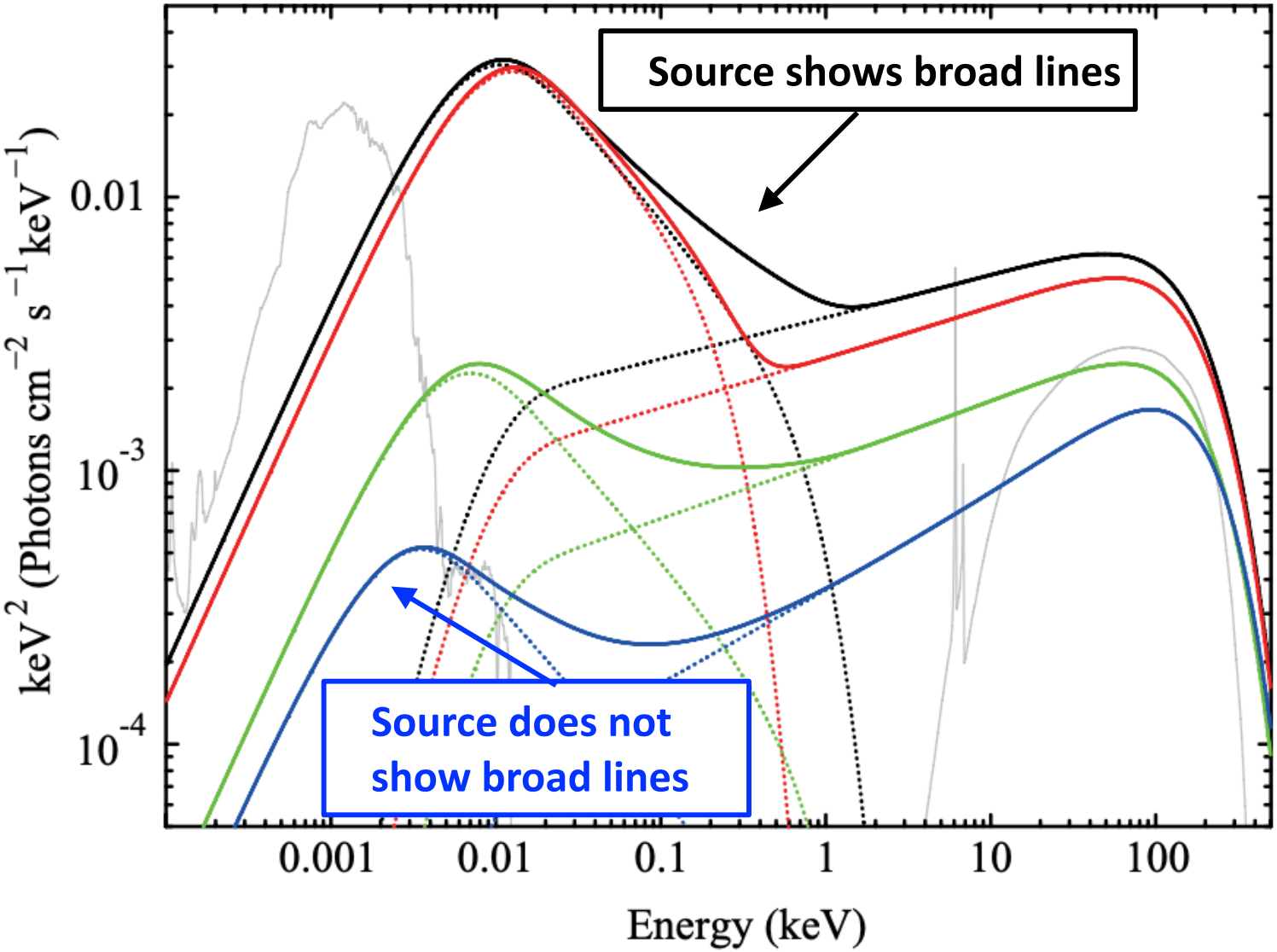


McElroy et al. 2016

What triggers changing-look events?

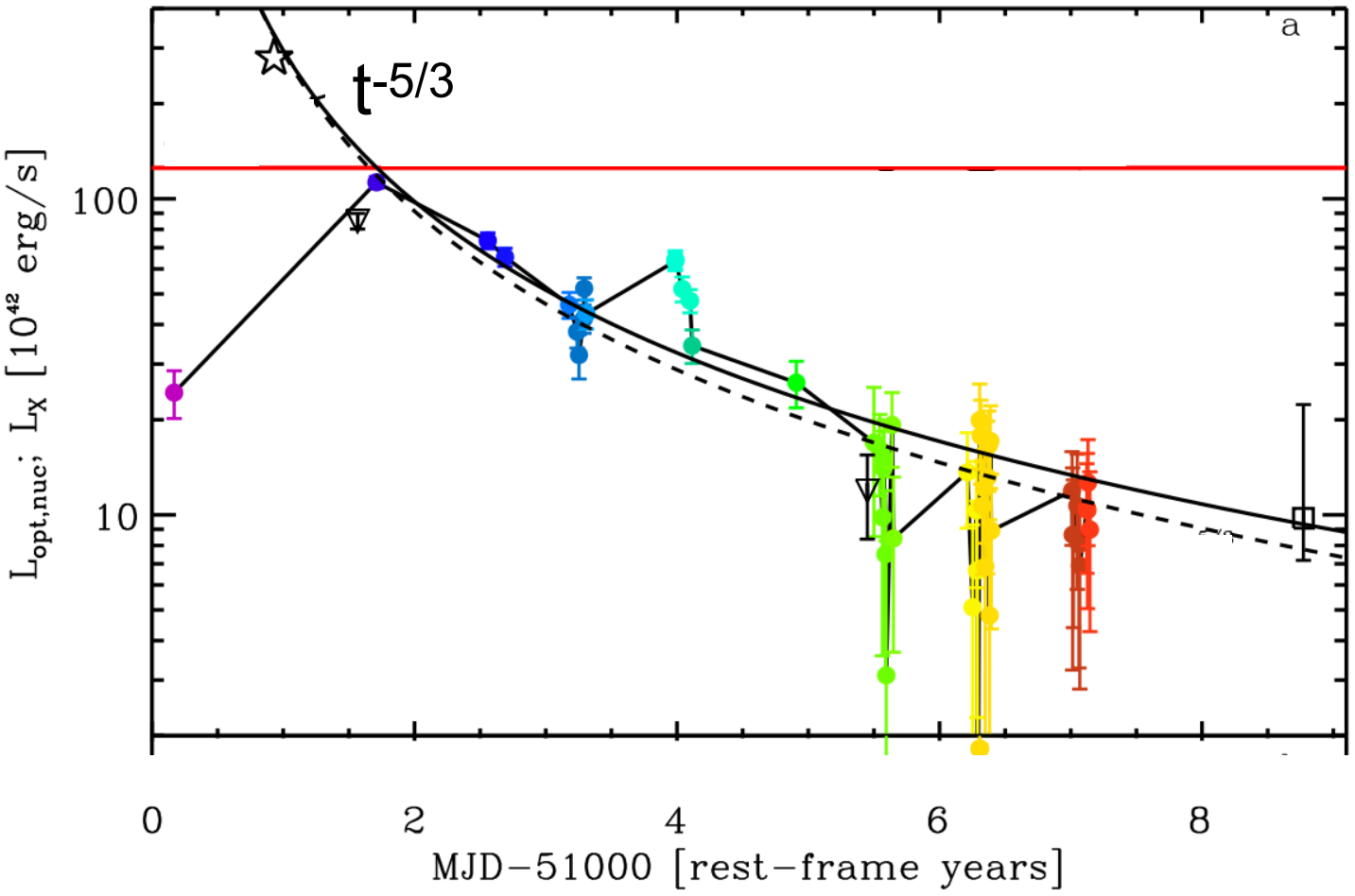


State transitions (as in BH binaries; e.g. Noda+18)



What triggers changing-look events?

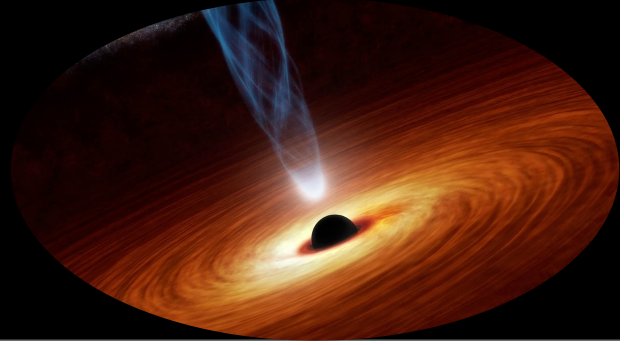
SDSS J0159+0033: a TDE-triggered event?



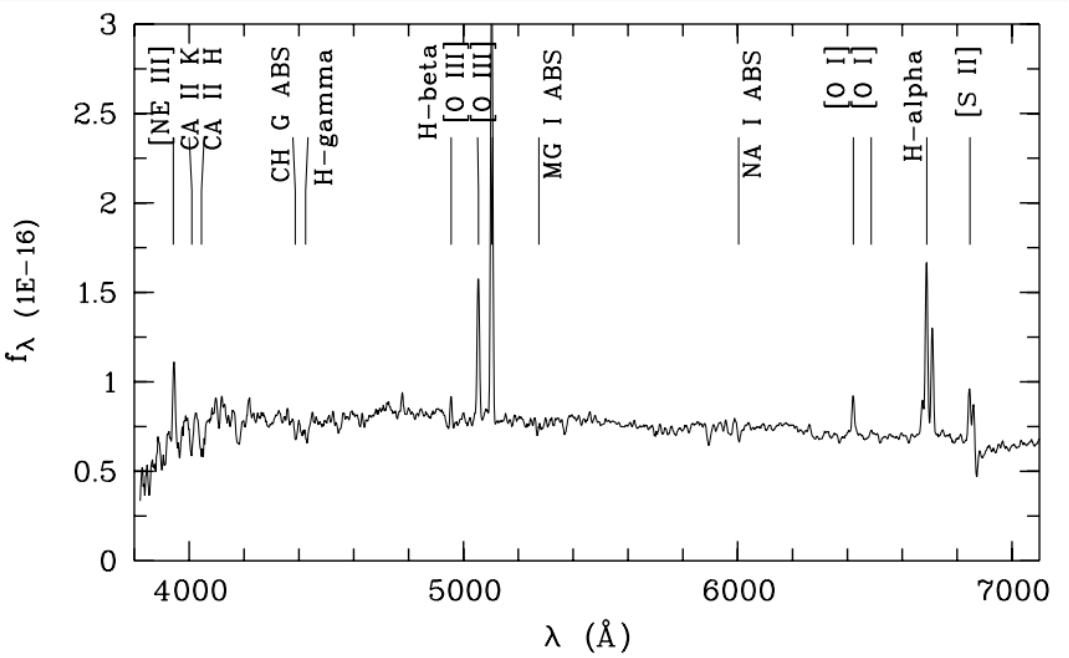
Merloni et al. (2016)

The strange case of 1ES 1927+654

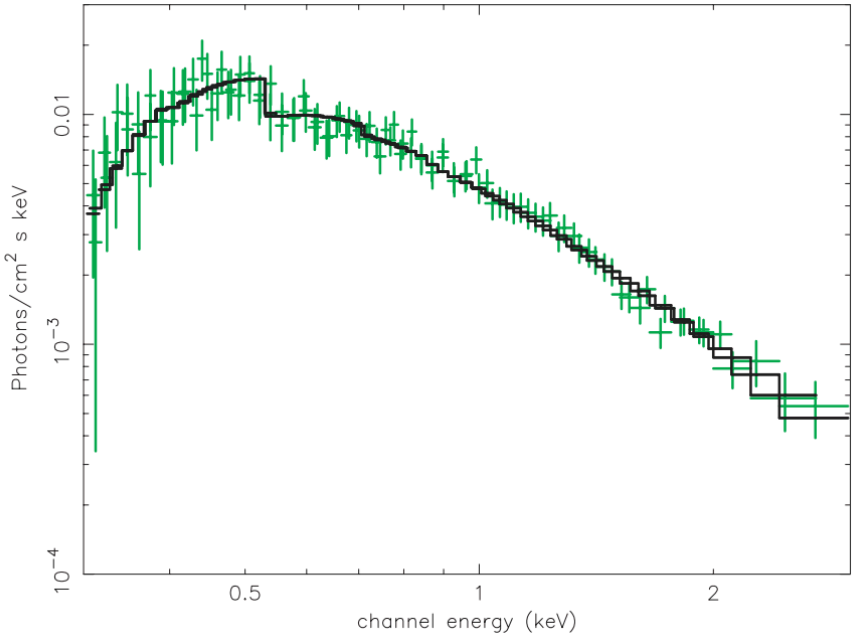
1ES 1927+654



AGN both in the optical and in the X-rays (Lx~1e43 erg/s)

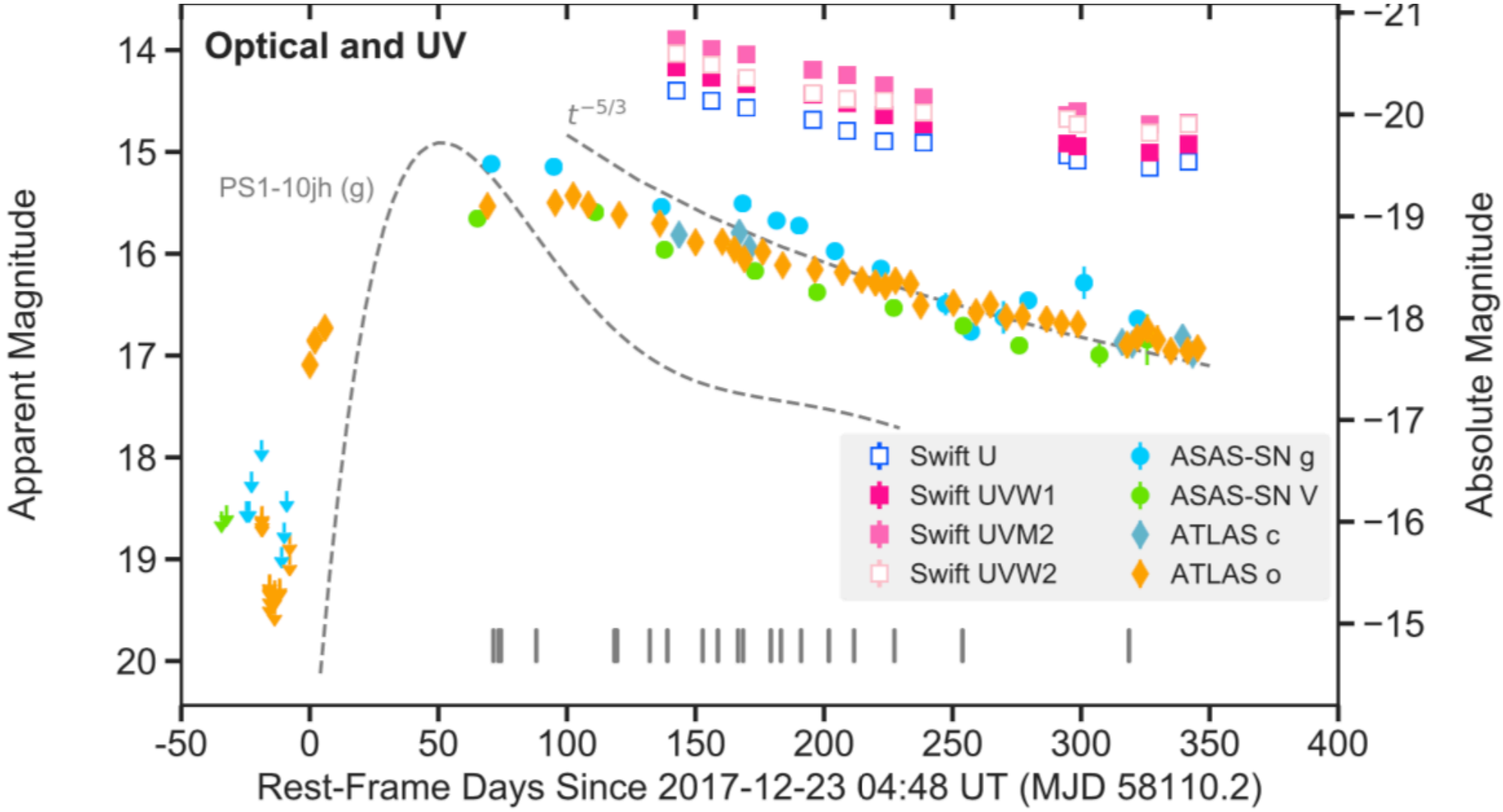


Boller et al. (2003)



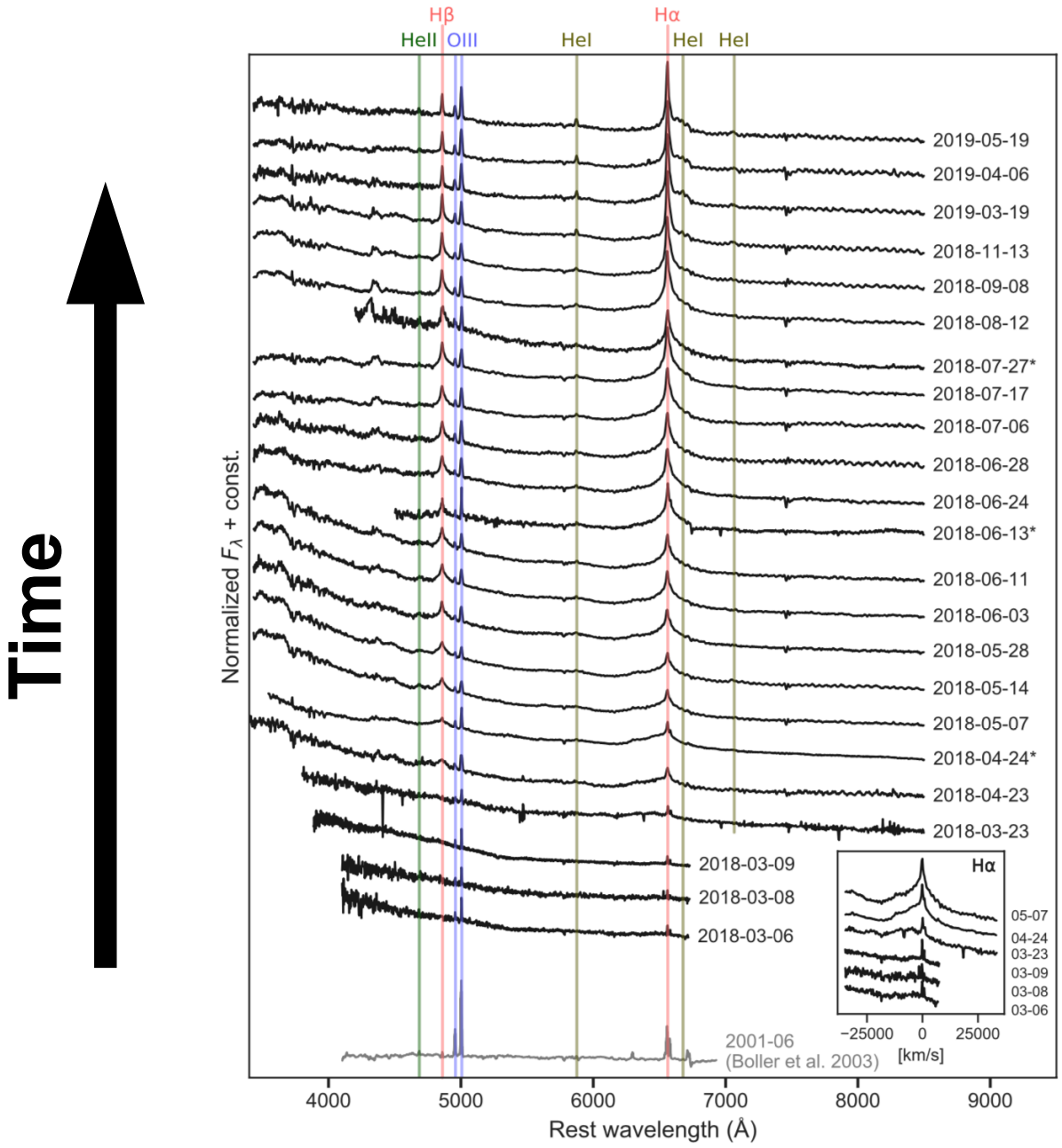
Boller et al. (2003); Gallo et al. (2013)

The optical/UV outburst of 1ES 1927+654



Trakhtenbrot et al. (2019)

The changing-look AGN 1ES 1927+654



Time

Trakhtenbrot et al. (2019)

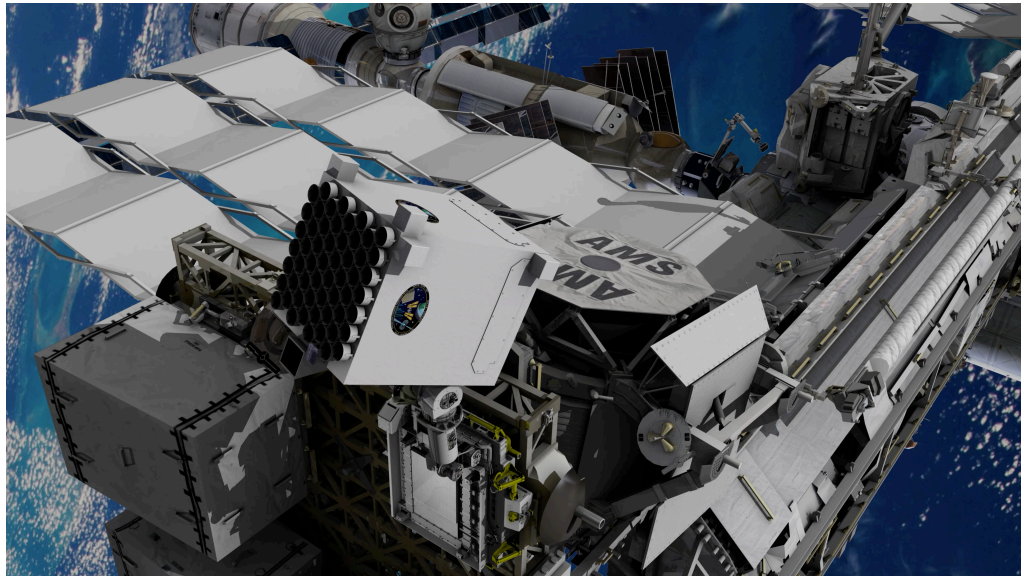
The X-ray campaign

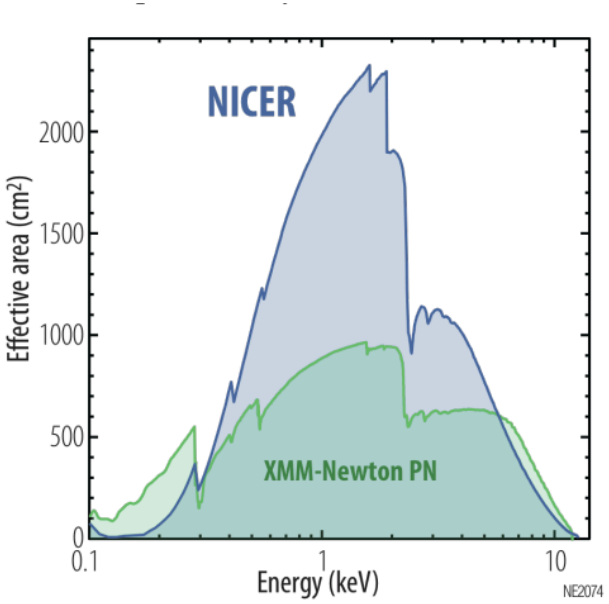
~ **1.3 Ms**

~300 NICER (~700 ks)

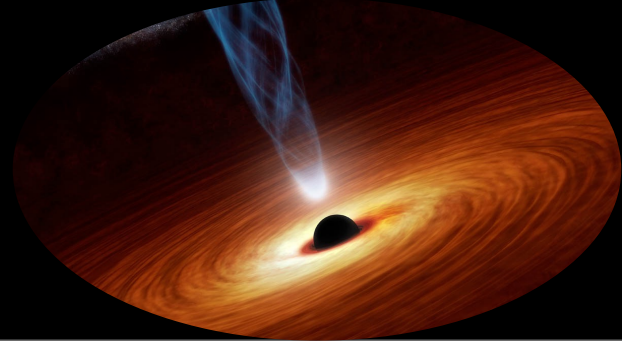
14 Swift (26 ks)

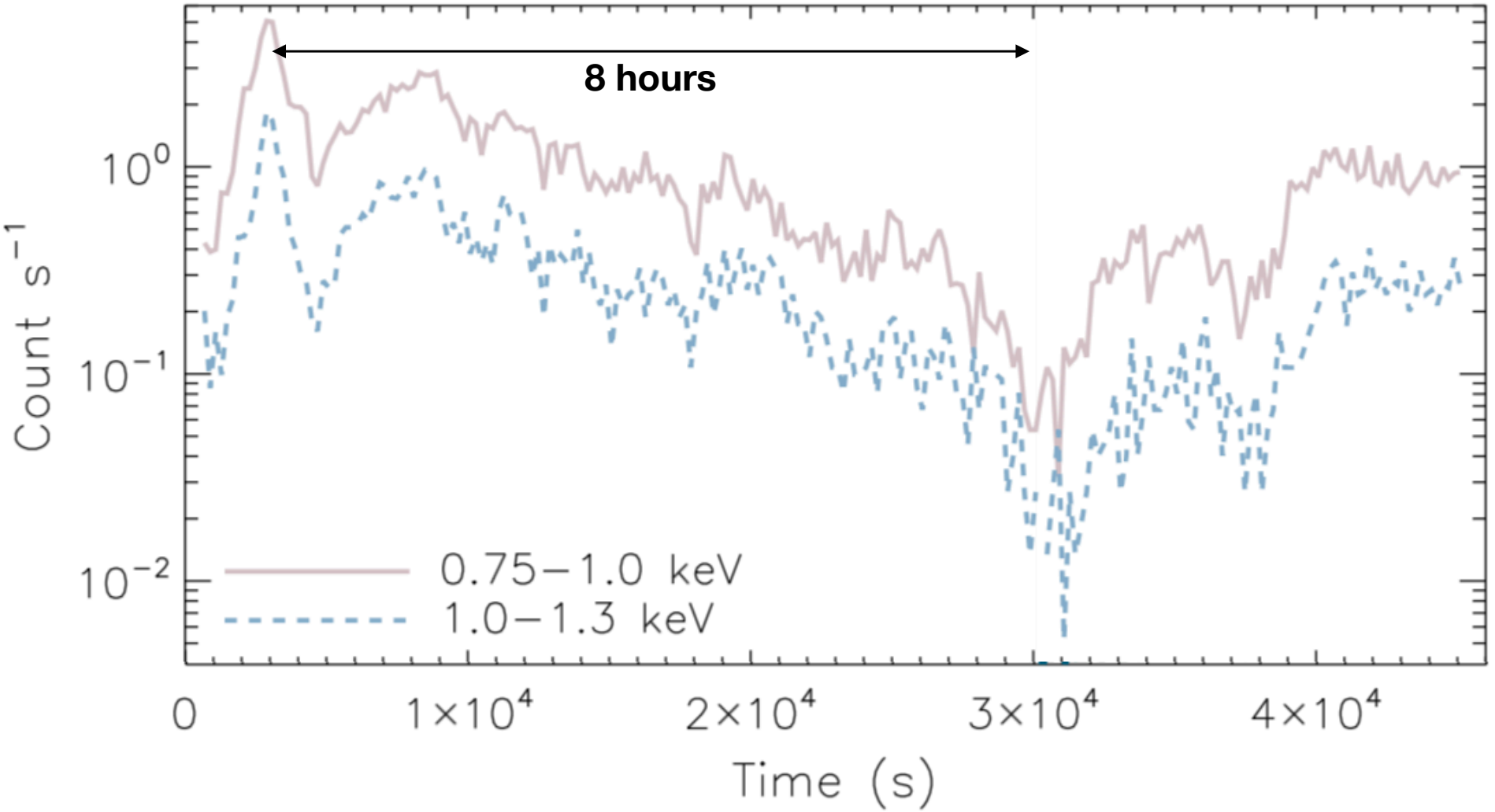
6 simultaneous XMM/NuSTAR (~600 ks)





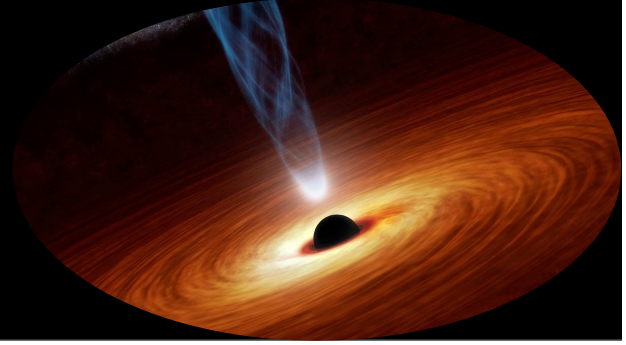
Extreme variability on short timescales..

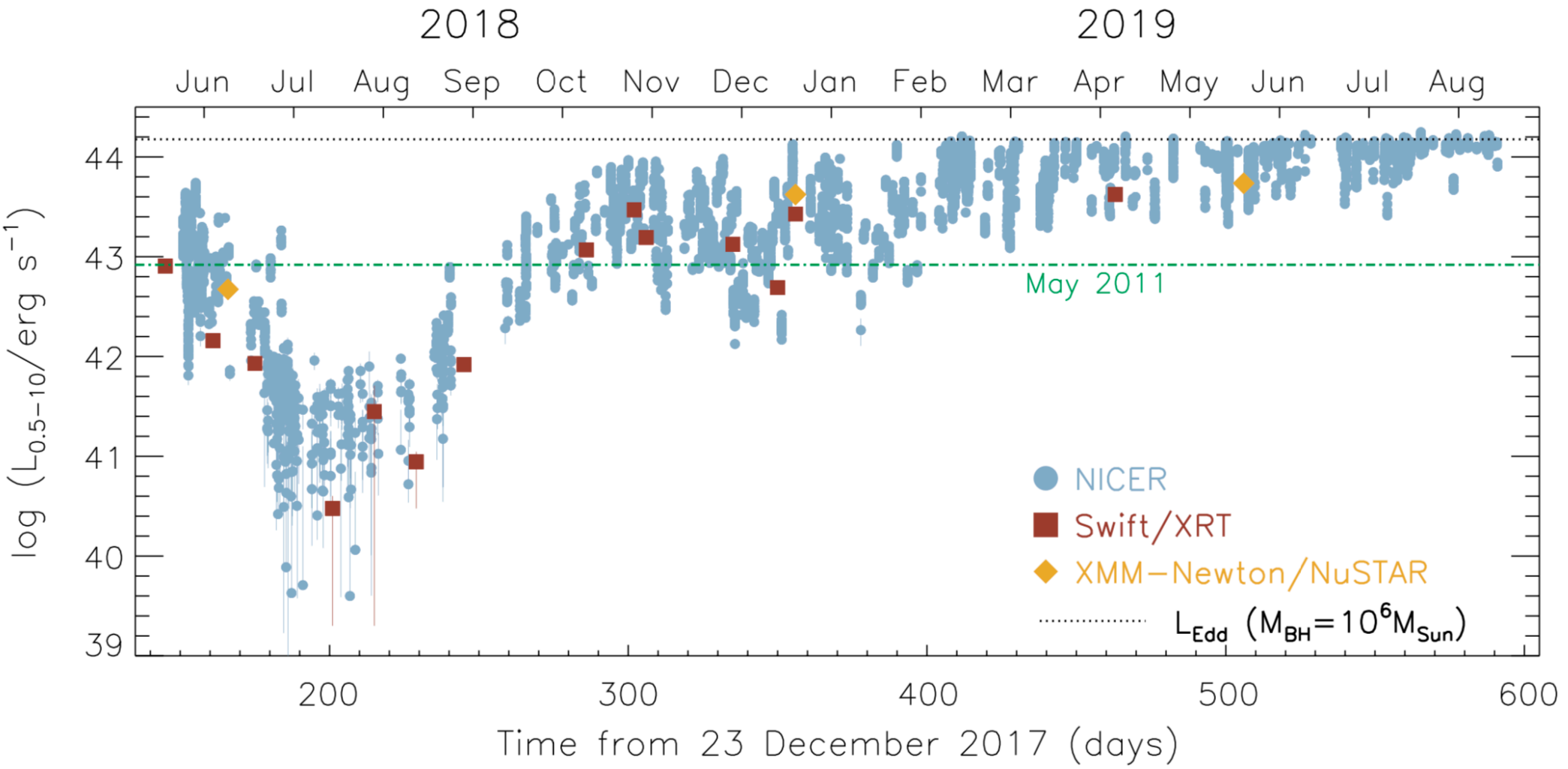




Ricci et al. (2020,2021)

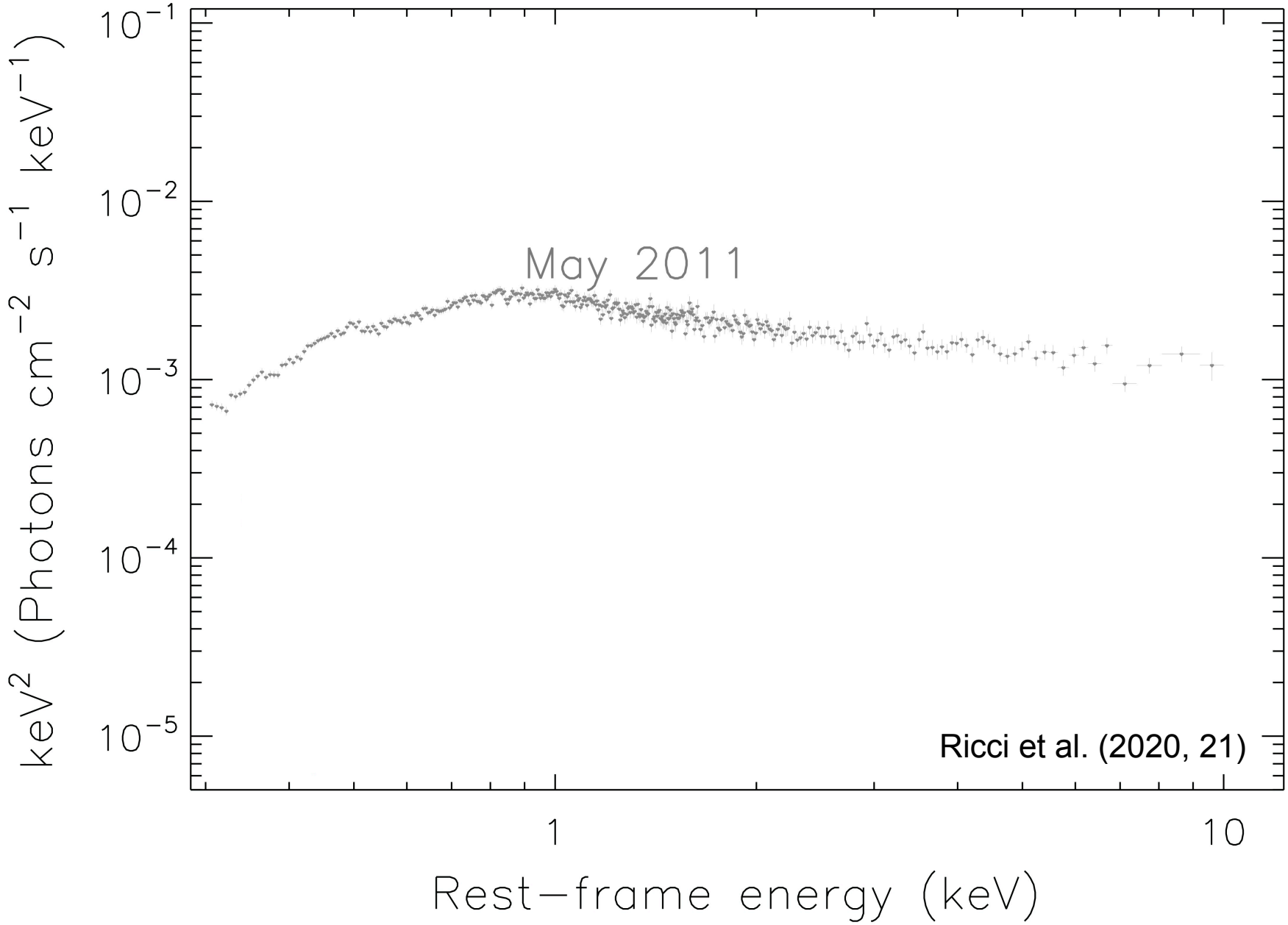
..and on long timescales





Ricci et al. (2020,2021)

The evolution of the X-ray spectrum



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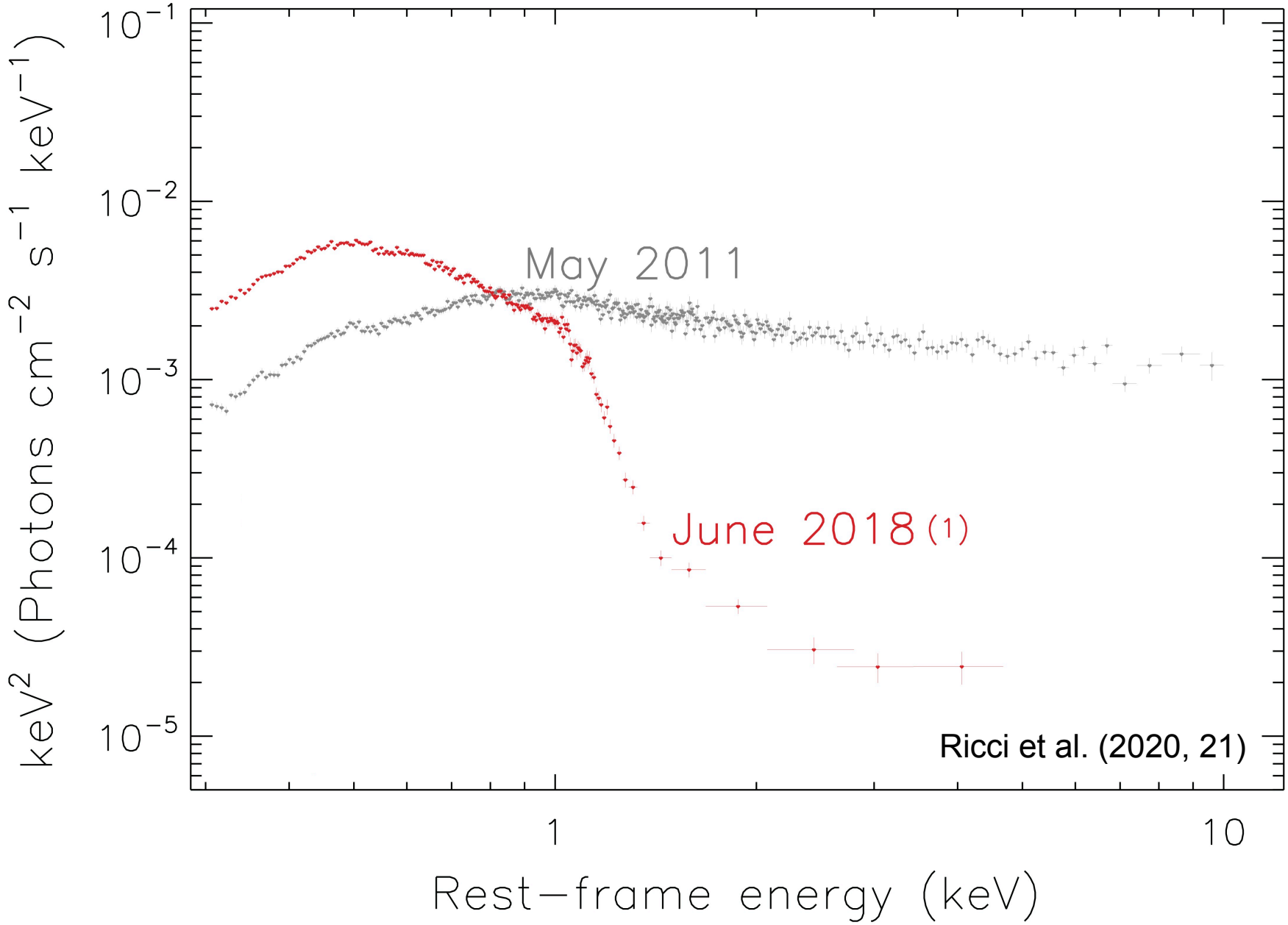

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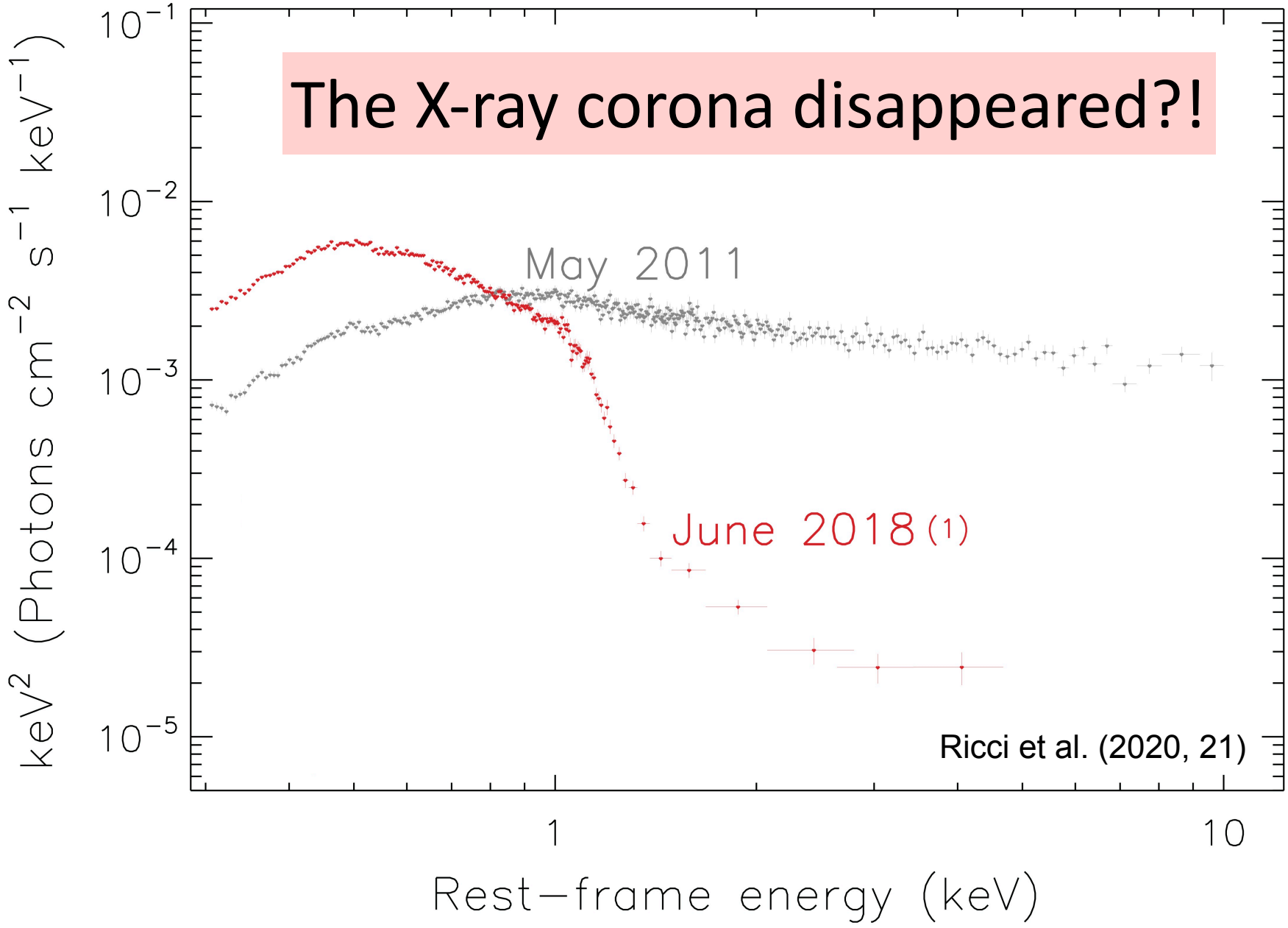

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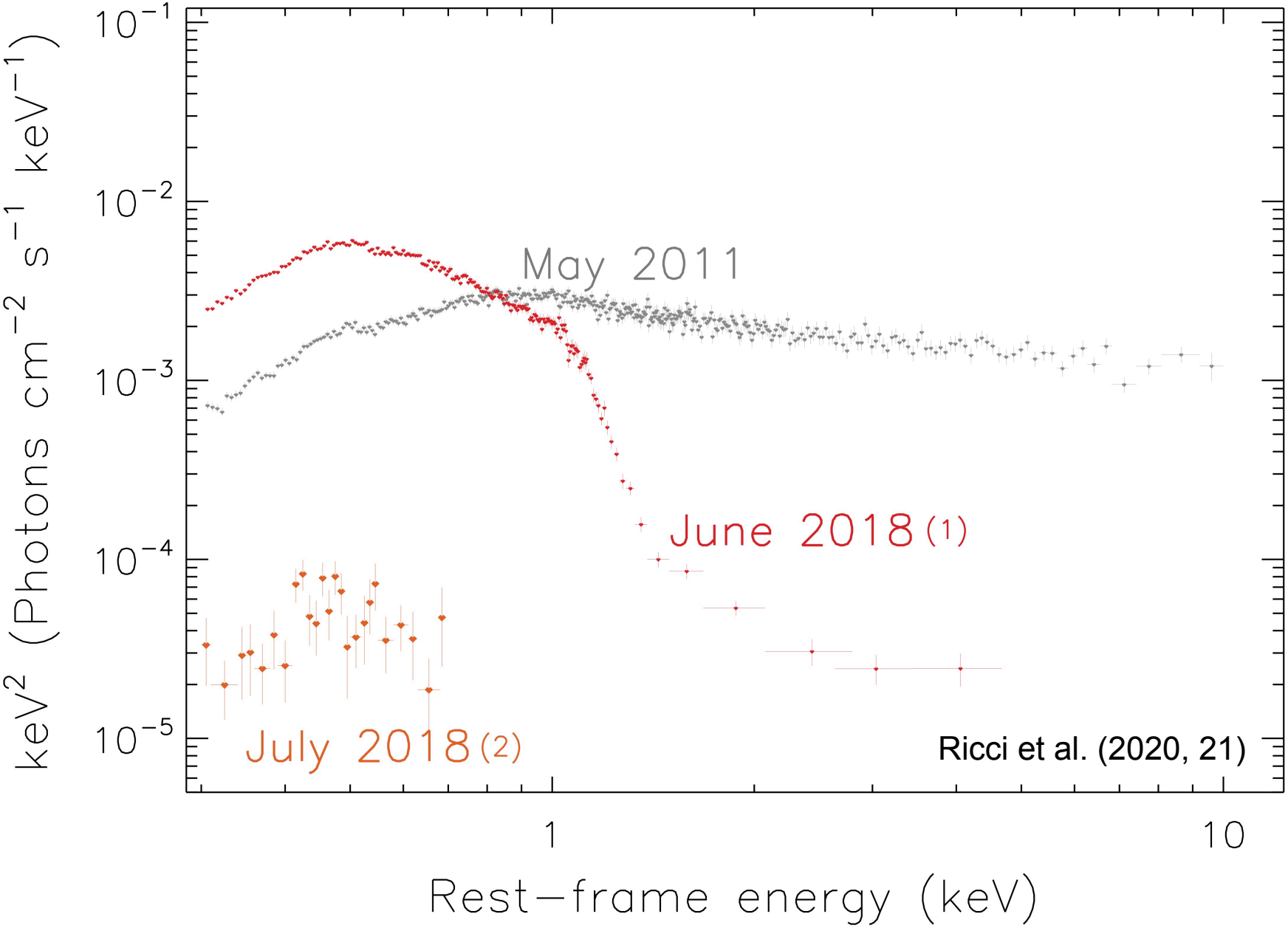

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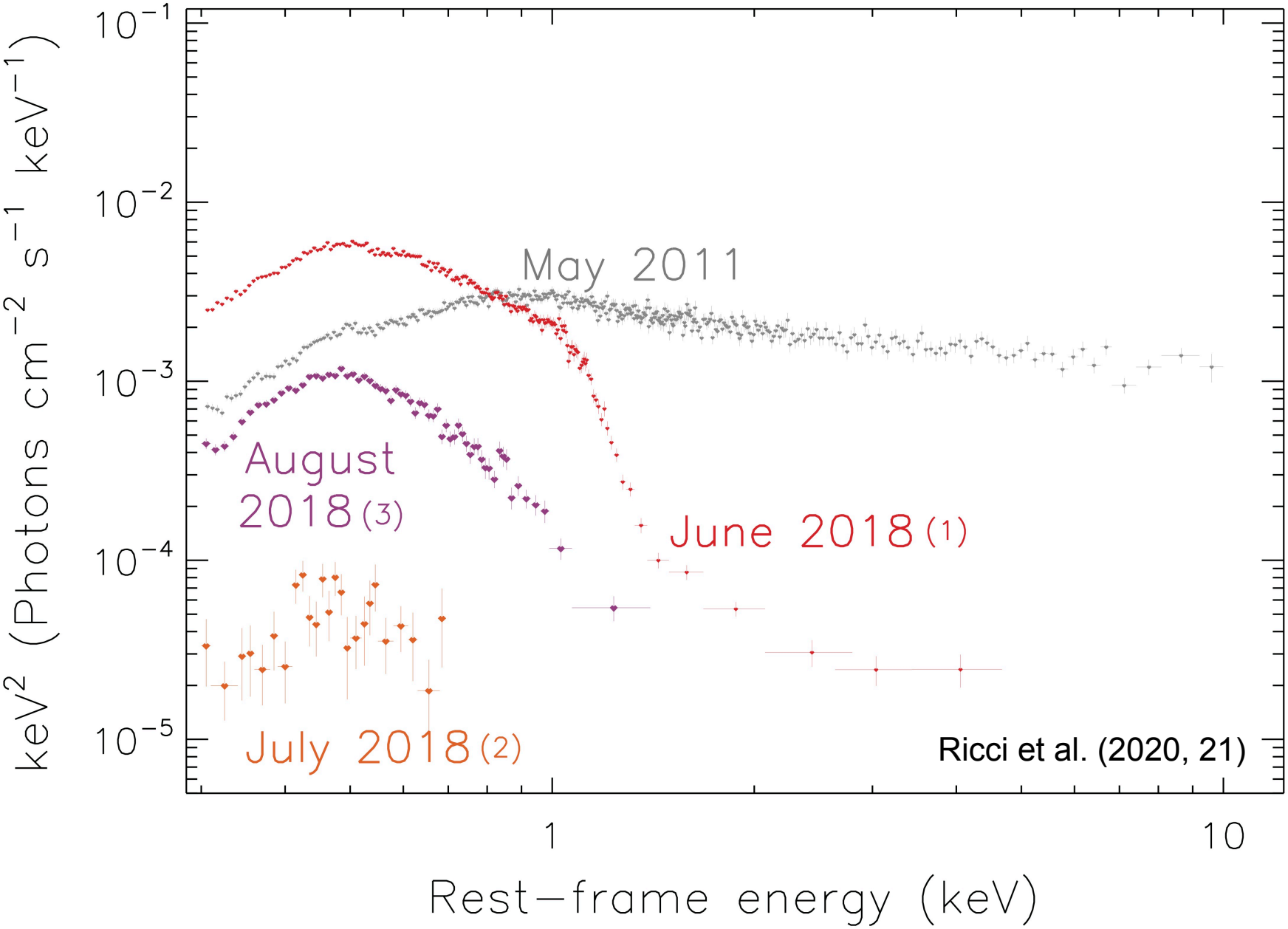

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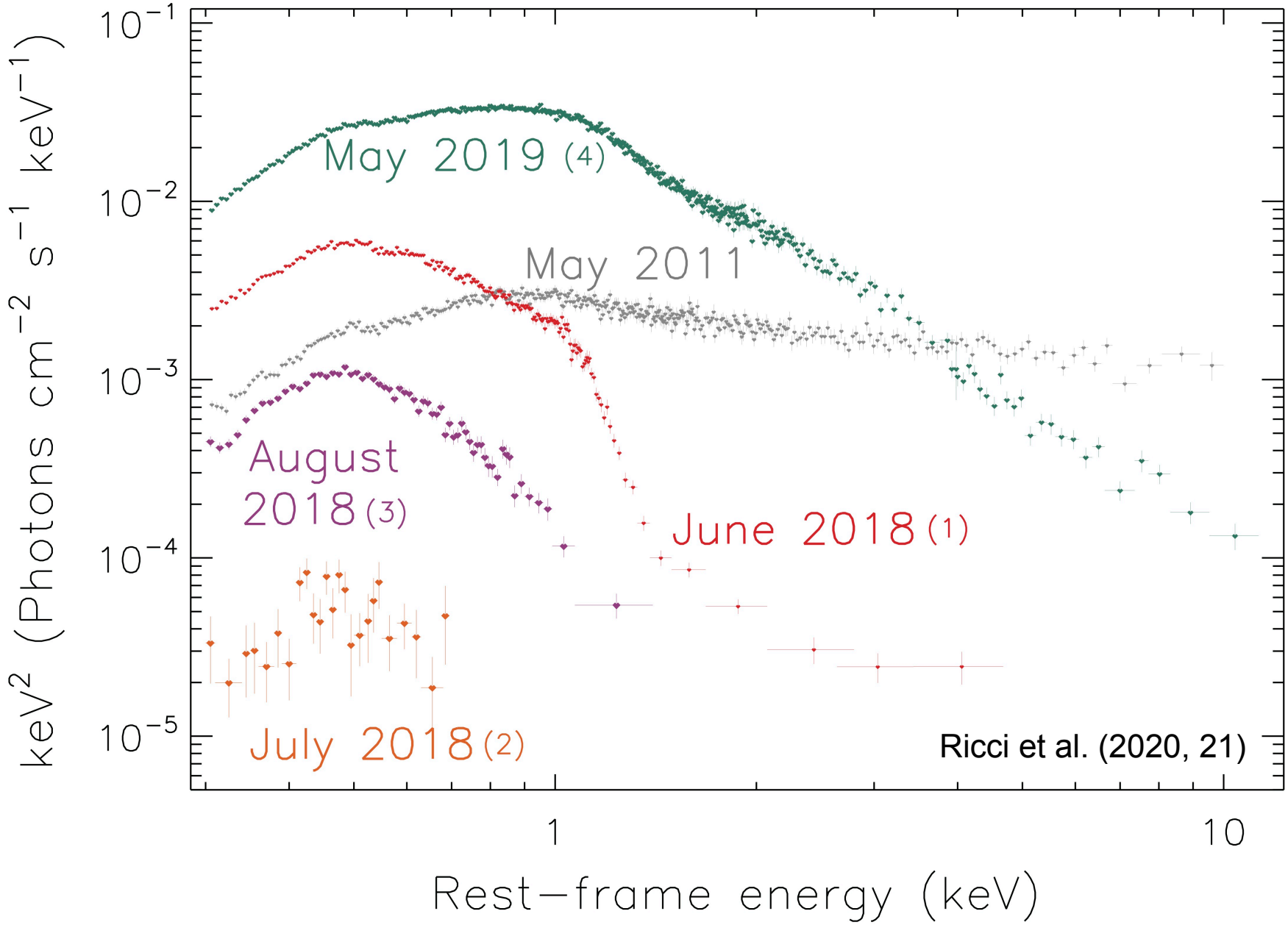

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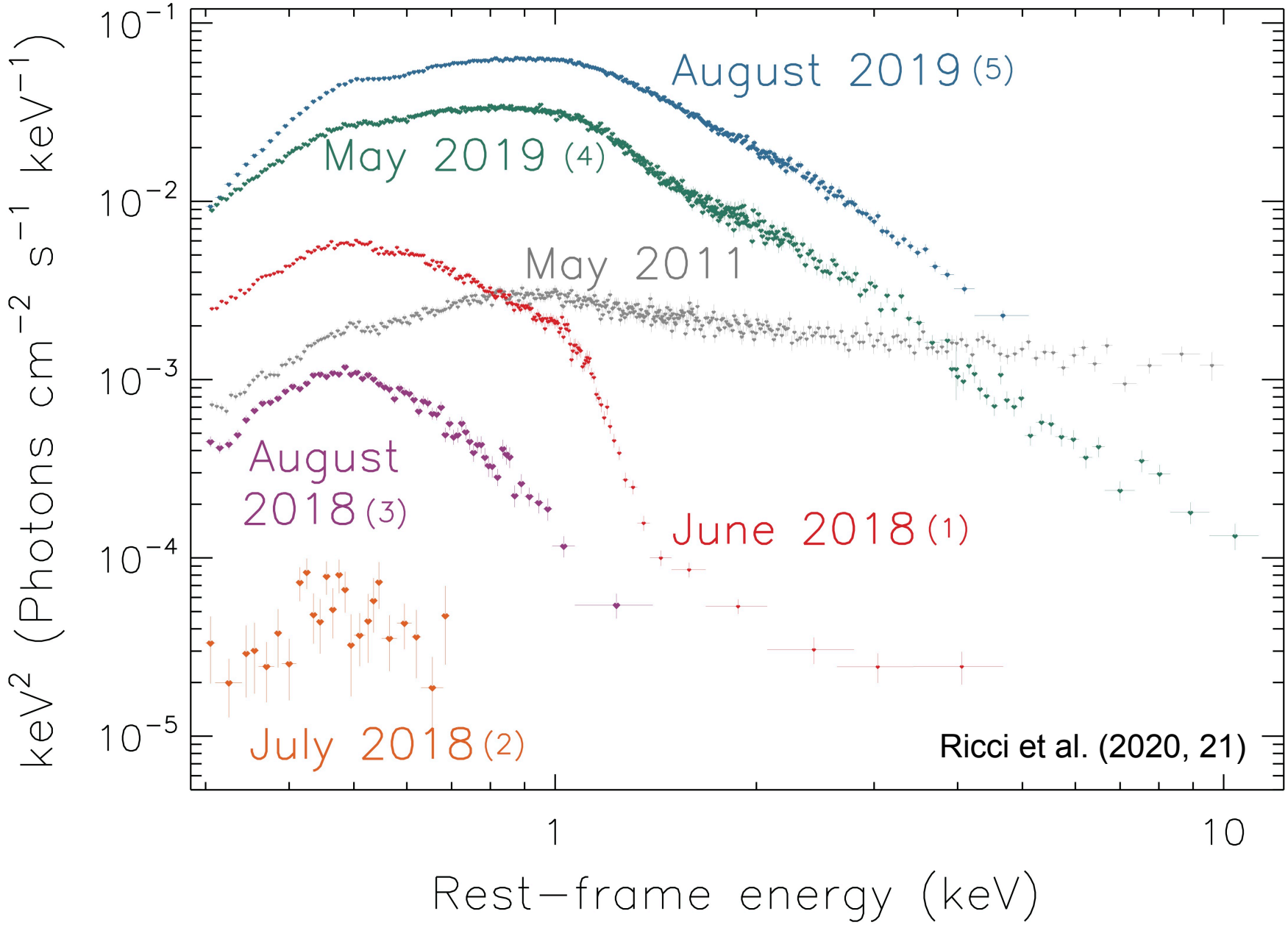

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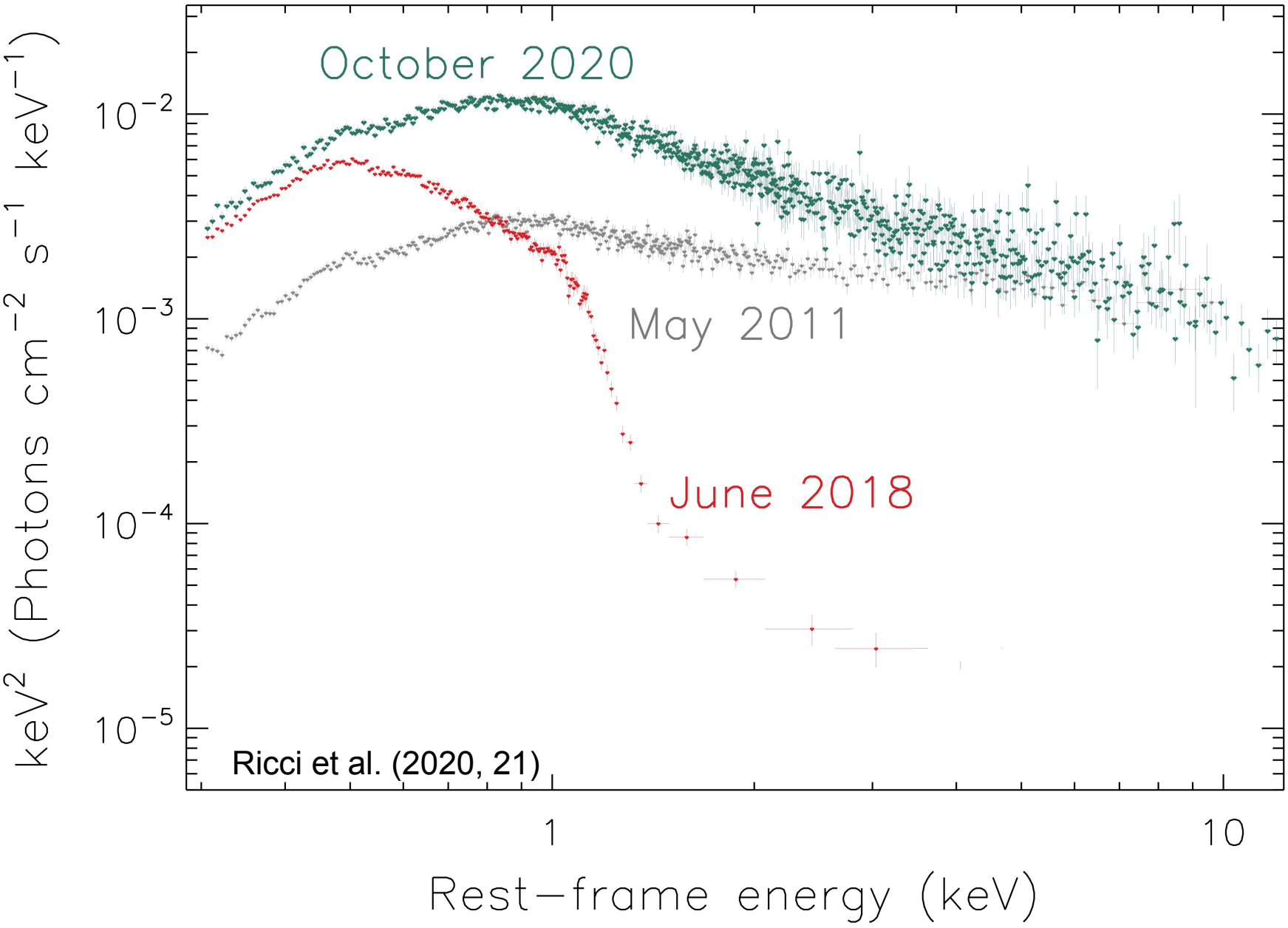

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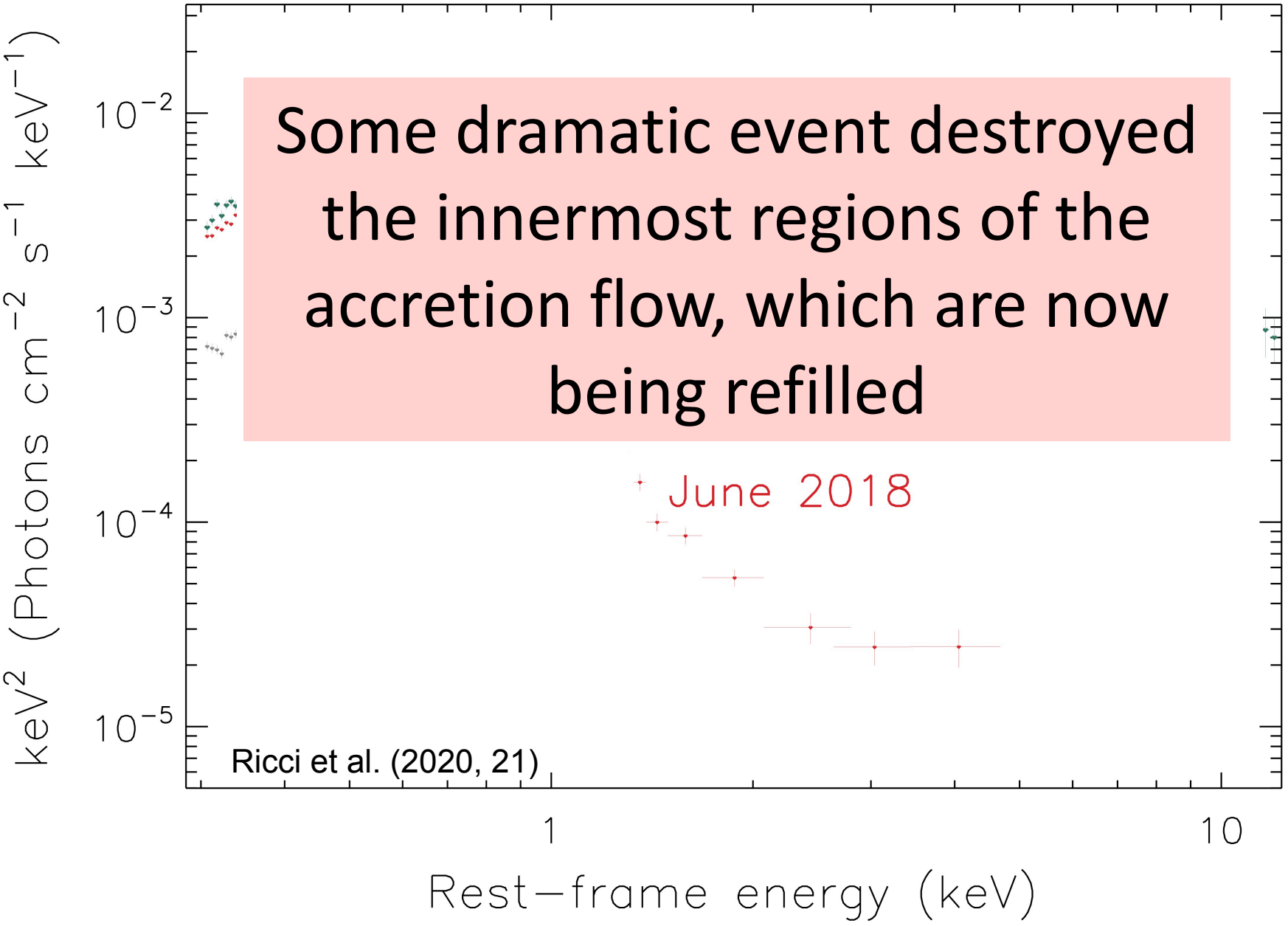
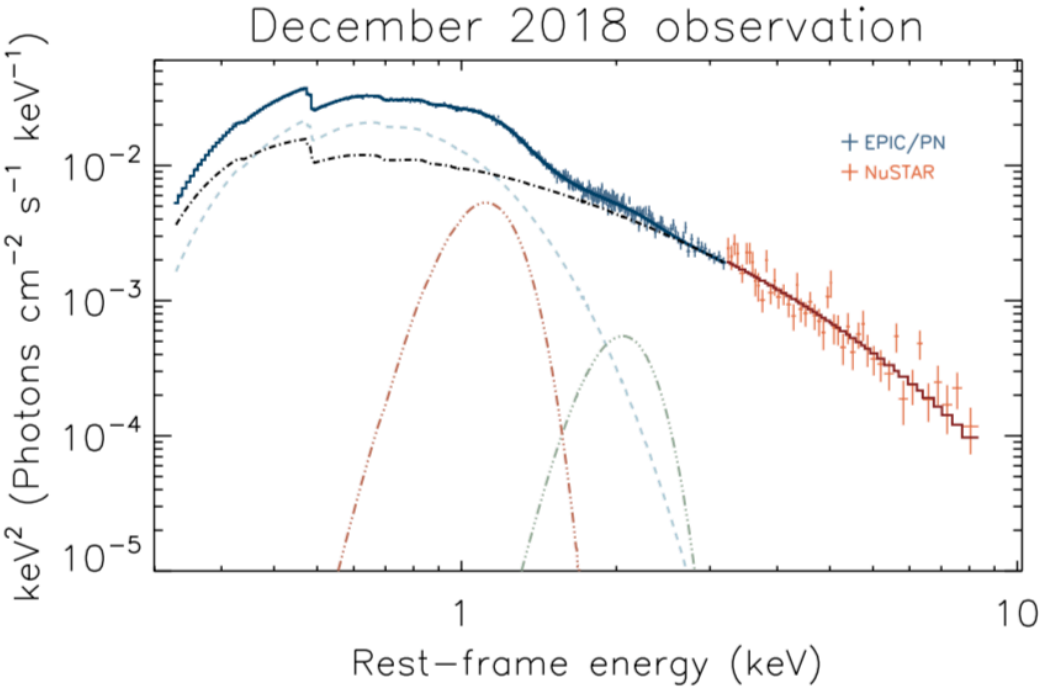


The other peculiarities of 1ES 1927+654

- Very soft ($\Gamma \simeq 3$)
[Typical AGN: $\Gamma \simeq 1.8$]

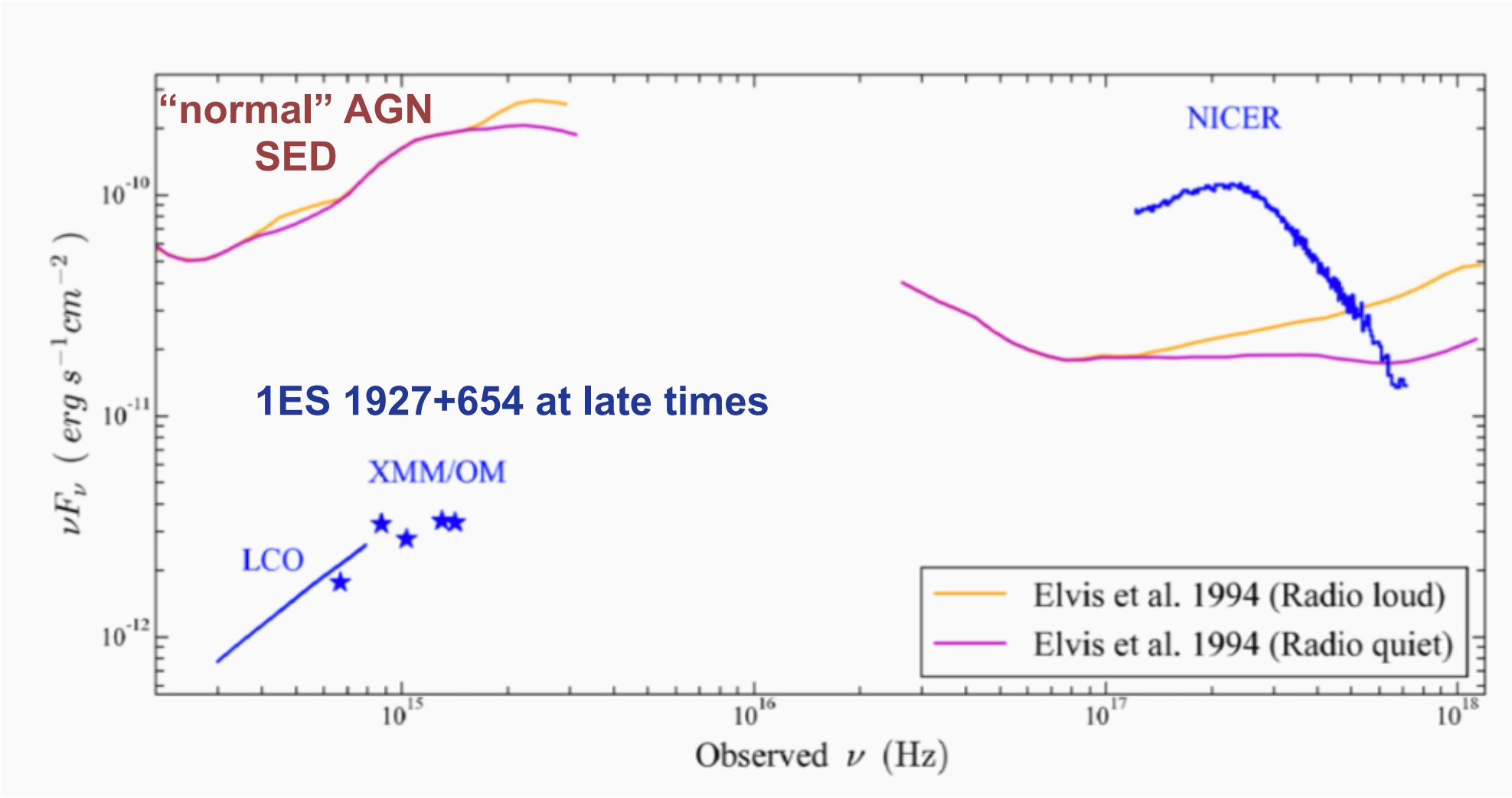
- Very low energy cutoff
($E_{\rm C} \simeq 2-3\,{\rm keV}$)
[Typical AGN: $E_{\rm C} \simeq 200\,{\rm keV}$]

- Very clear harder when brighter behaviour
[Typical AGN: softer when brighter]



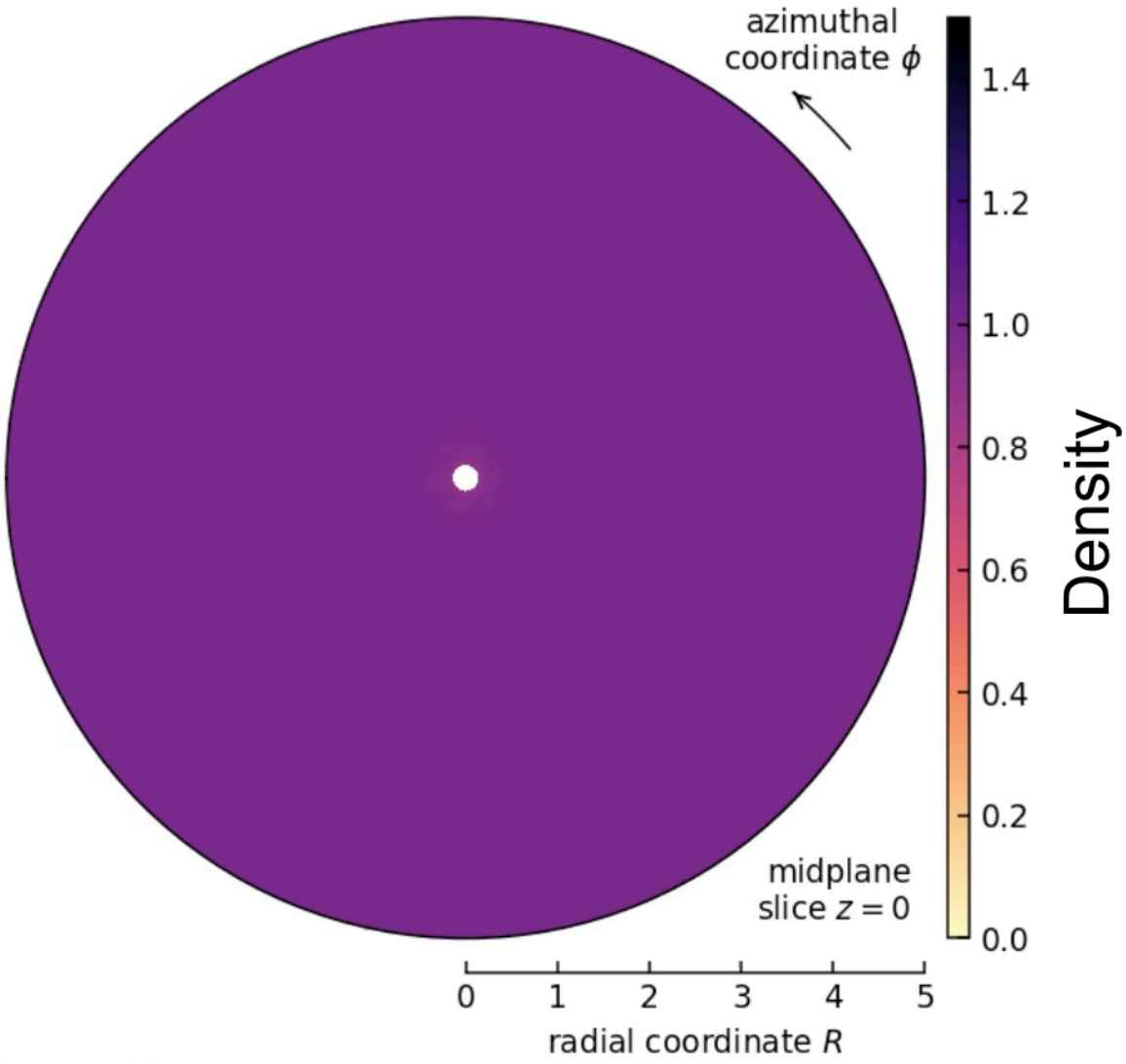
Ricci et al. (2020, 21)

The spectral energy distribution



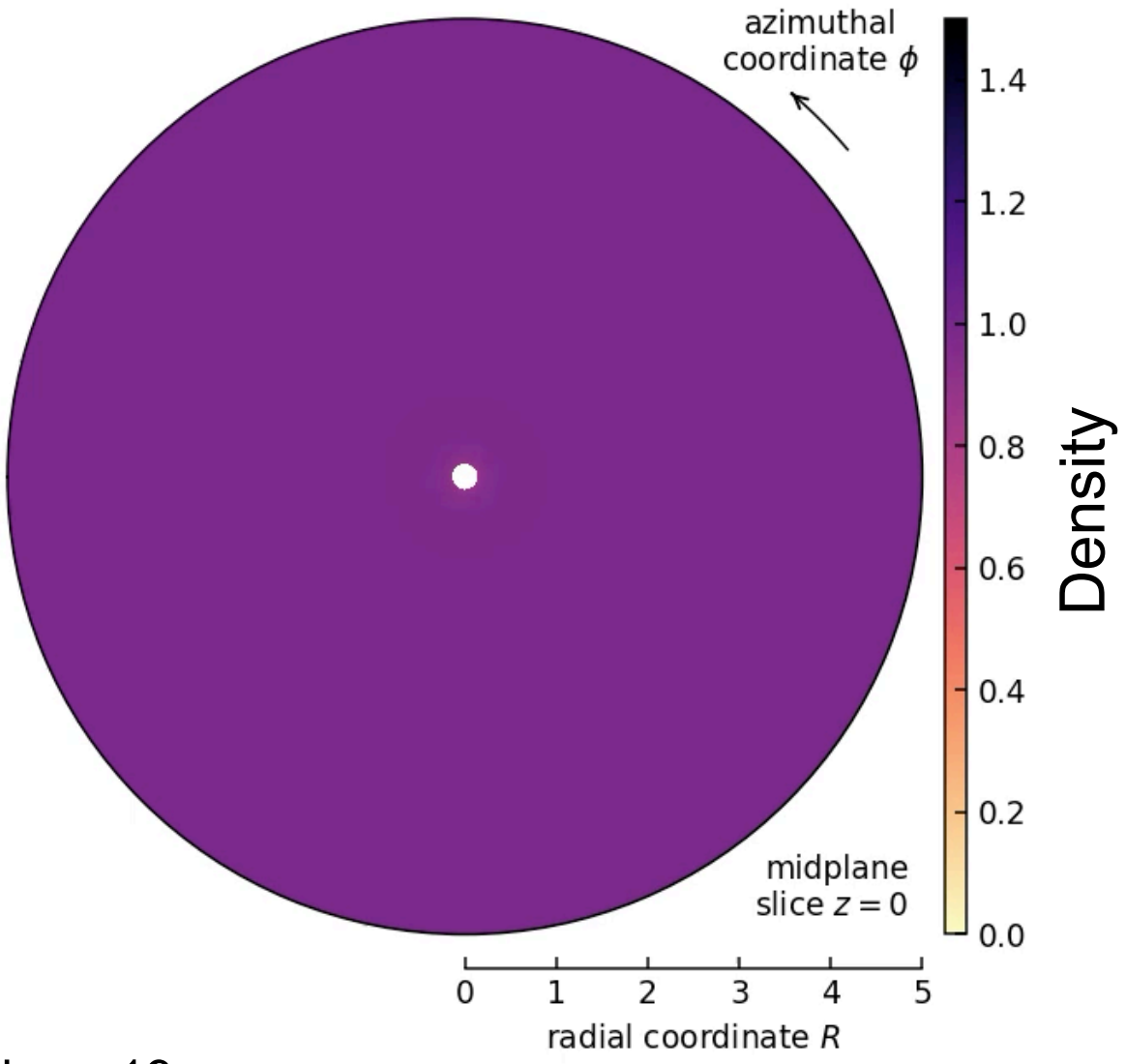
Ricci et al. (2020, 21)

A Tidal disruption event in an AGN?



Chan+19

A Tidal disruption event in an AGN?



Chan+19

Extreme AGN transients with *Theseus*

SXI:

- X-ray identification of changing-look AGN within a few days
- X-ray spectral evolution, identification of different classes and timescales
- New exotic AGN transients!

XGIS:

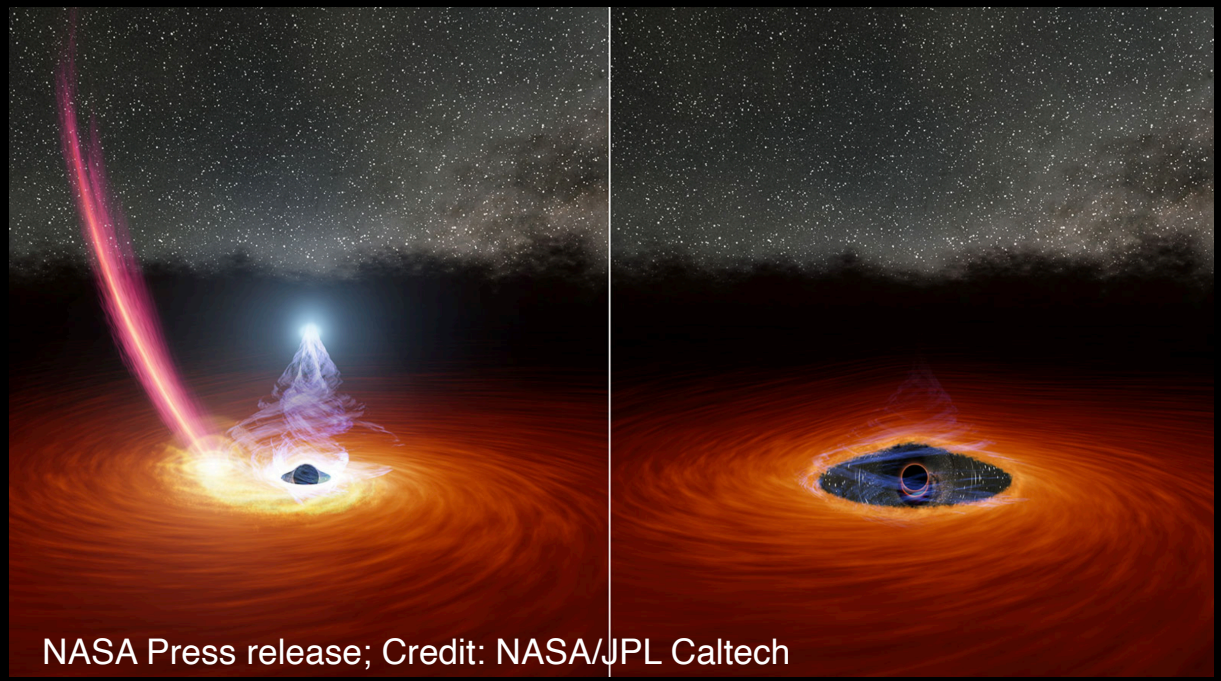
- Hard X-ray and gamma-ray emission expected from the second impact in TDEs in AGN (Chan et al. 2020)


Credit: NASA/JPL Caltech

Summary

- Changing-look events in AGN can be associated with dramatic and quick transformations of the innermost regions of accreting SMBHs (and TDEs?)

- Future studies with *eRosita,* the *Einstein probe* and later on with *Theseus* might find several more objects such as 1ES 1927+654 and other exotic AGN transients.



NASA Press release; Credit: NASA/JPL Caltech