

# The destruction and recreation of the X-ray corona in an accreting massive black hole

*Claudio Ricci*

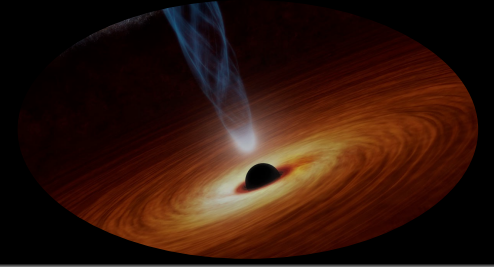
*Universidad Diego Portales, Chile*

*Kavli Institute for Astronomy and Astrophysics, China*

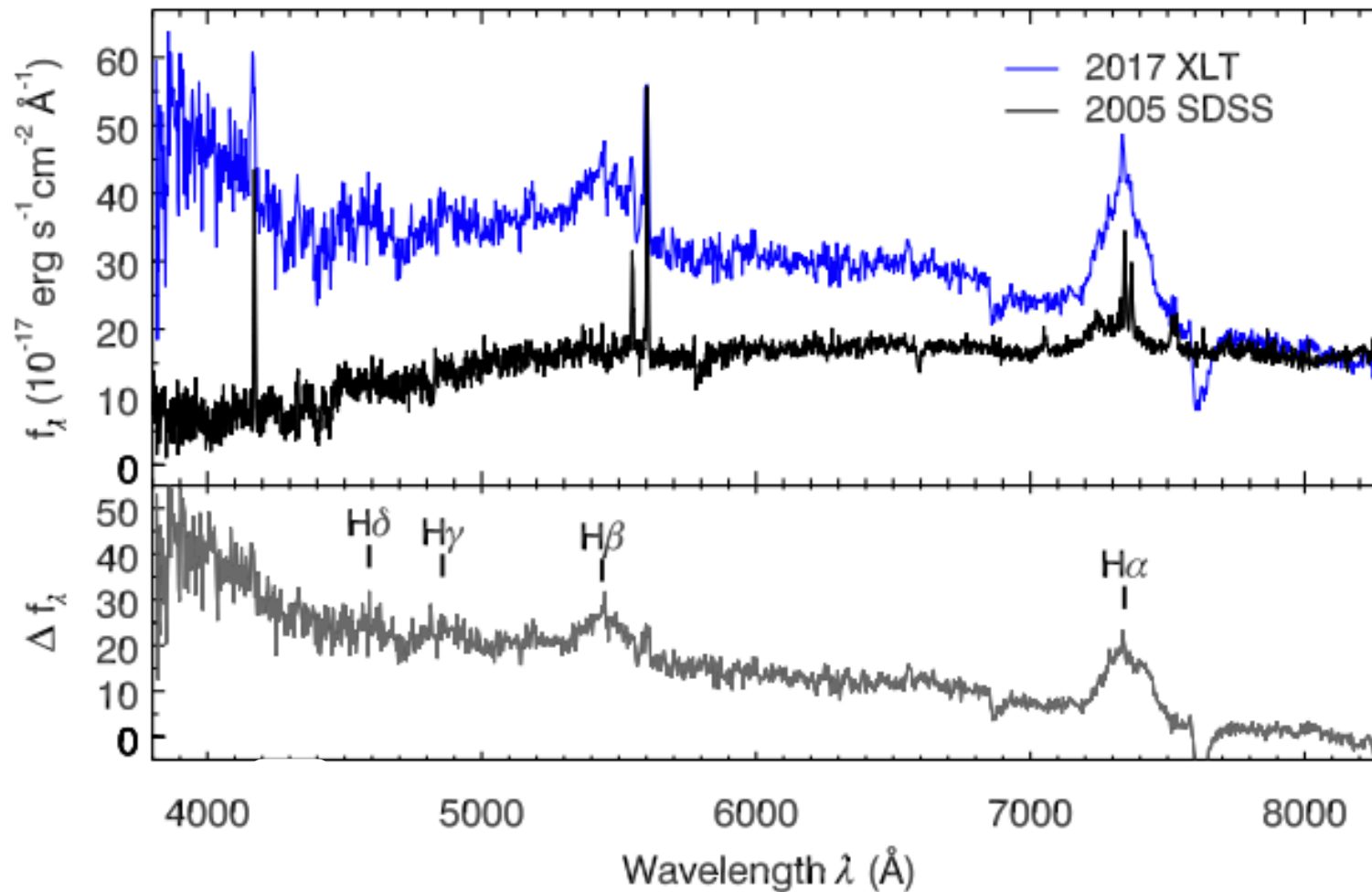
*George Mason University, USA*

Erin Kara (MIT), Michael Loewenstein (NASA), Benny Trakhtenbrot (Tel Aviv U.), Iair Arcavi (Tel Aviv U.), Ron Remillard (MIT), Andrew C. Fabian (Cambridge U.), Keith C. Gendreau (NASA), Zaven Arzoumanian (NASA), Ruancun Li (KIAA), Luis C. Ho (KIAA), Chelsea L. MacLeod (CFA), Ed Cackett (Wayne State U.), Diego Altamirano (Southampton U.), Poshak Gandhi (Southampton U.), Peter Kosec (Cambridge U.), Dheeraj Pasham (MIT), Jack Steiner (MIT), Chi-Ho Chan (Jerusalem U.)

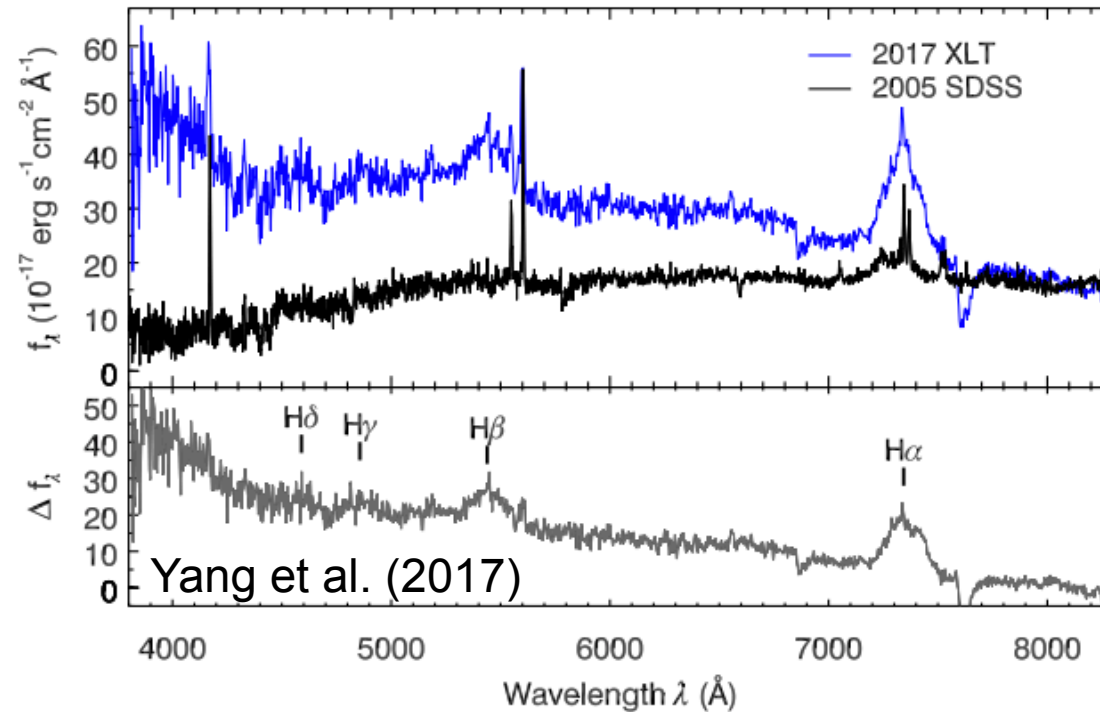
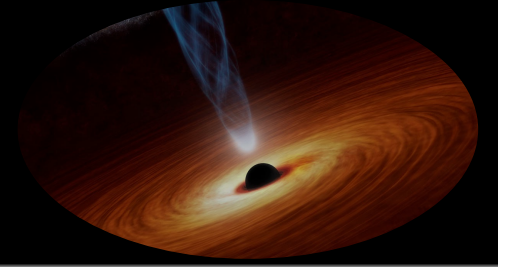
# Changing-look AGN



Type 1  $\longleftrightarrow$  Type 2

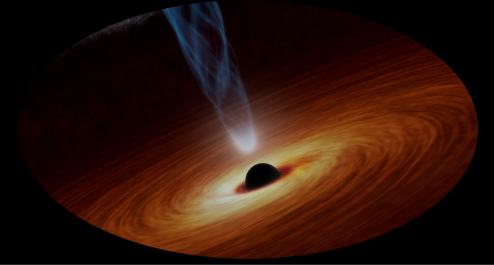


# Mechanisms triggering Changing-look events

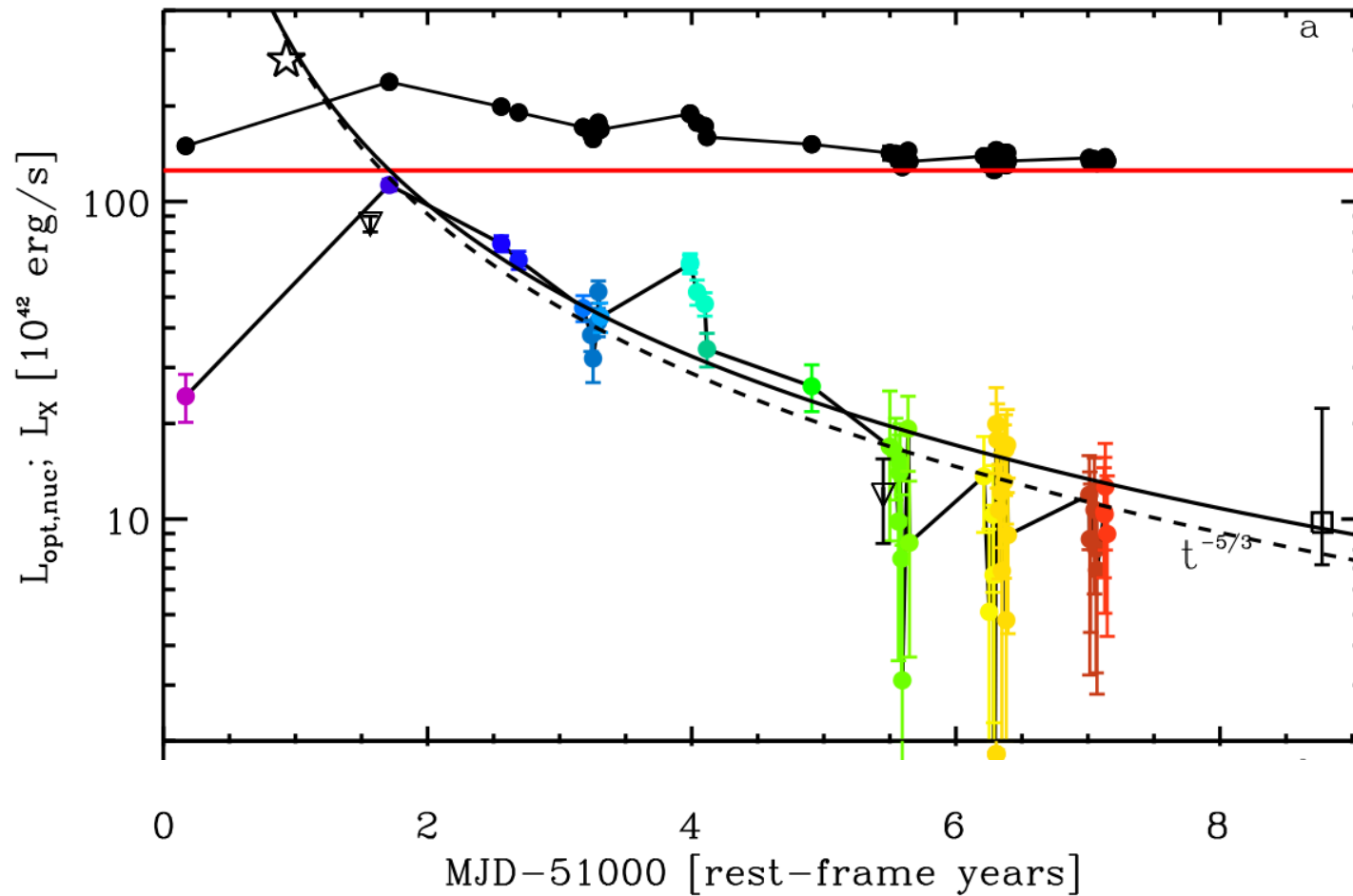


- **State transitions** (as in BH binaries; e.g. Noda+18)
- **Disk instabilities** (e.g. Stern+18, Ross+18)
- **Tidal disruption events** (e.g. Merloni+16)

# TDEs and changing-look AGN

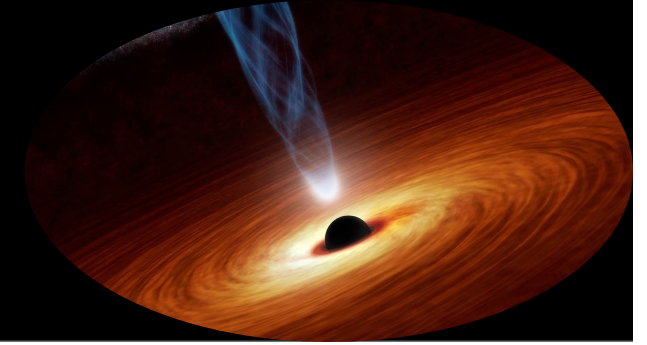


## The changing-look AGN SDSS J0159+0033

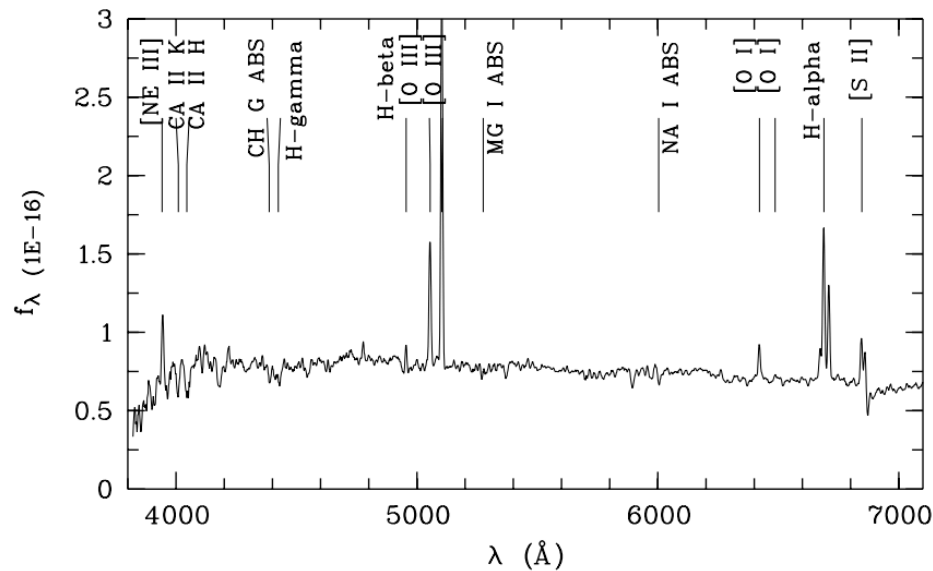


Merloni et al. (2016),  
see also poster by Liu

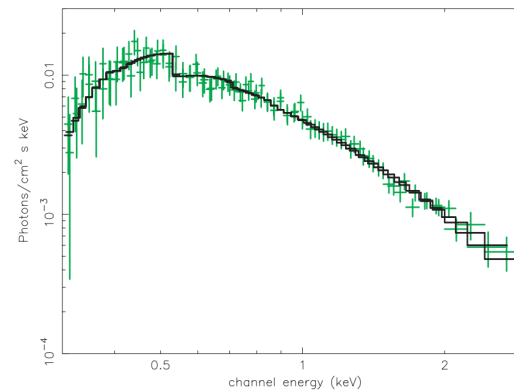
# 1ES 1927+654



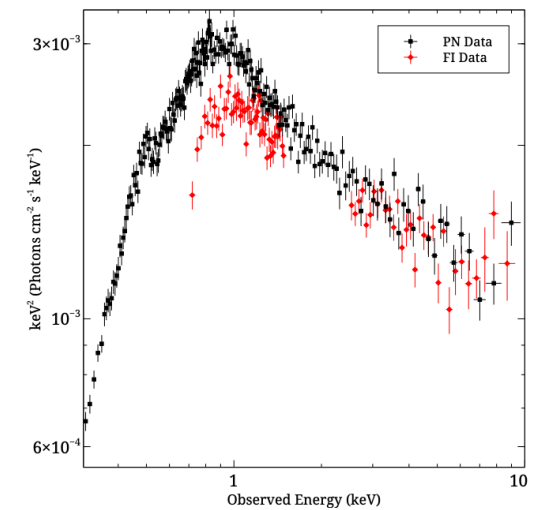
Source previously classified as an AGN both in the optical and in the X-rays ( $L_x \sim 1e43$  erg/s)



Boller et al. (2003)

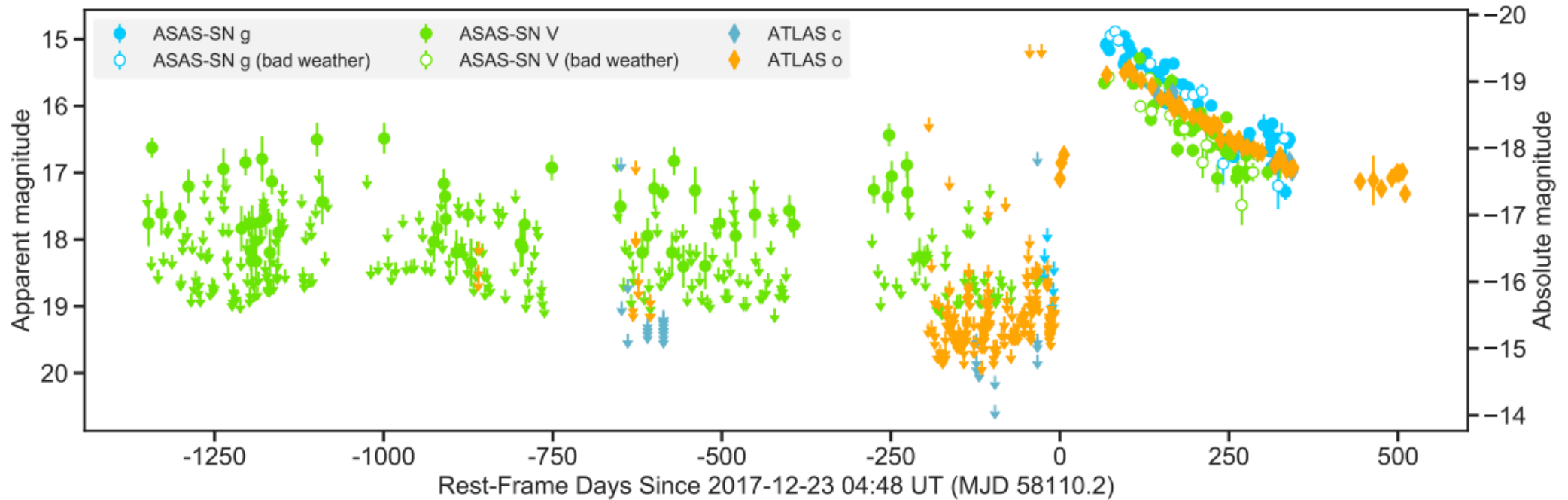
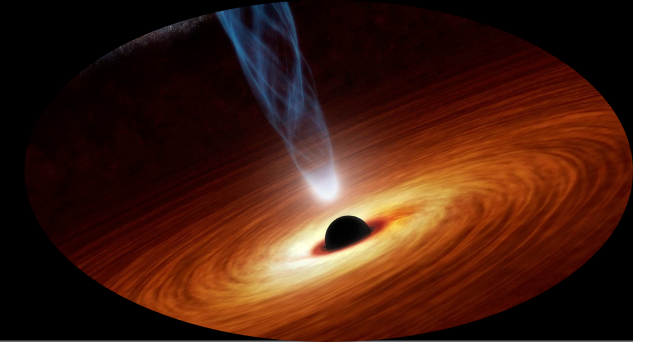


Boller et al. (2003)



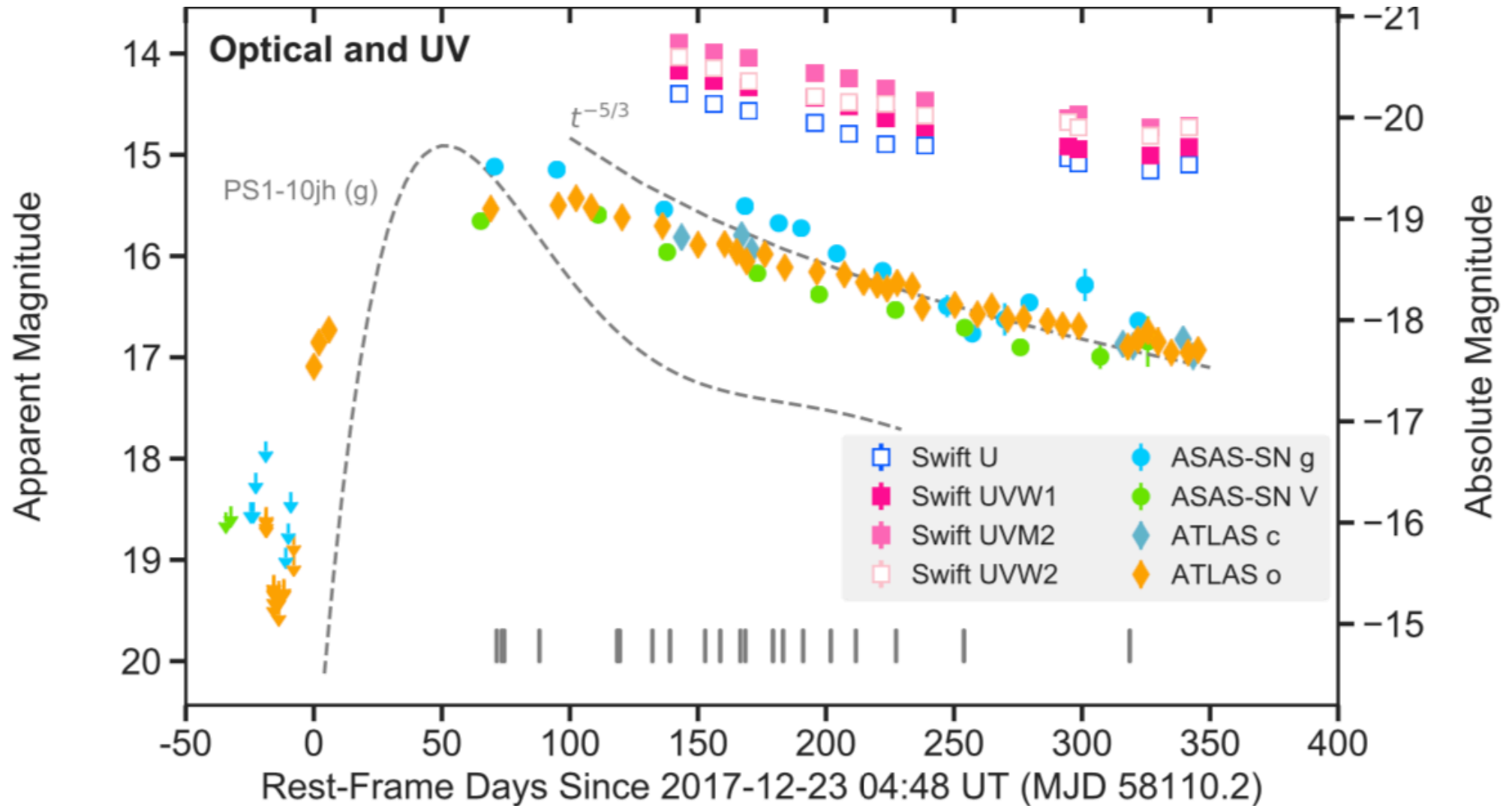
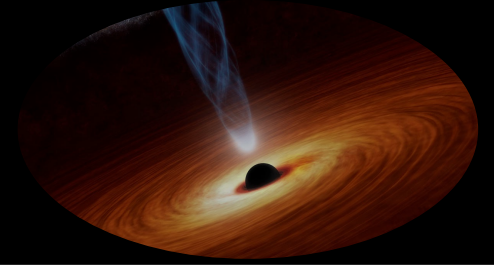
Gallo et al. (2013)

# The optical/UV outburst of 1ES 1927+654

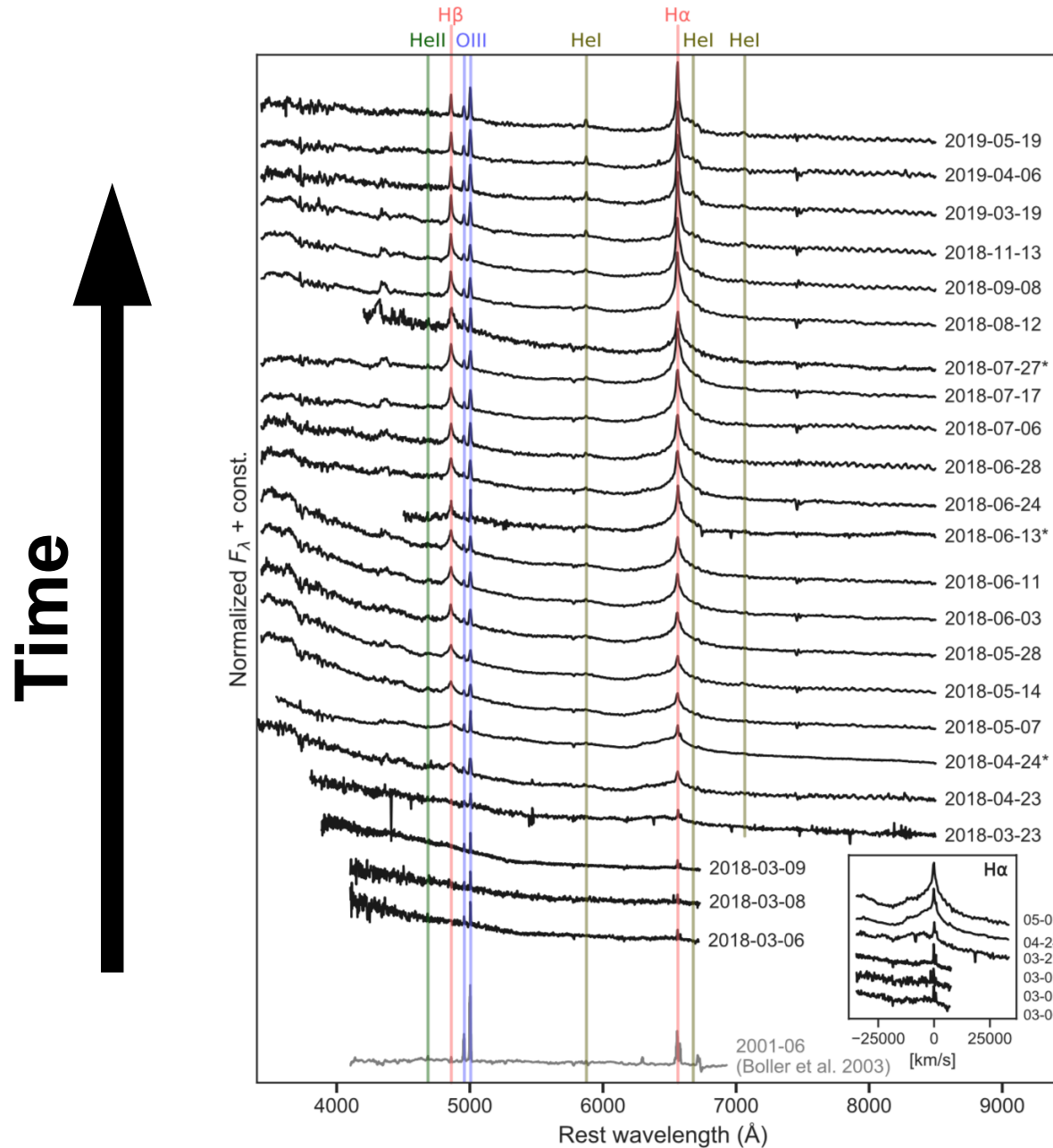
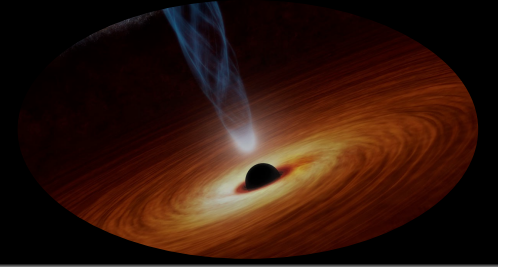


Trakhtenbrot et al. (2019)

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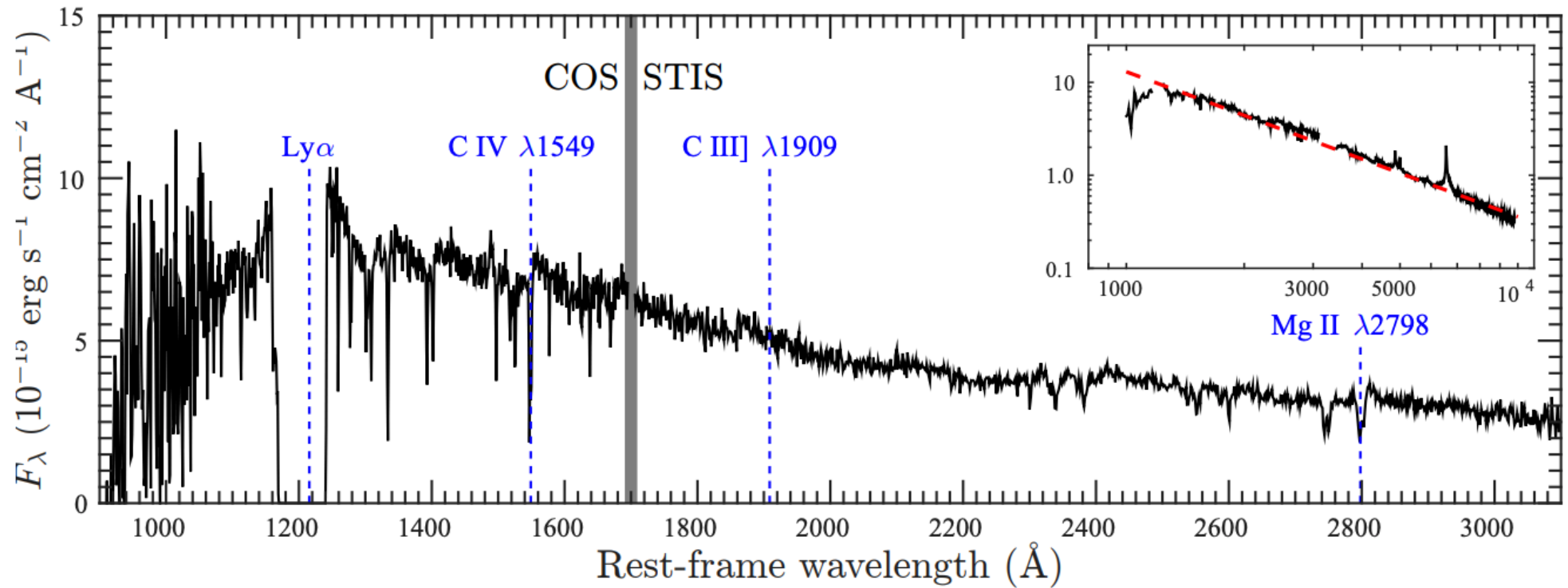
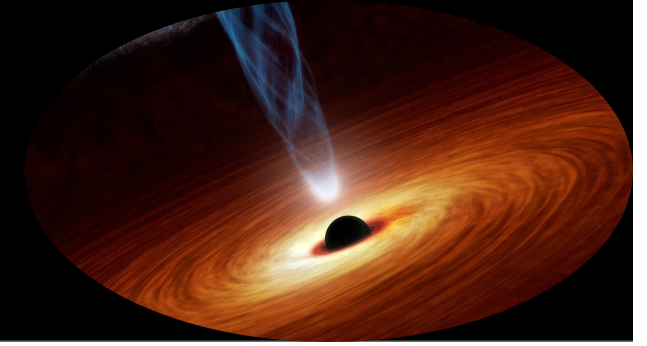
# The changing-look AGN 1ES 1927+654



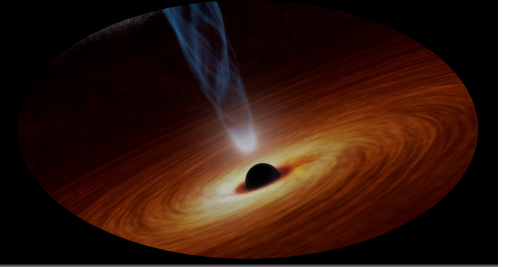
Trakhtenbrot et al. (2019)



# The UV spectrum



# The X-ray campaign

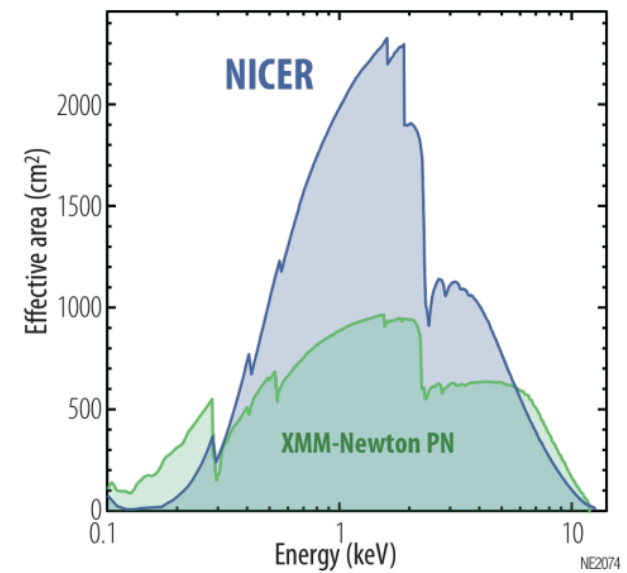
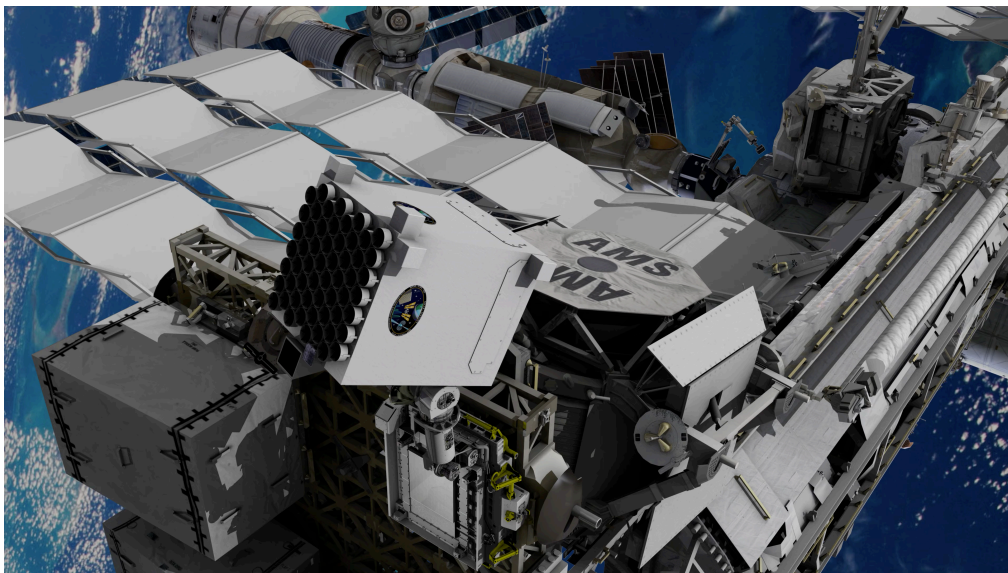


~ 1.1 Ms (13 full days)

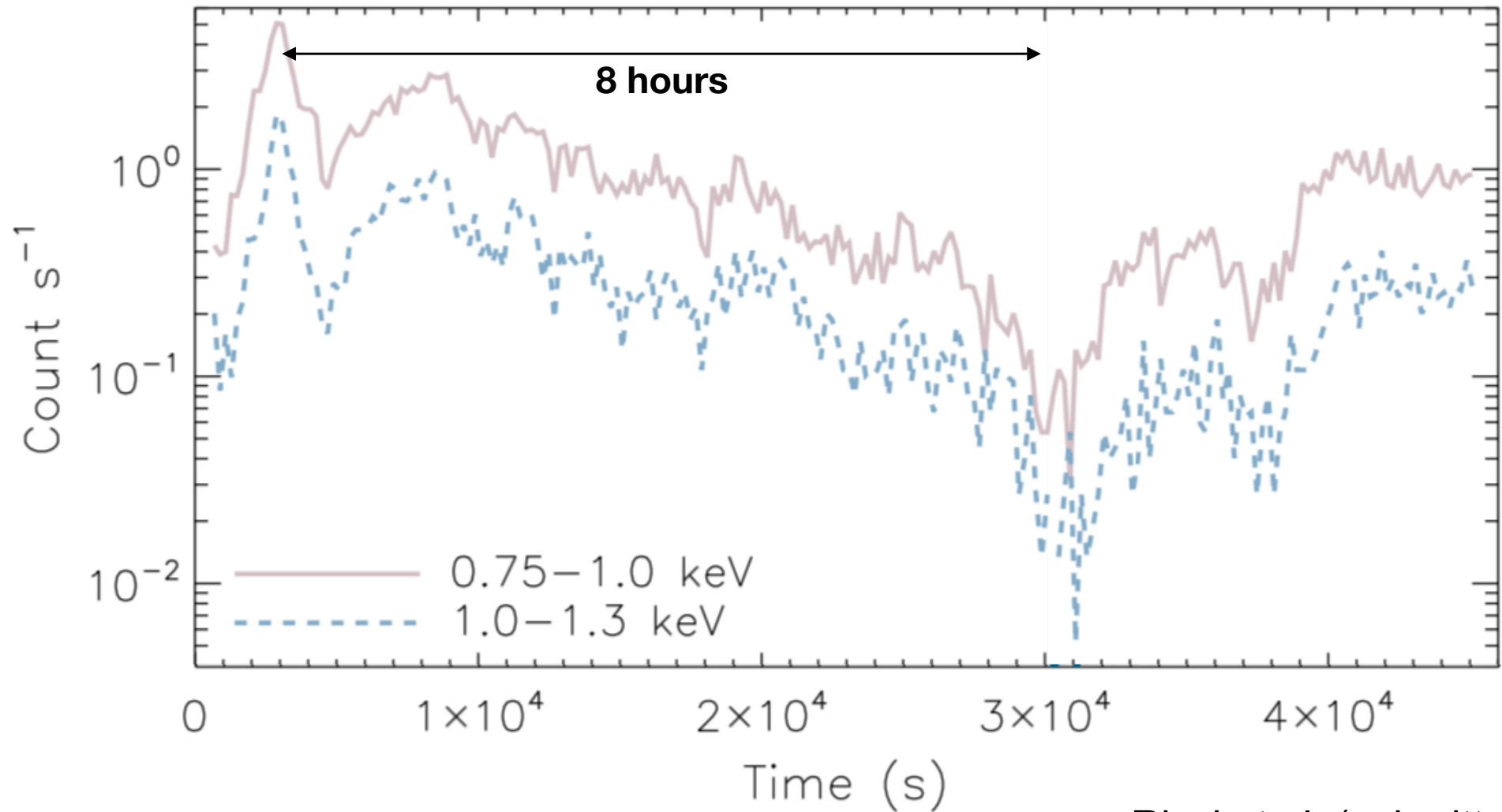
265 NICER (~ 700 ks)

14 Swift (26 ks)

4 simultaneous XMM-Newton/NuSTAR (~400 ks)

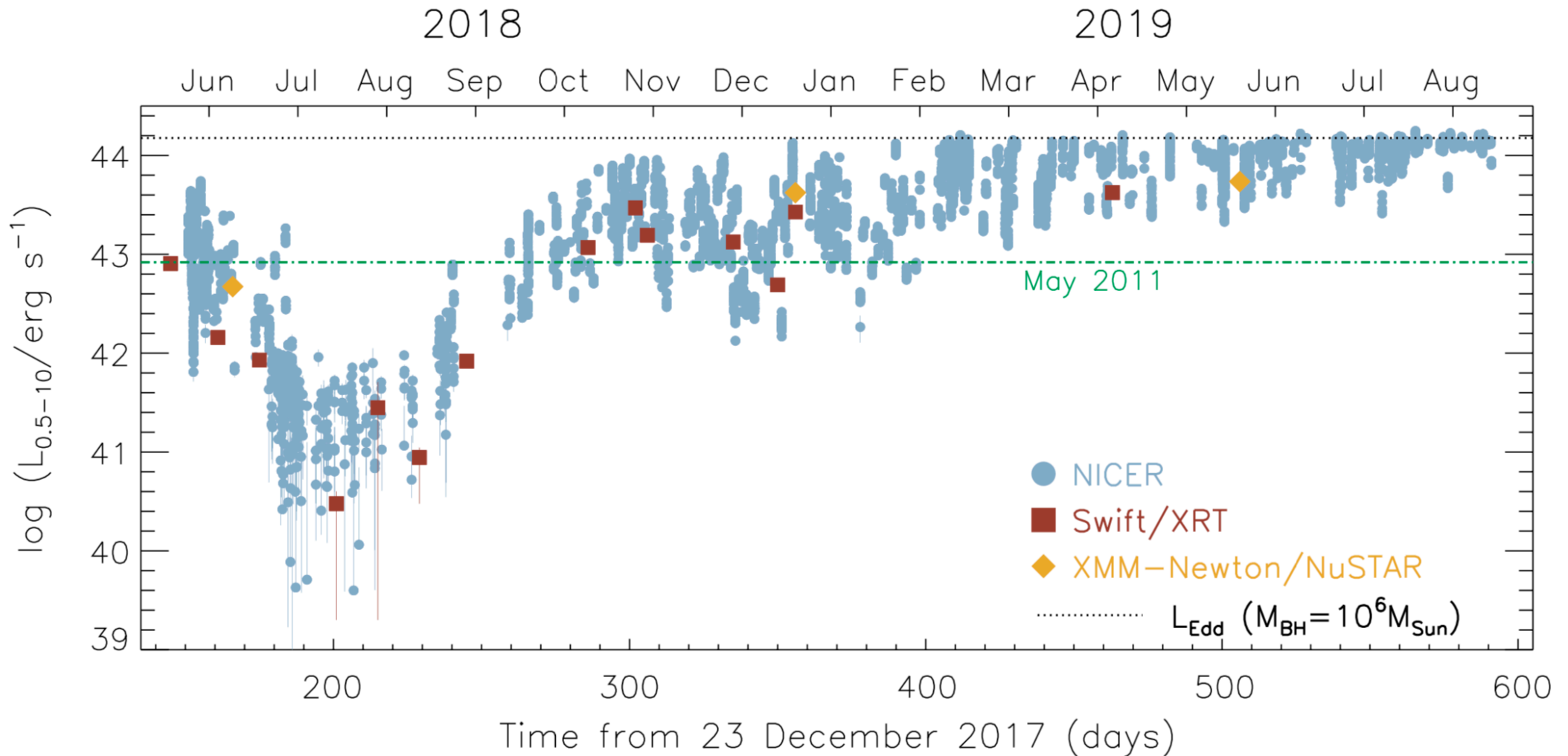


# Extreme variability on short timescales..

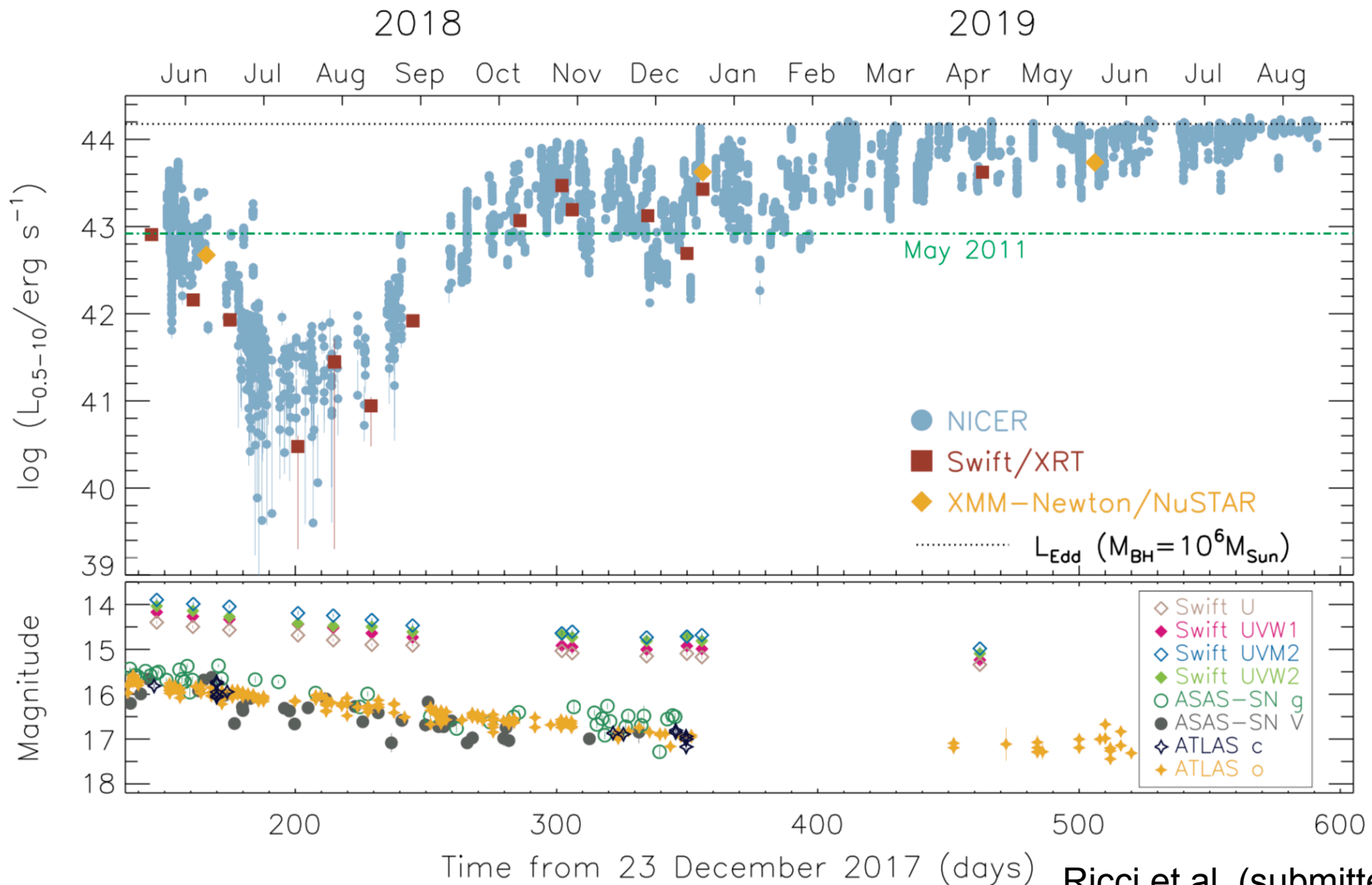


Ricci et al. (submitted)

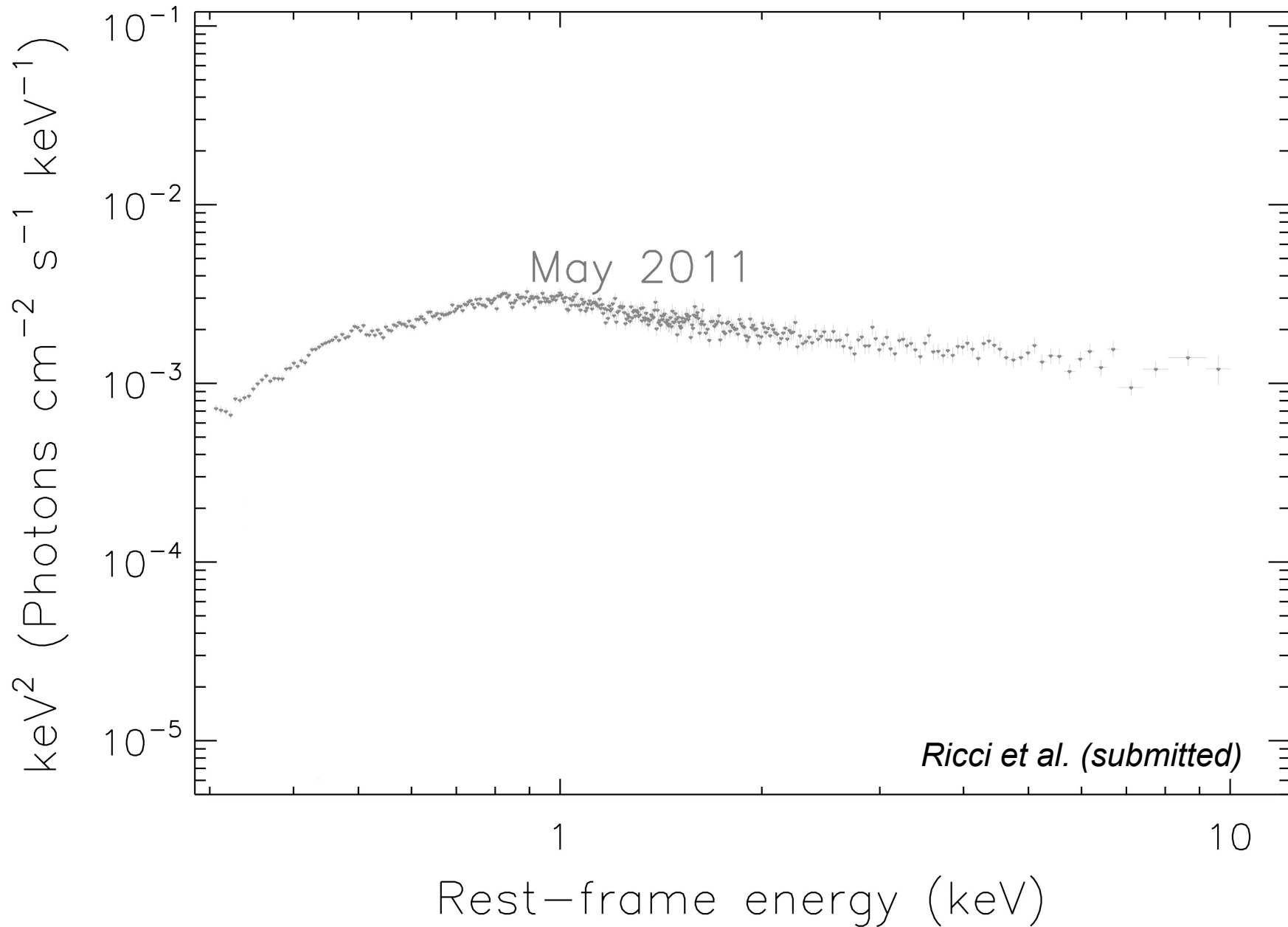
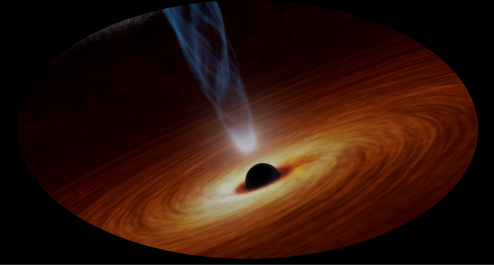
# ..and on long timescales



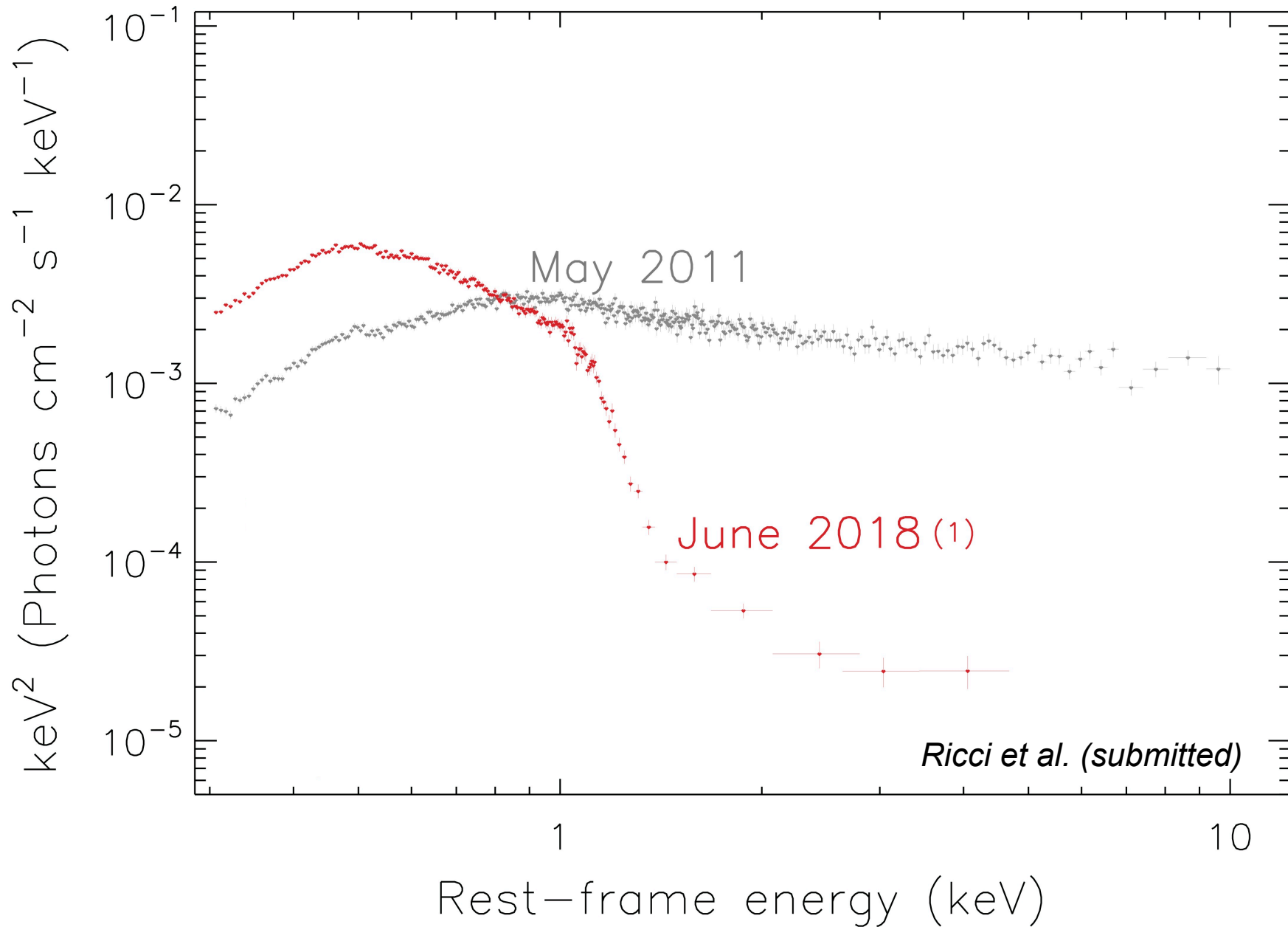
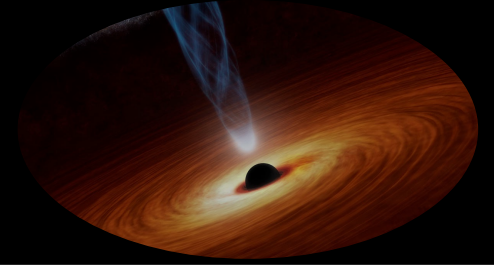
# X-ray and UV variability are disconnected



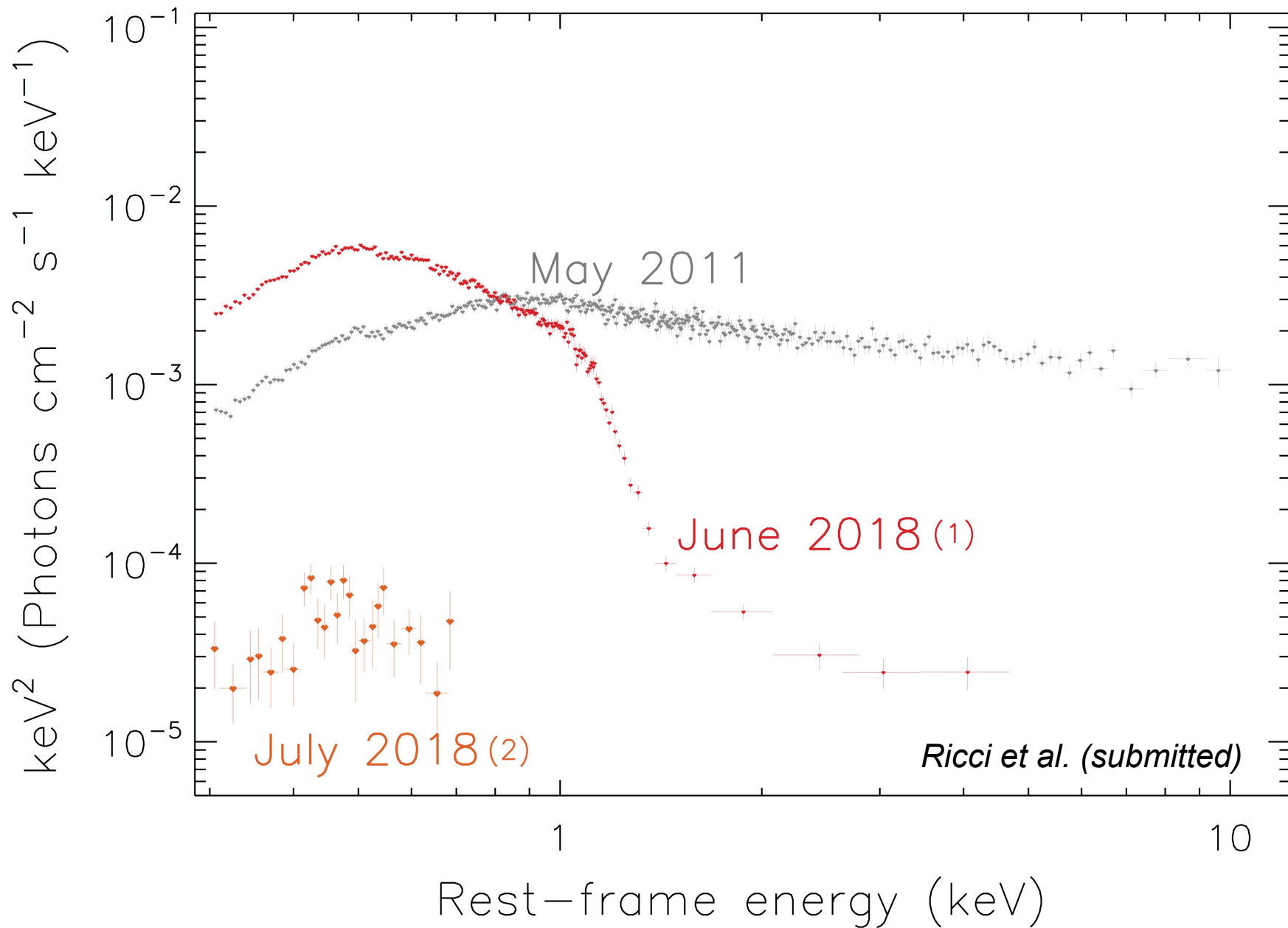
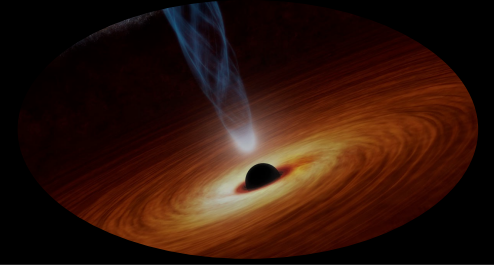
# The X-ray campaign



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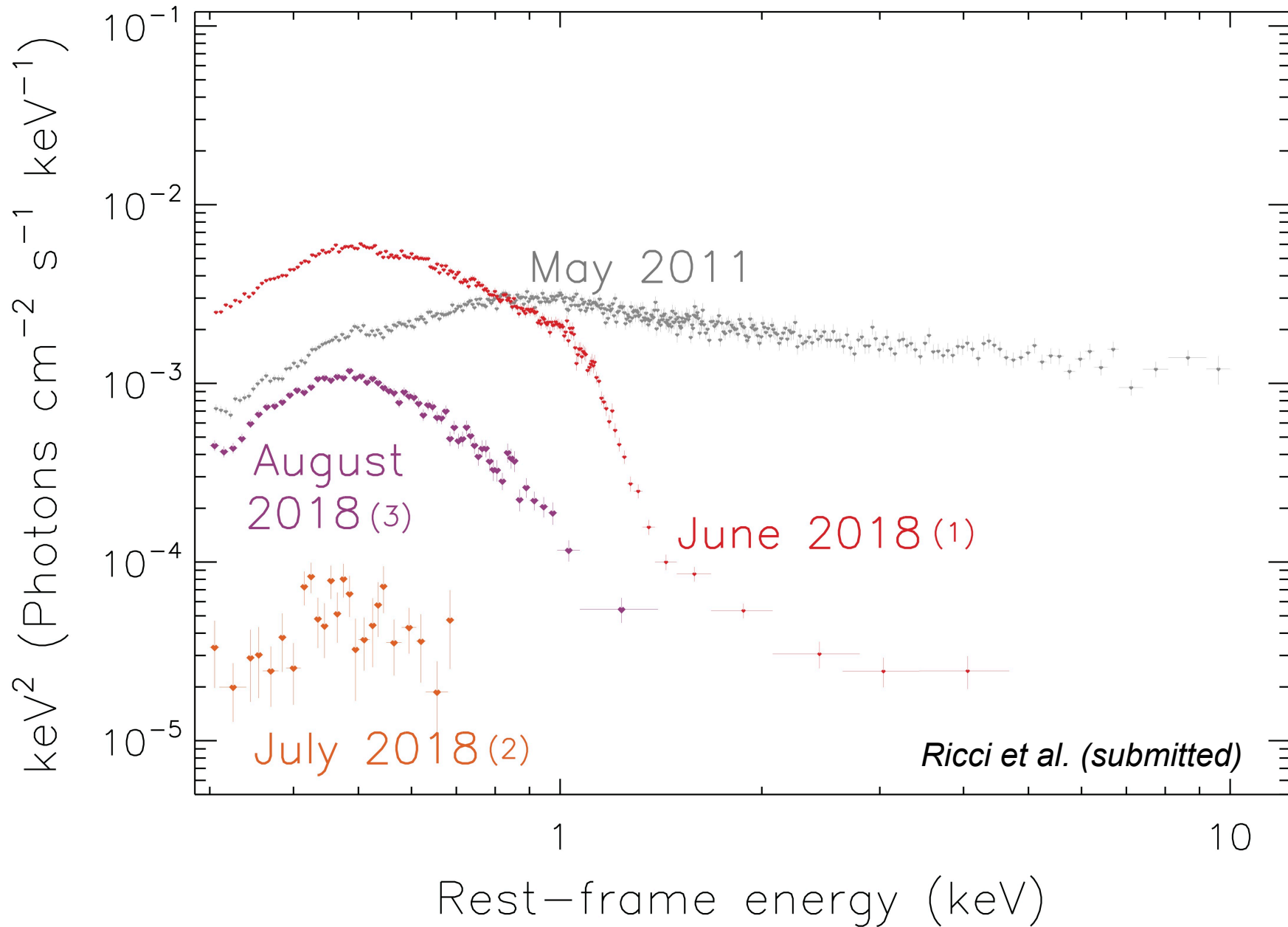
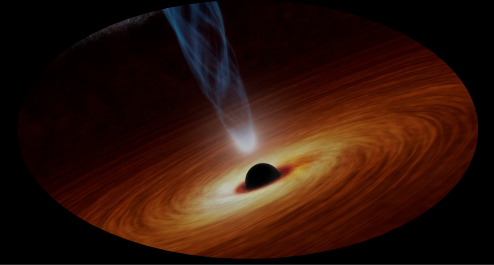


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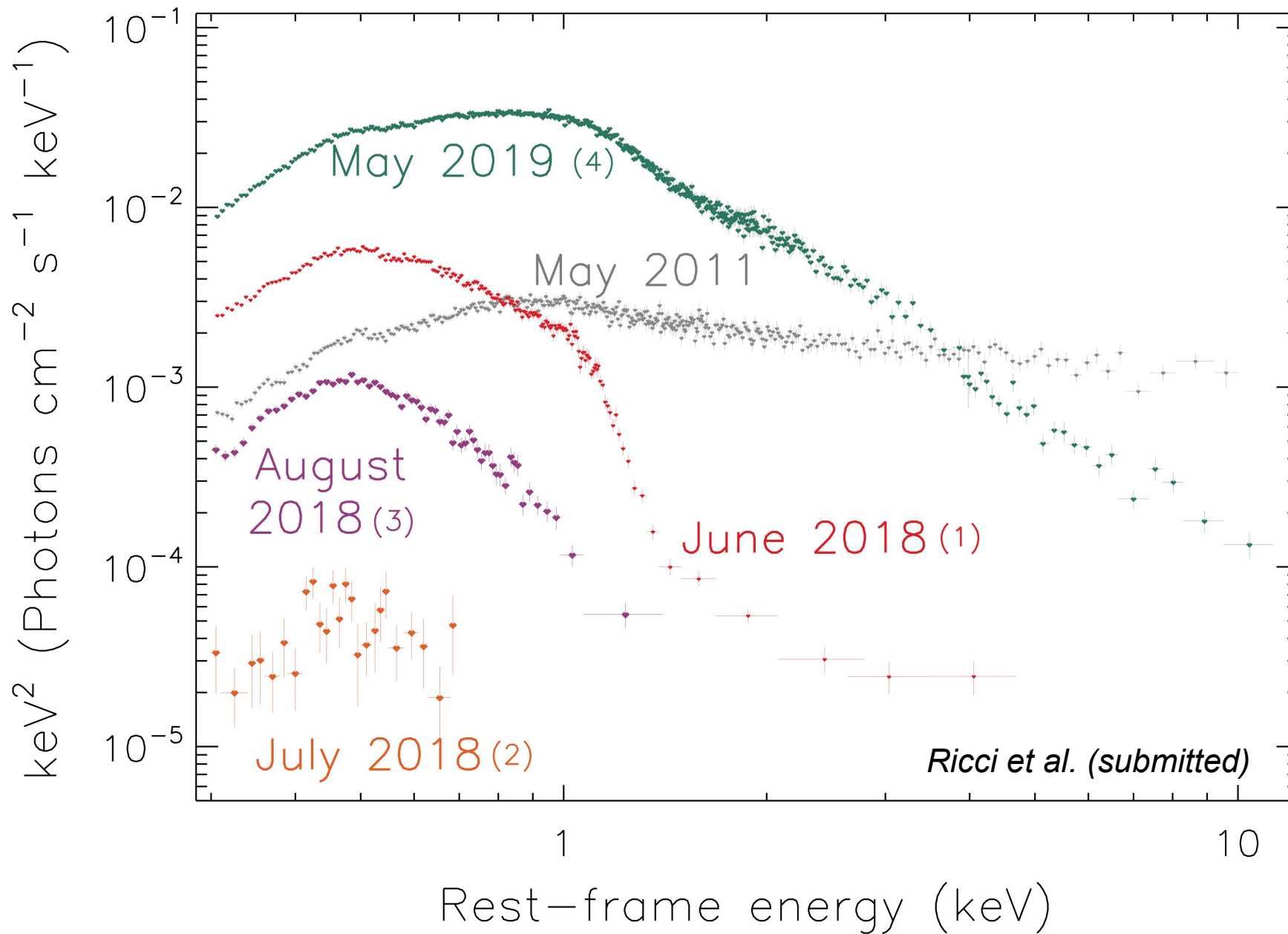
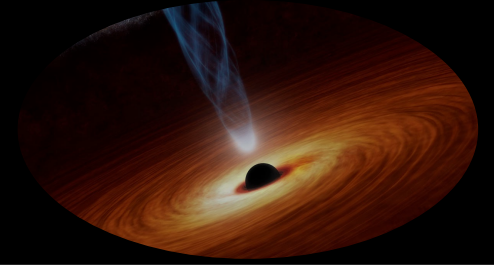




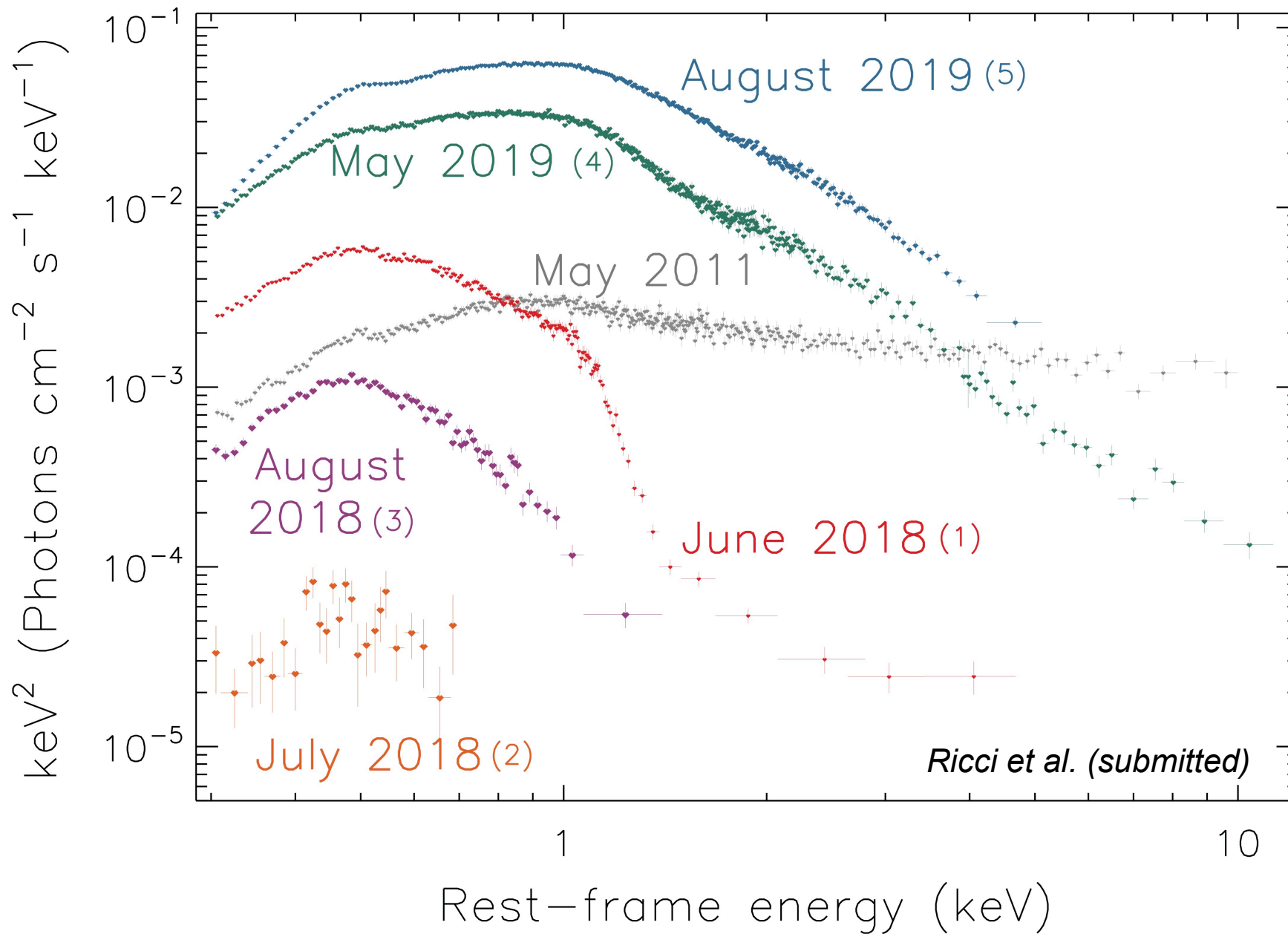
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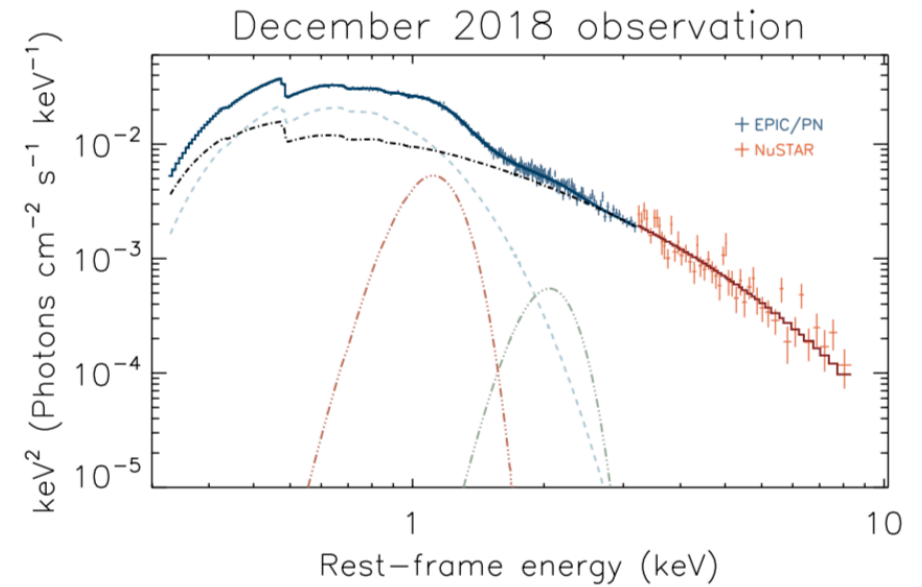
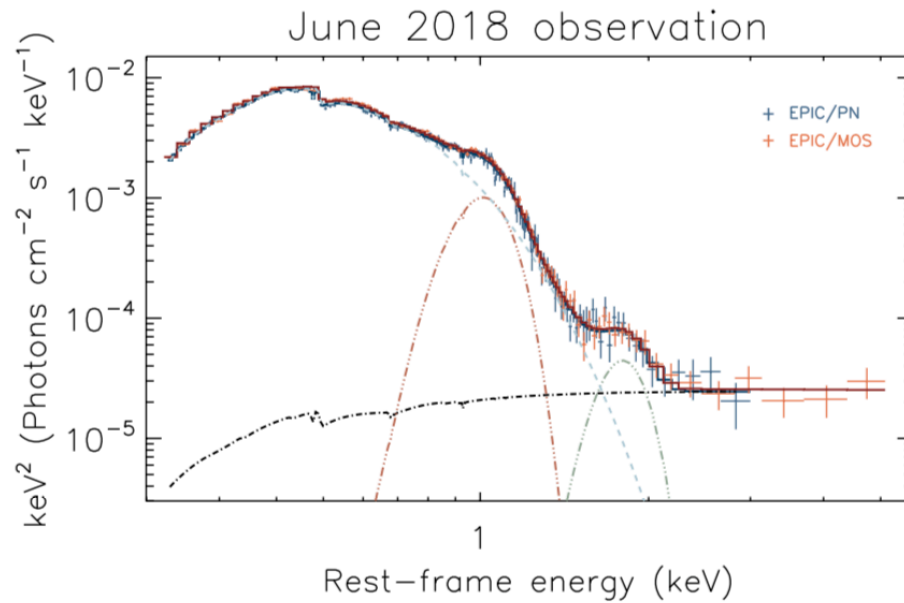
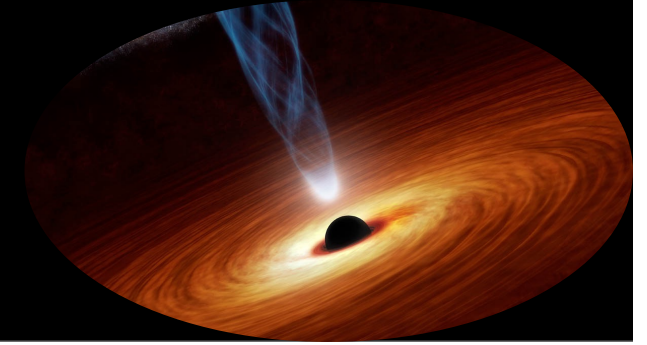
# The X-ray campaign



# The X-ray campaign



# X-ray spectroscopy



*Ricci et al. (submitted)*

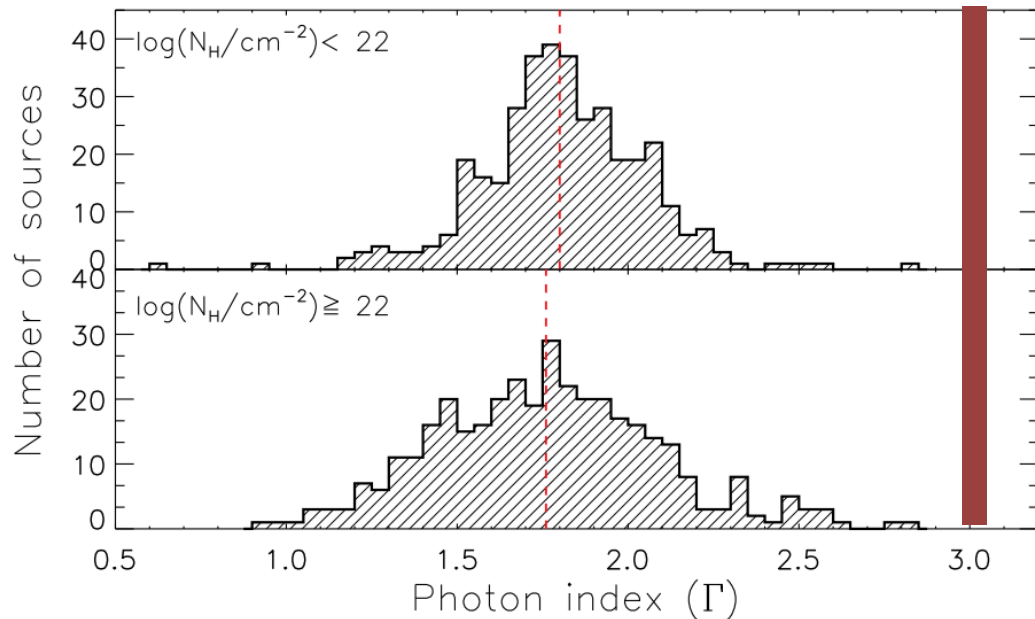
Very soft ( $\Gamma \simeq 3$ )

Very low energy cutoff! ( $E_C \simeq 2 - 3$  keV)

# X-ray spectroscopy

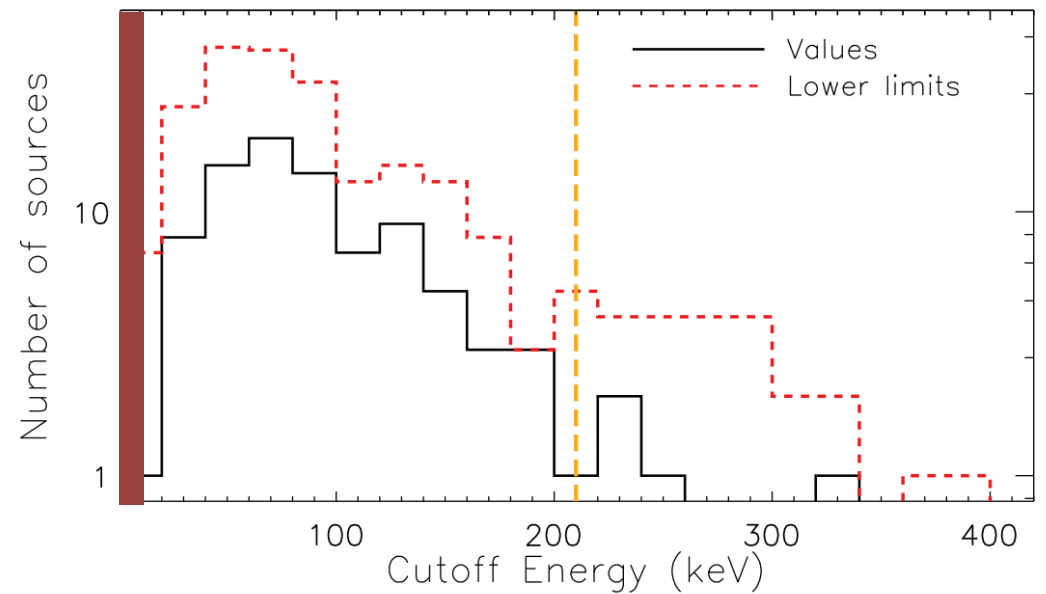


## Photon index AGN ( $\sim 1.8$ )



*Ricci et al. 2017d*

## Cutoff energy ( $E_{\text{C}} \simeq 200$ keV)

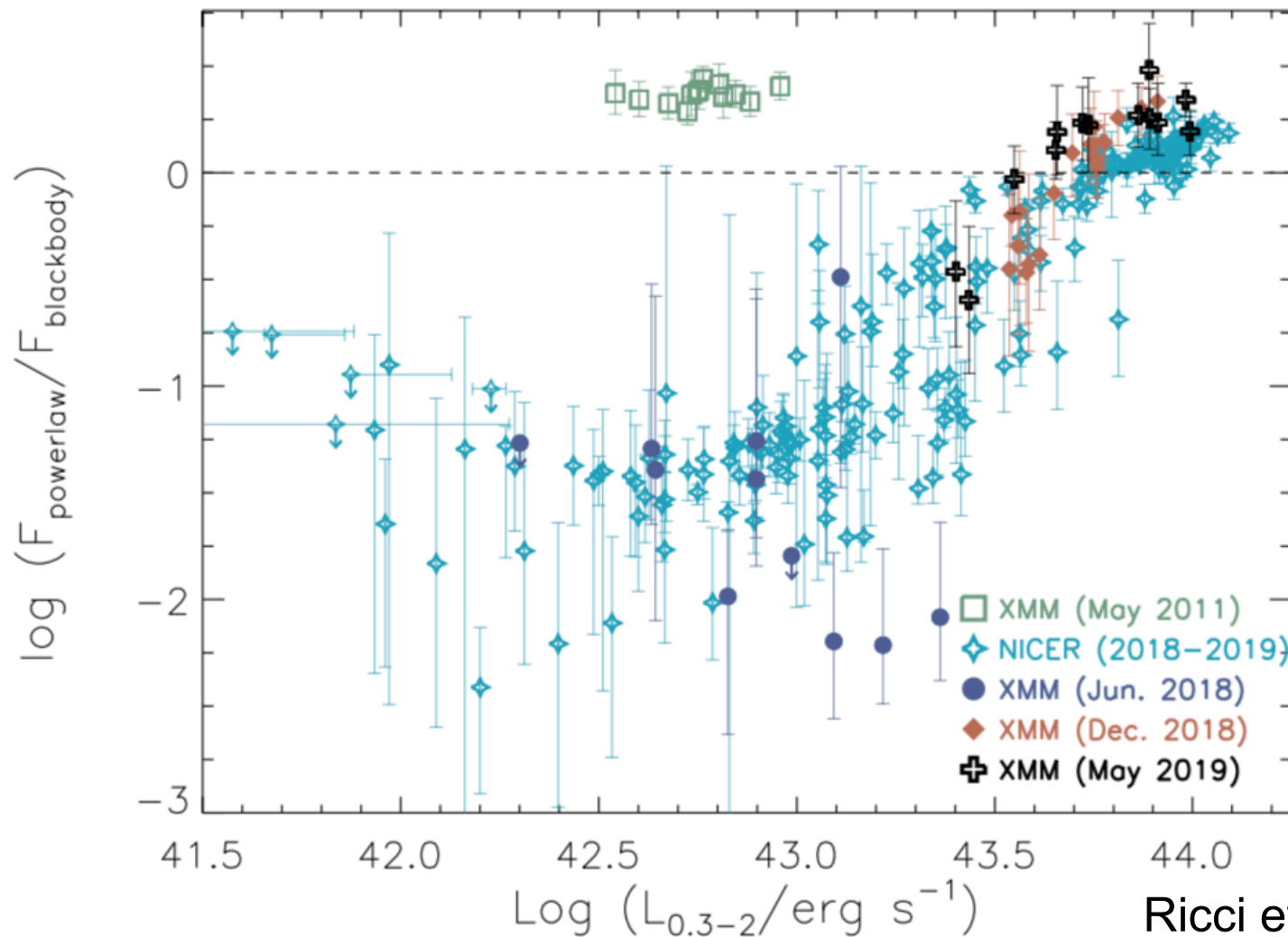


*Ricci et al. 2018*

# X-ray spectral variability

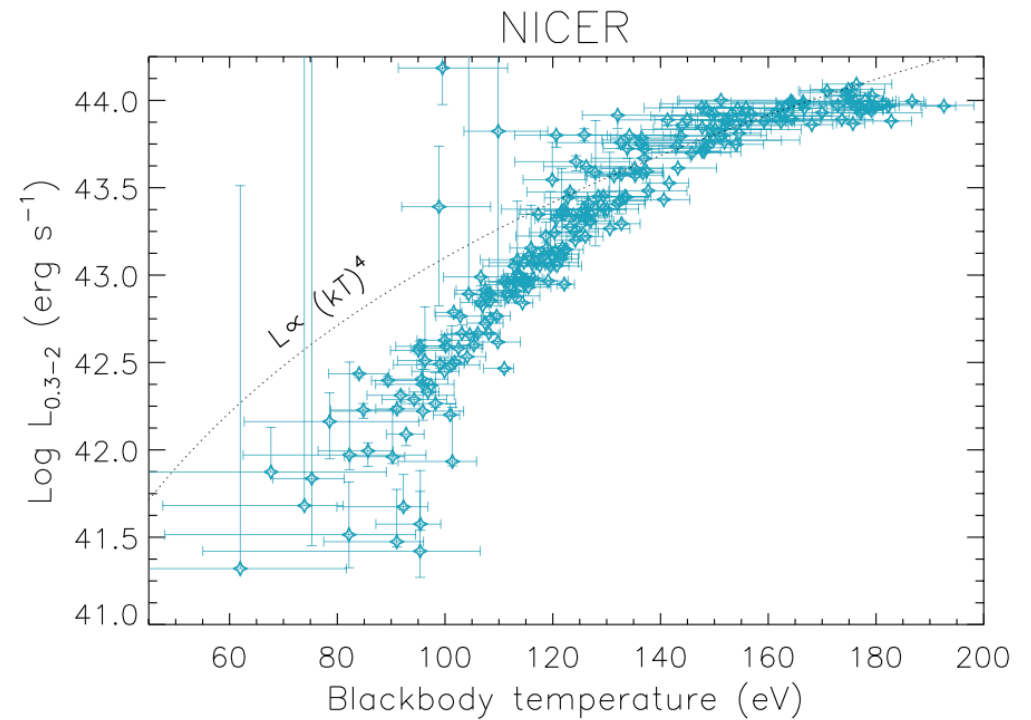
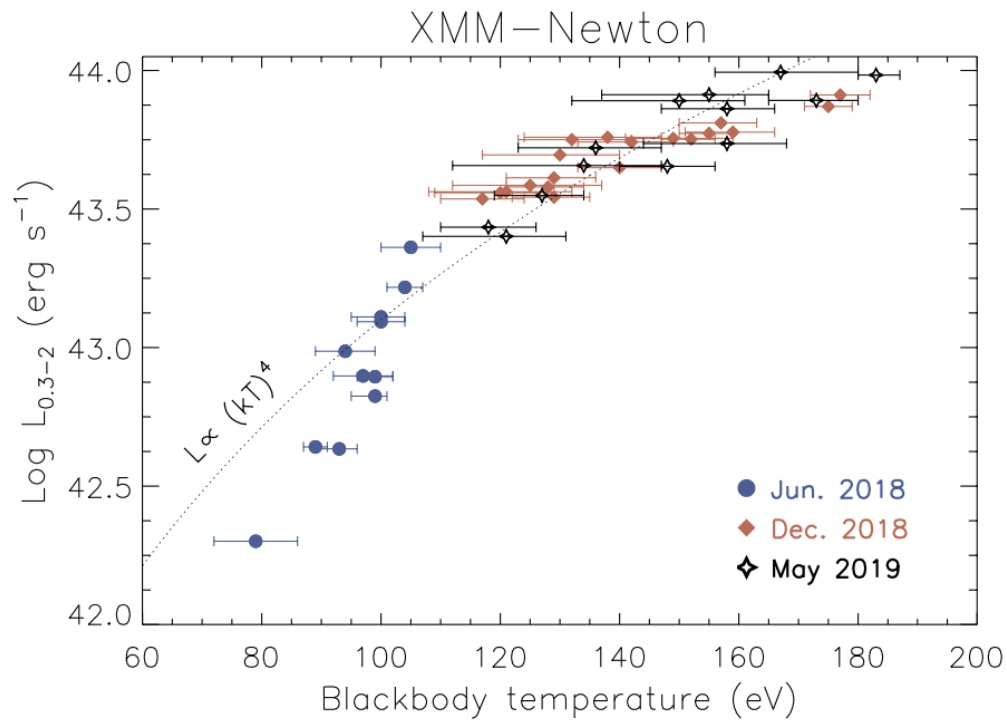


Is the *normal* X-ray continuum reappearing ?



Ricci et al. (submitted)

# X-ray spectral variability



*Ricci et al. (submitted)*

See also R. Saxton's talk, also Shu+17,18

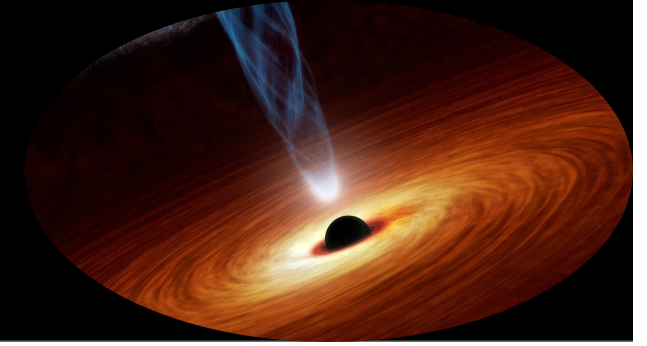
# What do we know?



- 1) **Some crazy event destroyed the X-ray corona**



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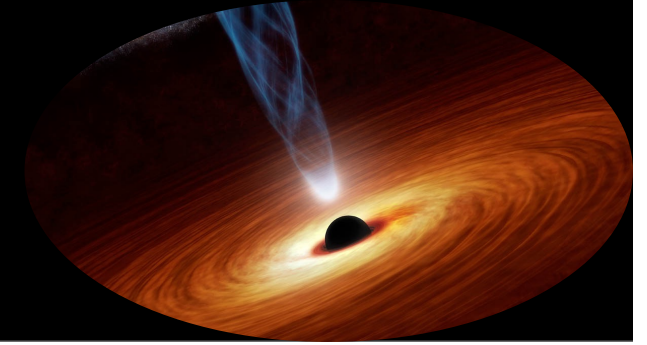
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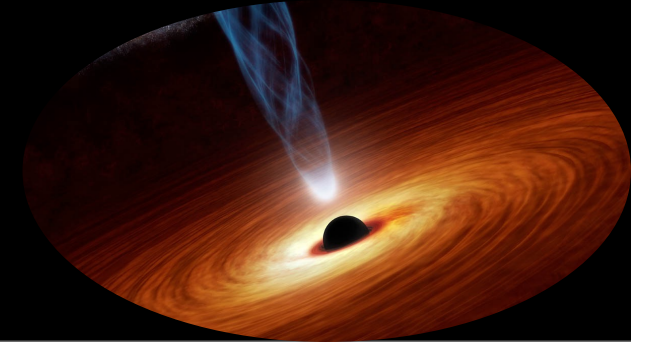
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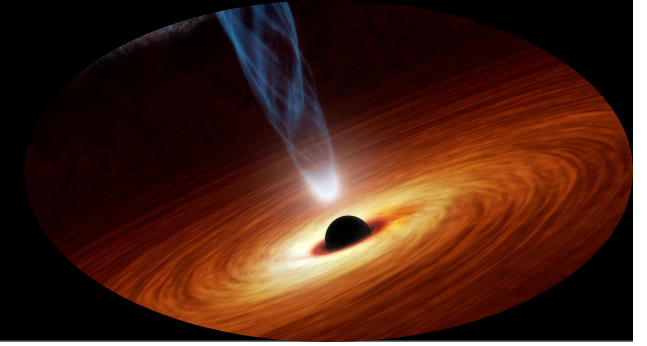
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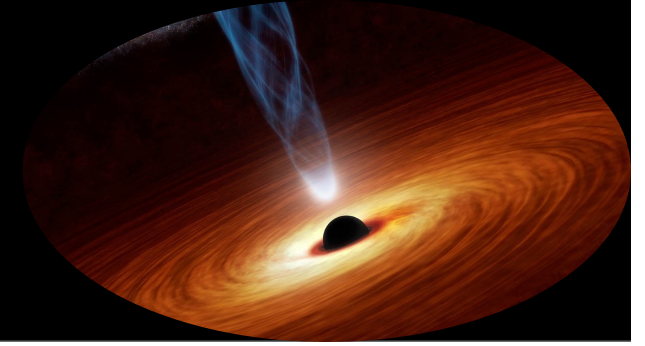
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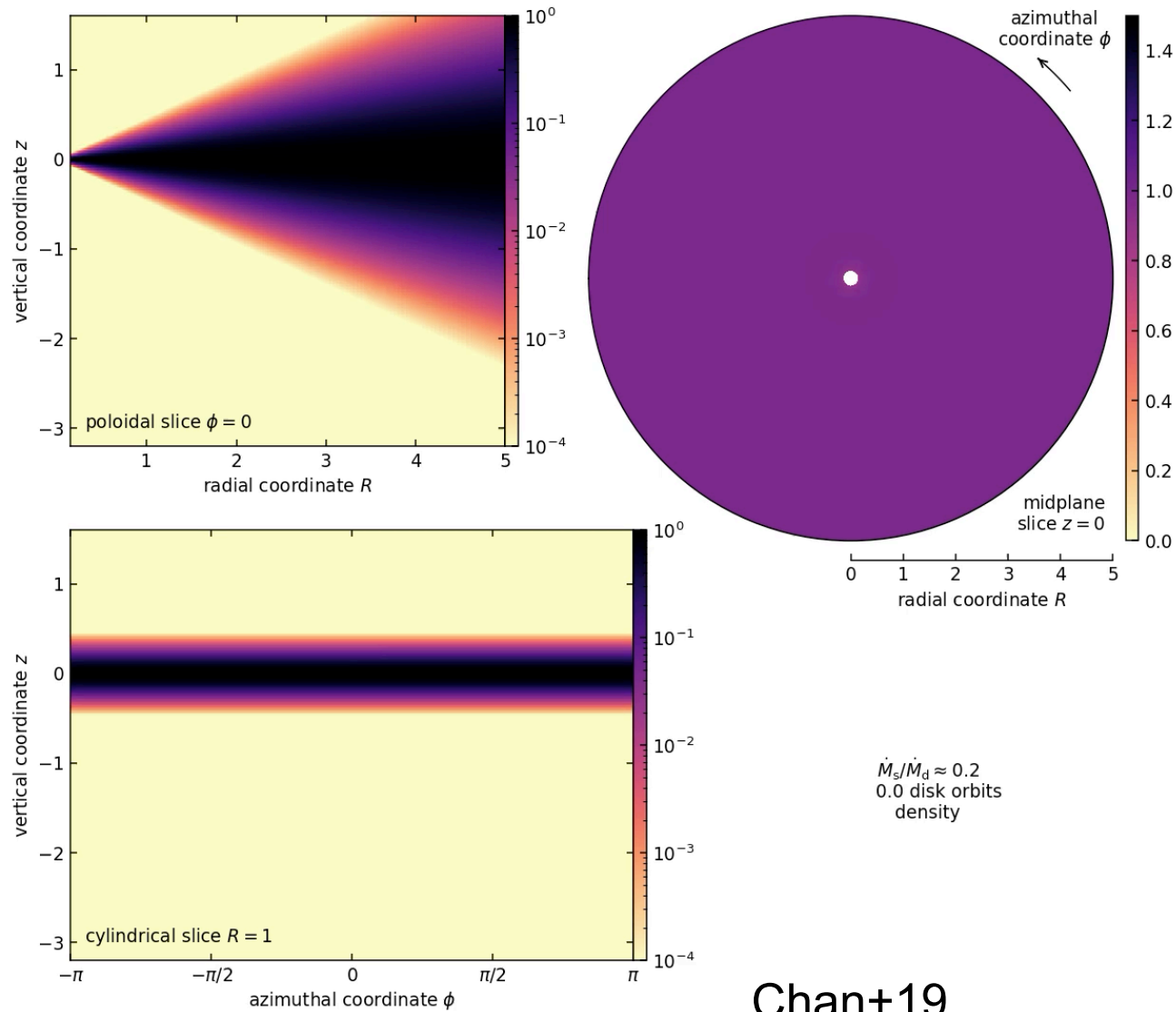
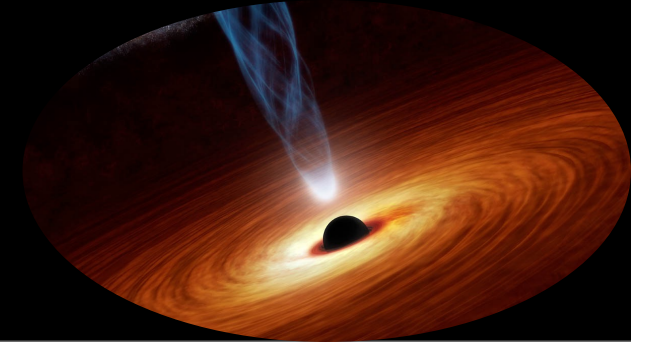
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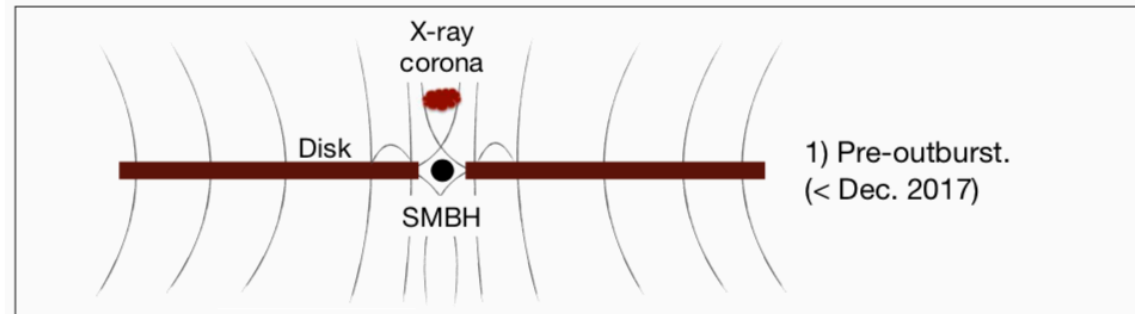
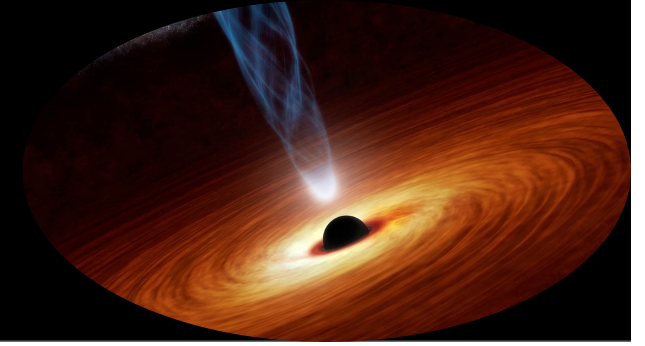


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- 5) Very clear harder when brighter behaviour (very different from normal AGN)
- 6) Power law with a very low cutoff energy re-appears as the luminosity increases
- 7) **No correlation between X-ray and UV variability**

# A TDE in an AGN?

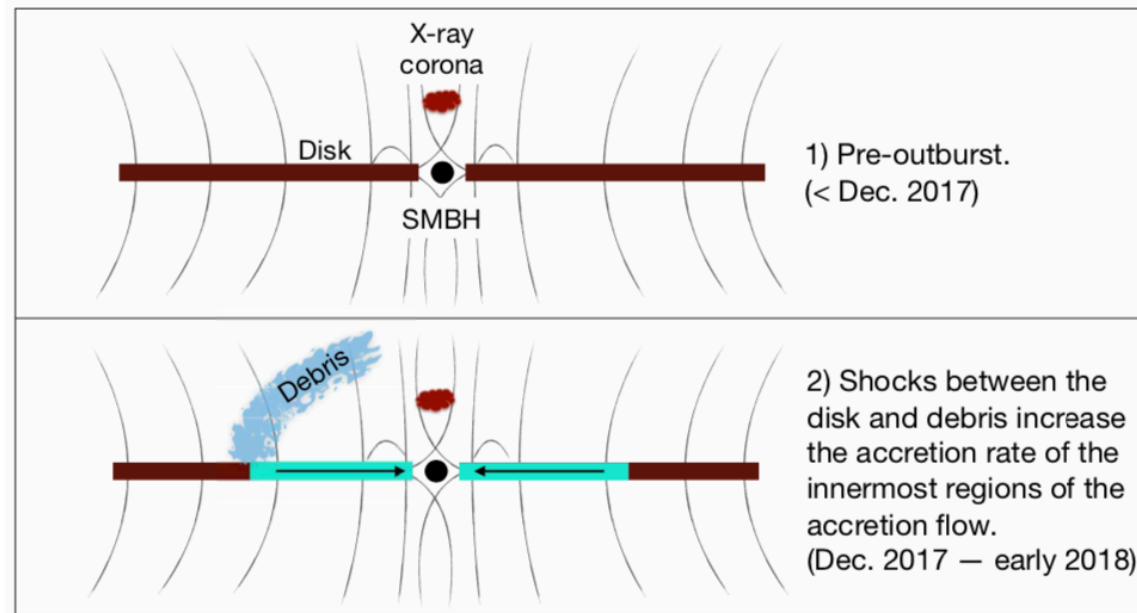


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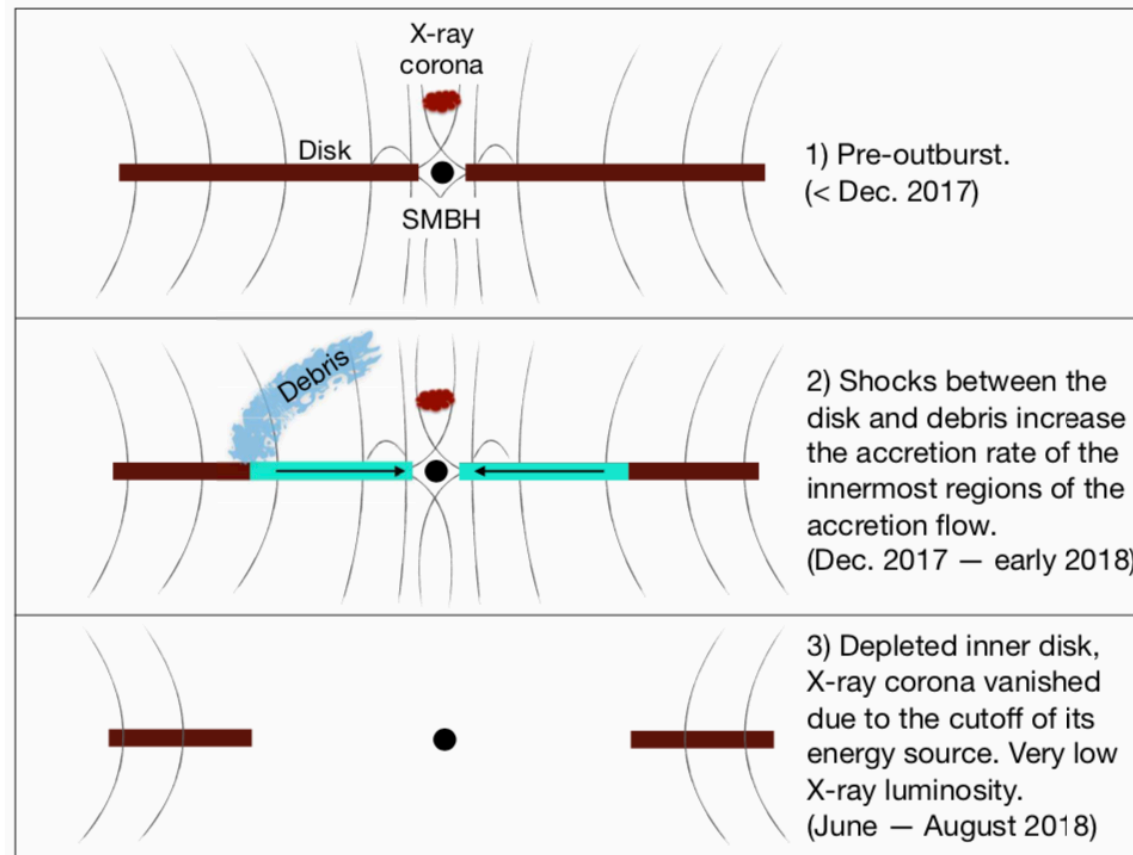
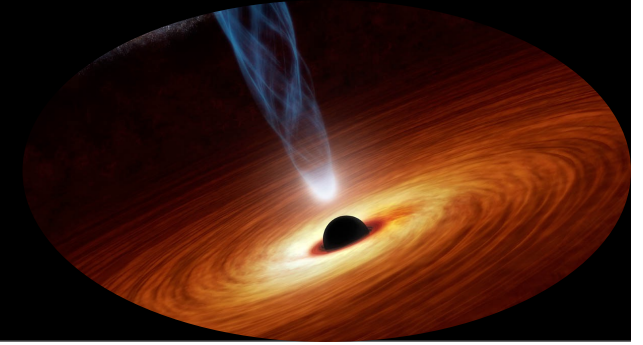


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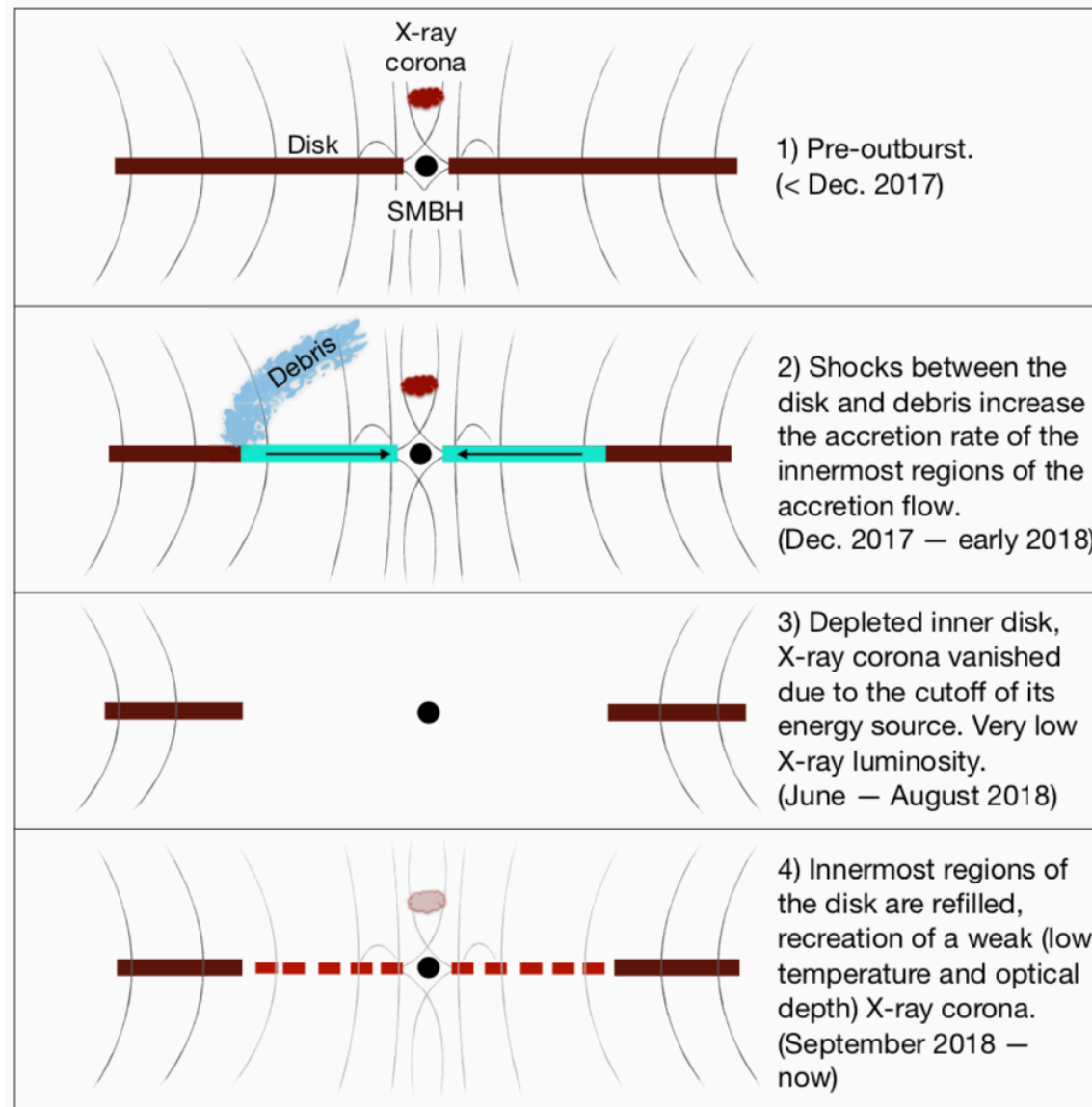
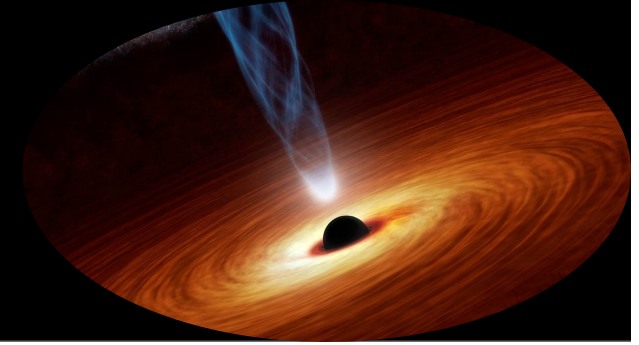
Ricci et al.  
(submitted)

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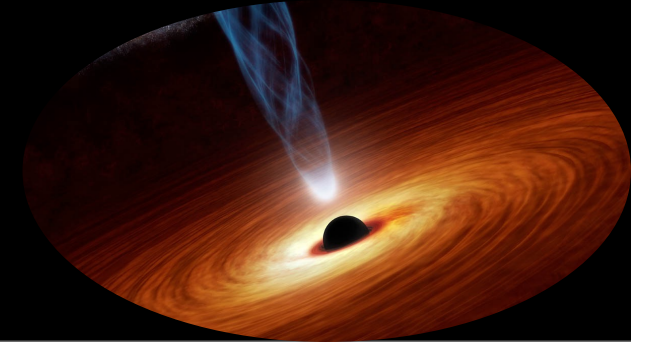
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# A TDE in an AGN?



Ricci et al.  
(submitted)

# Summary



- The destruction of the X-ray corona and of the innermost regions of 1ES1927+654 could be caused by the interaction with a star
- 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* and the *Einstein probe* might find many more objects such as 1ES 1927+654