NuSTAR Reveals a Significantly Variable Active Galactic Nucleus Corona

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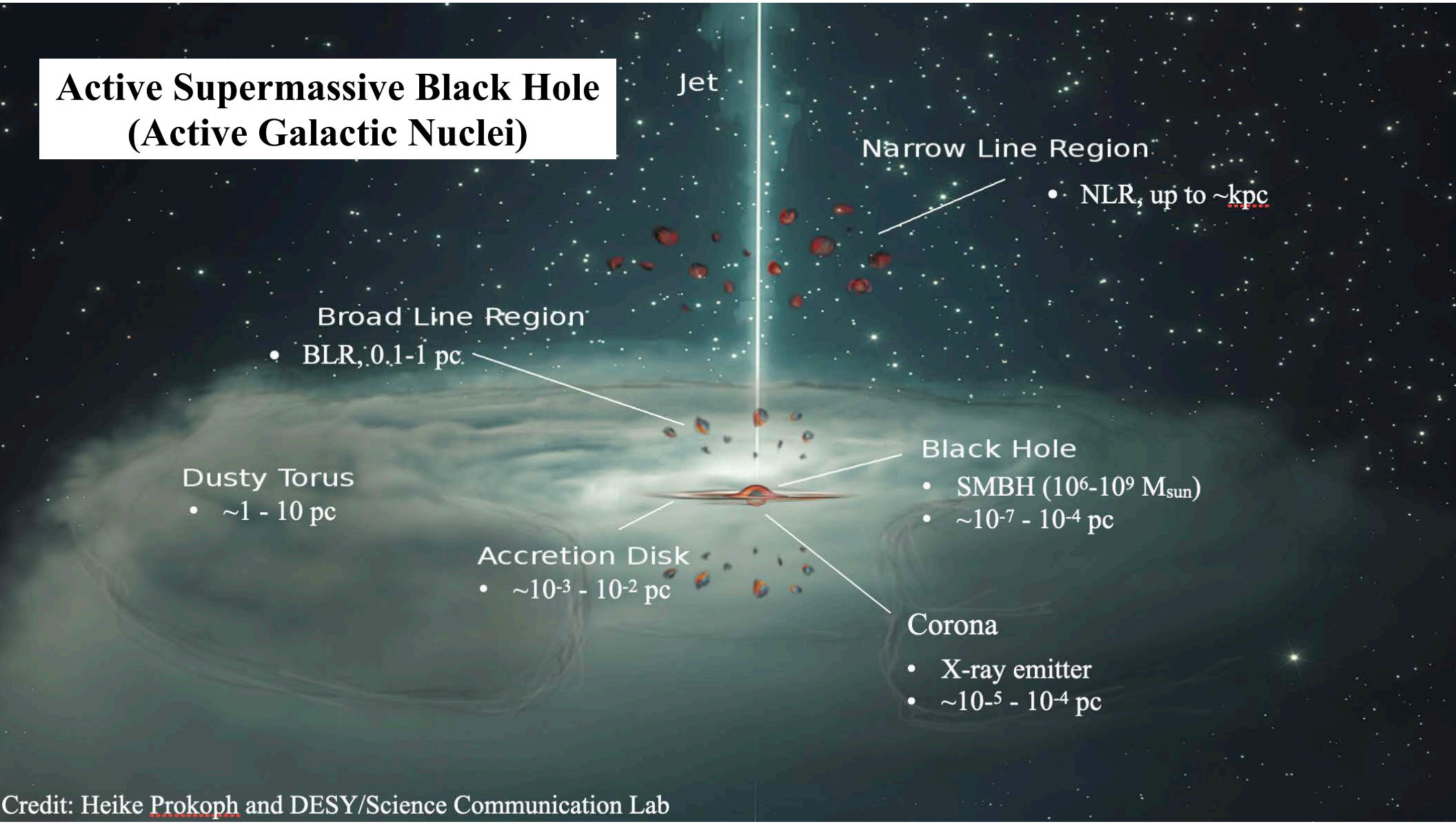
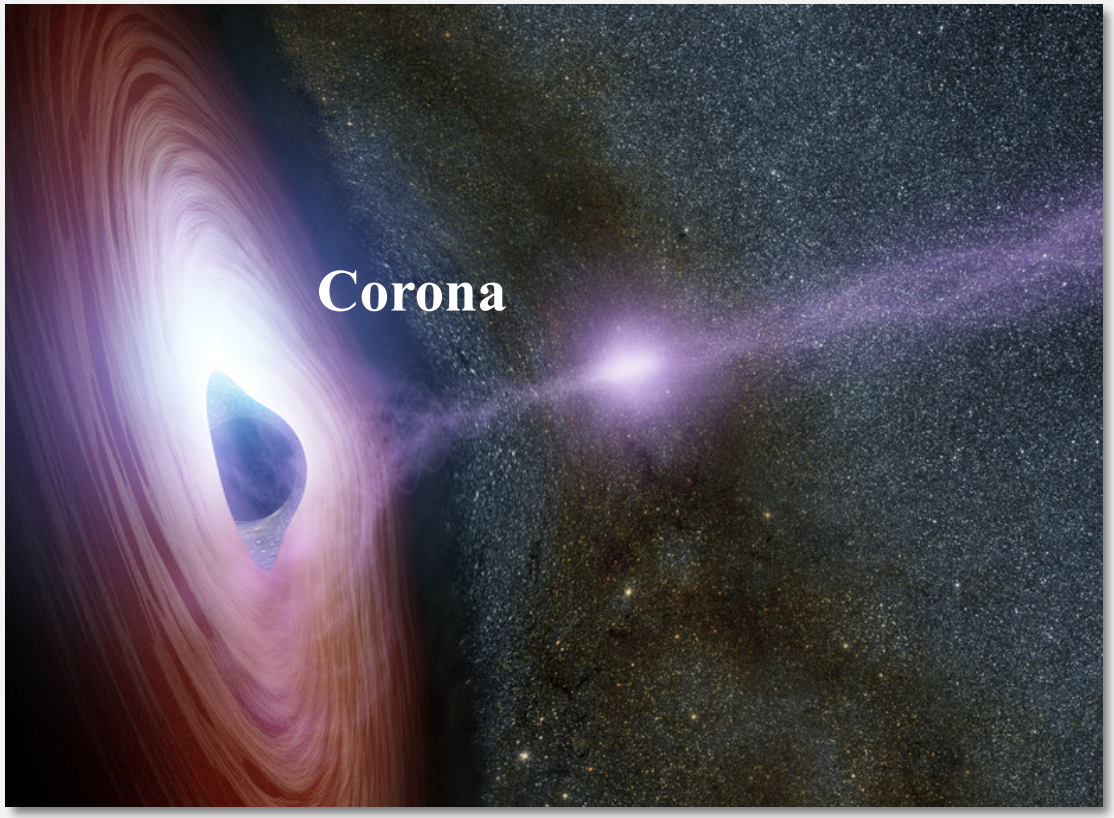

Active Supermassive Black Hole
(Active Galactic Nuclei)
Jet
Narrow Line Region
• NLR, up to ~kpc
Broad Line Region
• BLR, 0.1-1 pc
Dusty Torus
• ~1 - 10 pc
Black Hole
• SMBH (10^6-10^9 M_{sun})
• ~10^{-7} - 10^{-4} pc
Accretion Disk
• ~10^{-3} - 10^{-2} pc
Corona
• X-ray emitter
• ~10^{-5} - 10^{-4} pc
Credit: Heike Prokoph and DESY/Science Communication Lab

Corona

- More than 90% of X-ray photons in extra-galactic are from AGN
- AGN X-ray photons are from Corona
- Corona is significant for understanding the accretion physics of supermassive black hole



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Corona Flares

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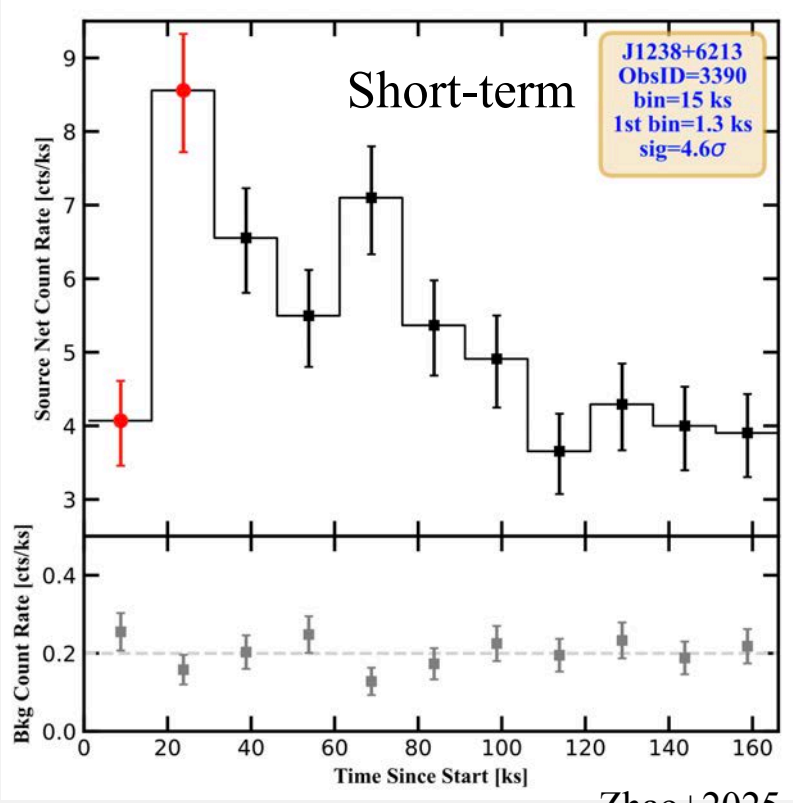
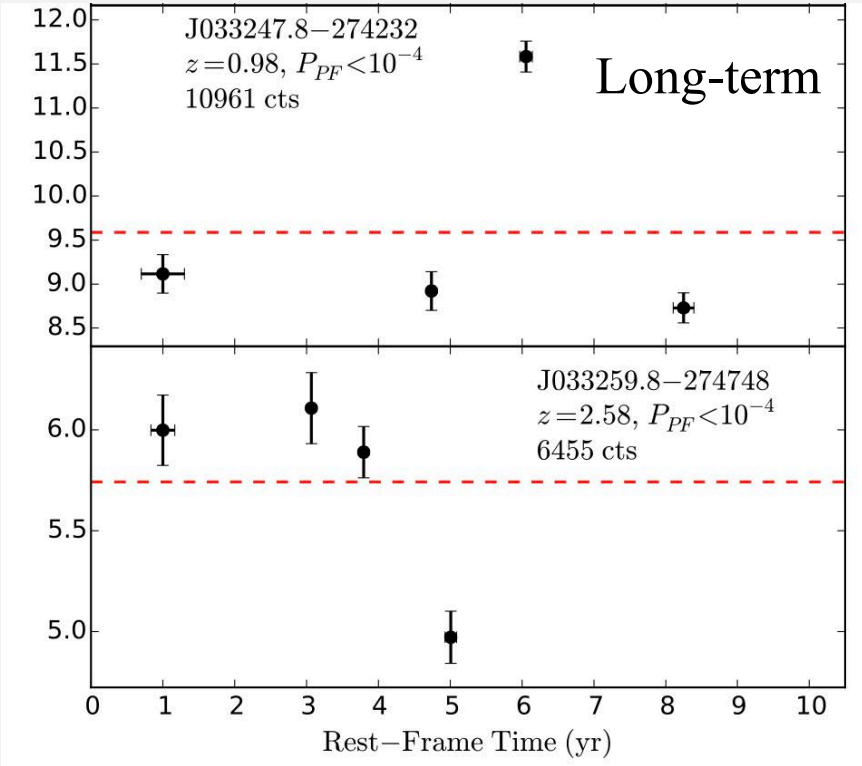
Corona

Corona Luminosity Variability



Zhao+2025



Yang+2016

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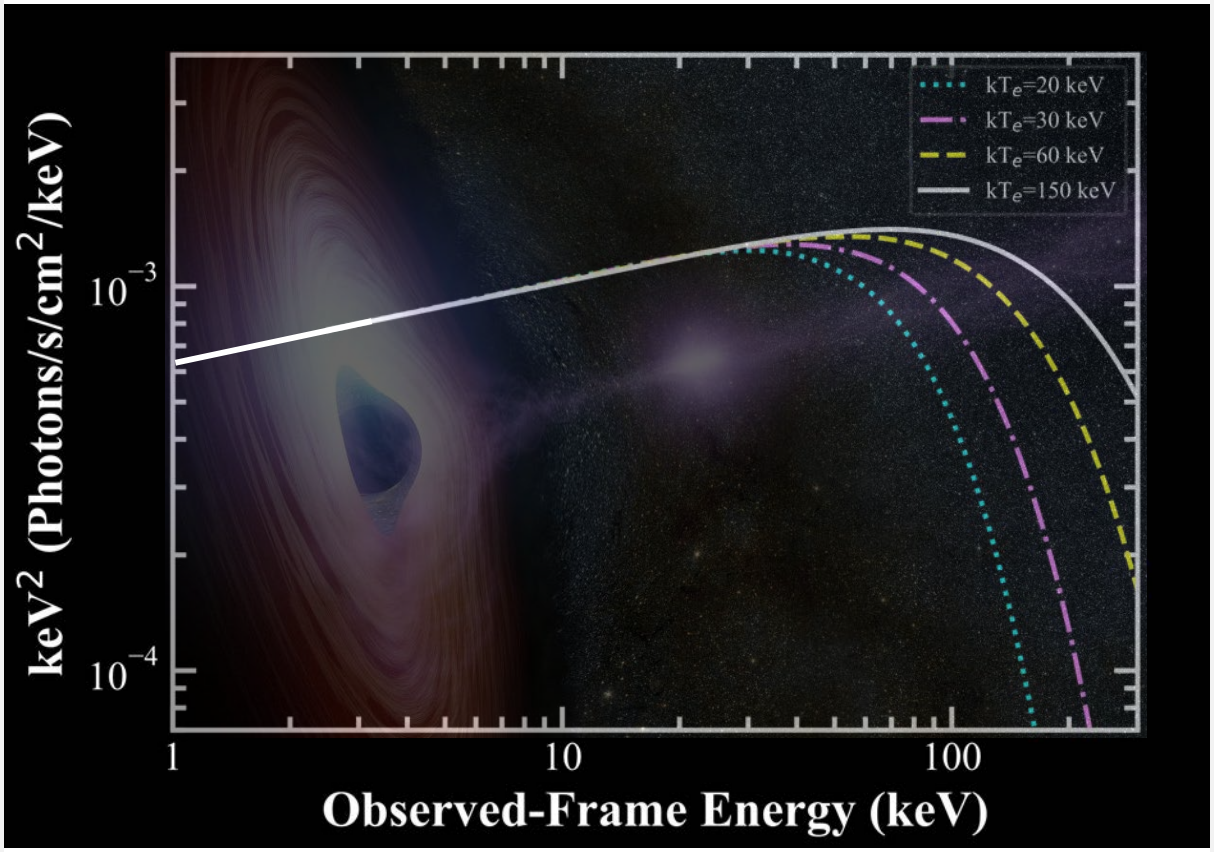
Corona

Coronal Temperature



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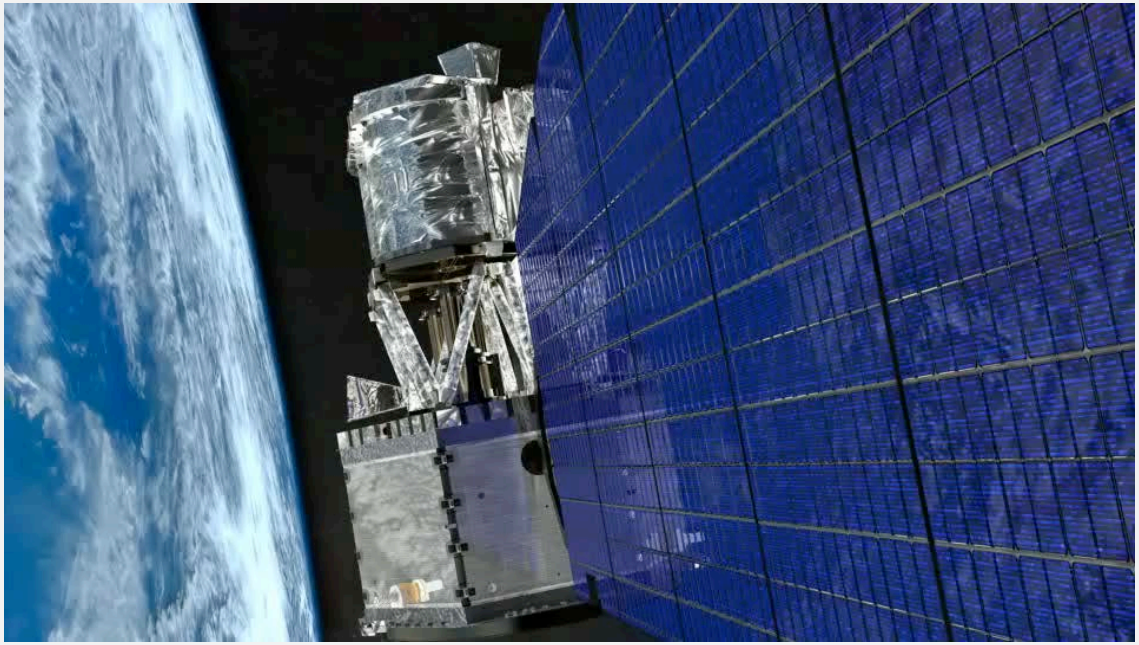
Corona

PI: Fiona Harrison (Caltech)

NuSTAR

- First NASA telescope focusing hard X-ray light
- Energy bandpass: (3-79 keV)
- Launched in 2012 (PI: F. Harrison)

14th Anniversary!



Courtesy: NASA/JPL-Caltech

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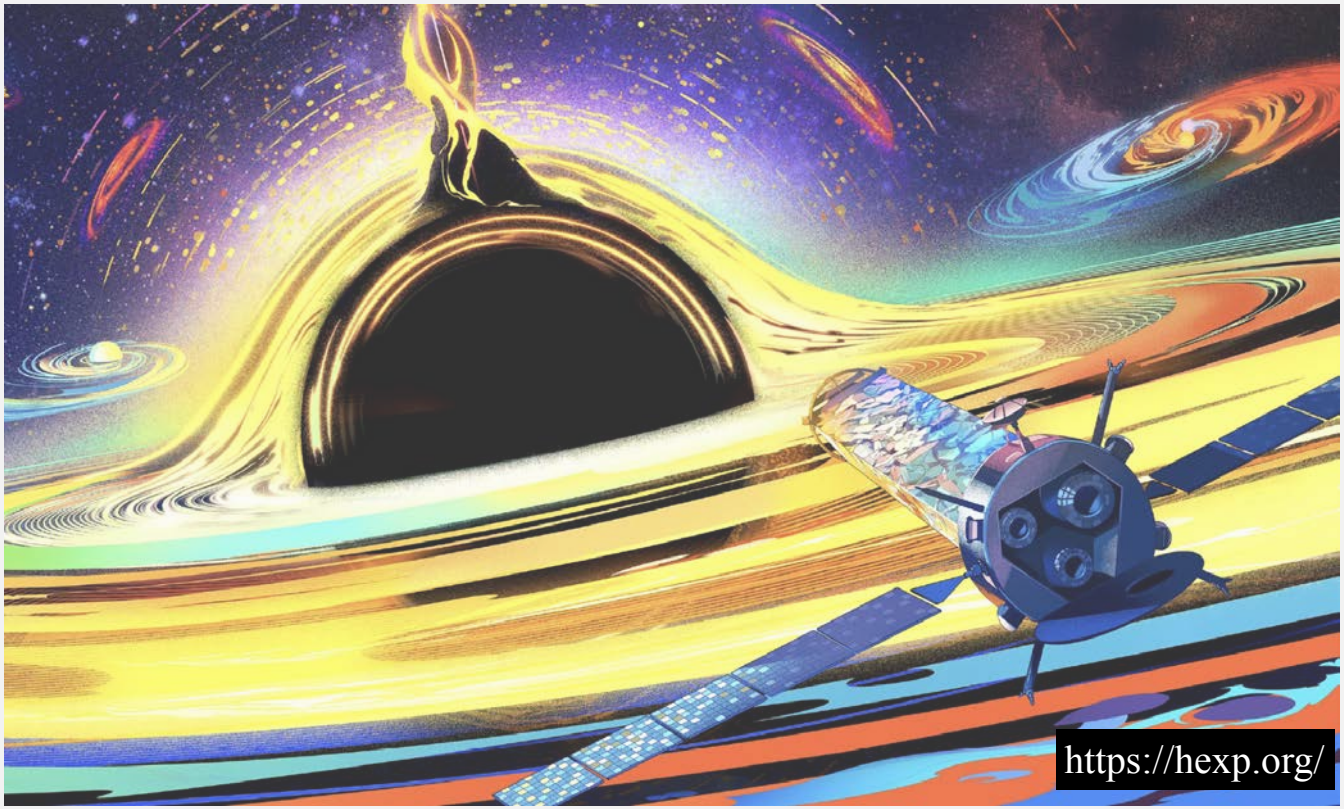
Corona

NuSTAR Monitoring



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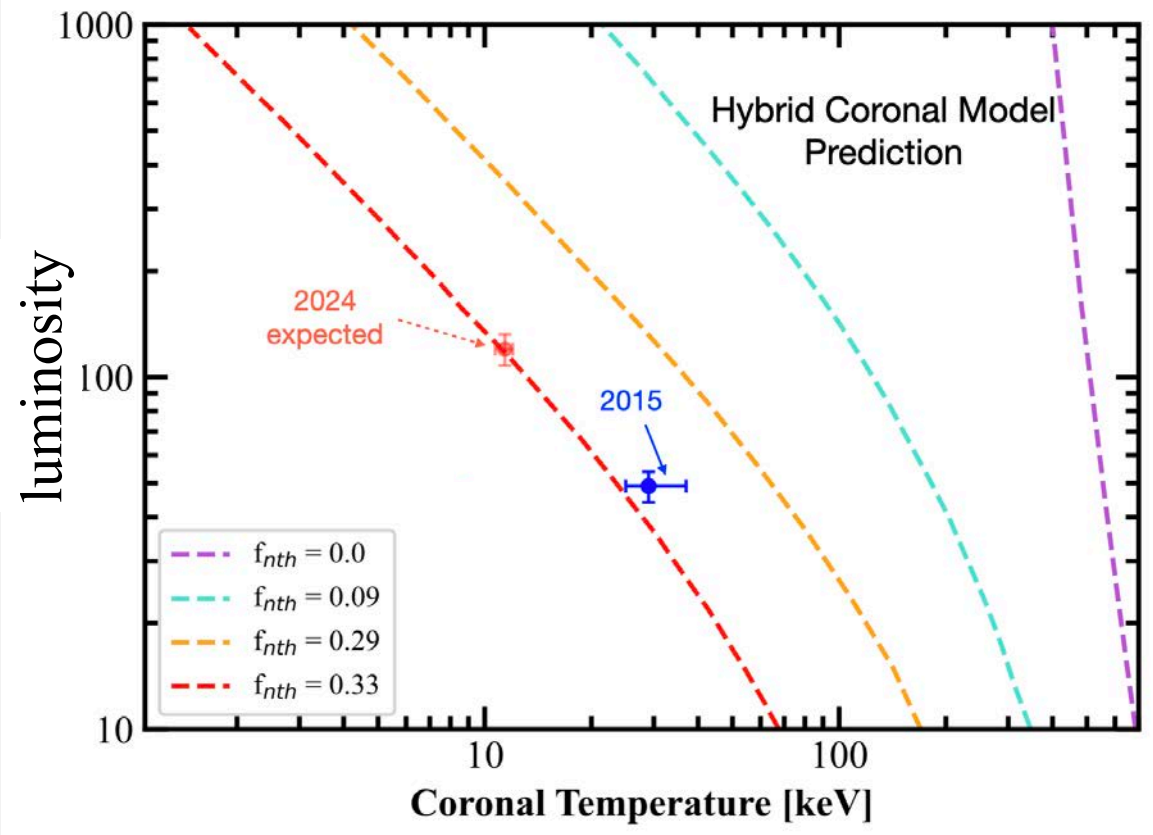
Corona

NuSTAR observed of an AGN Mrk 509 two times.



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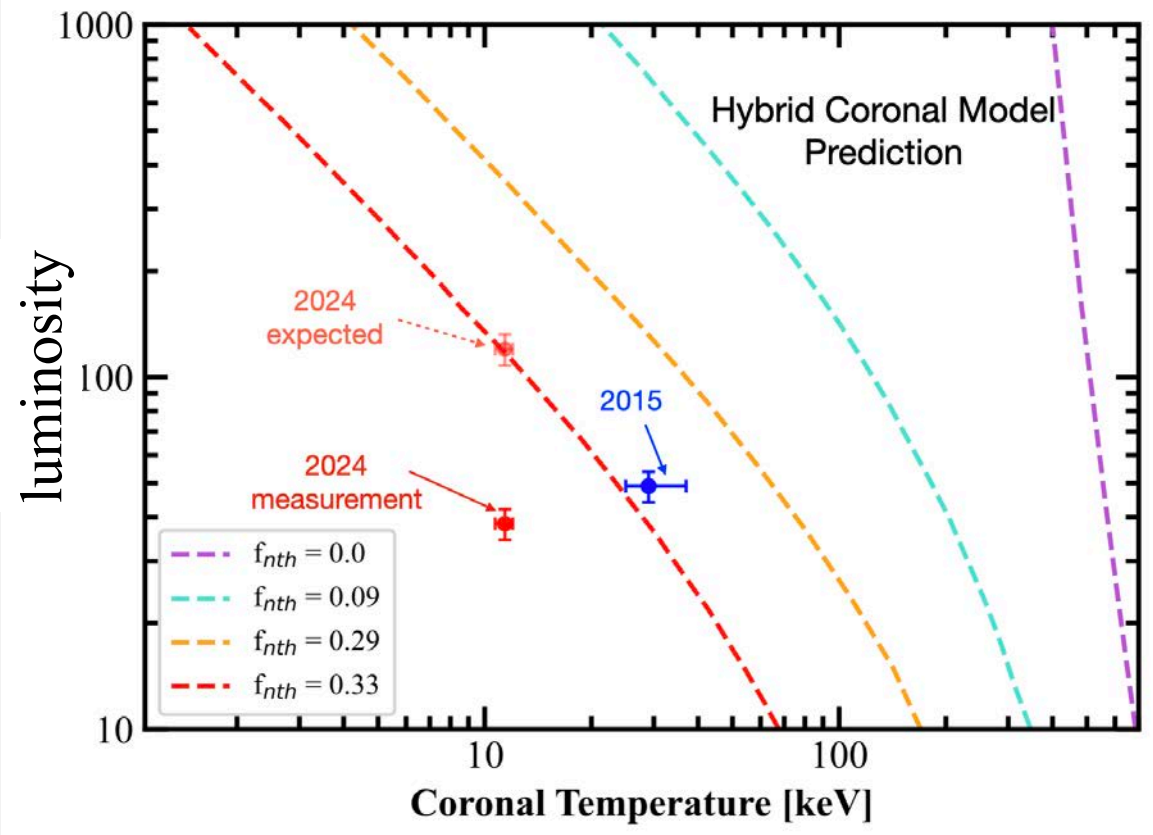
Corona

NuSTAR observed of an AGN Mrk 509 two times.



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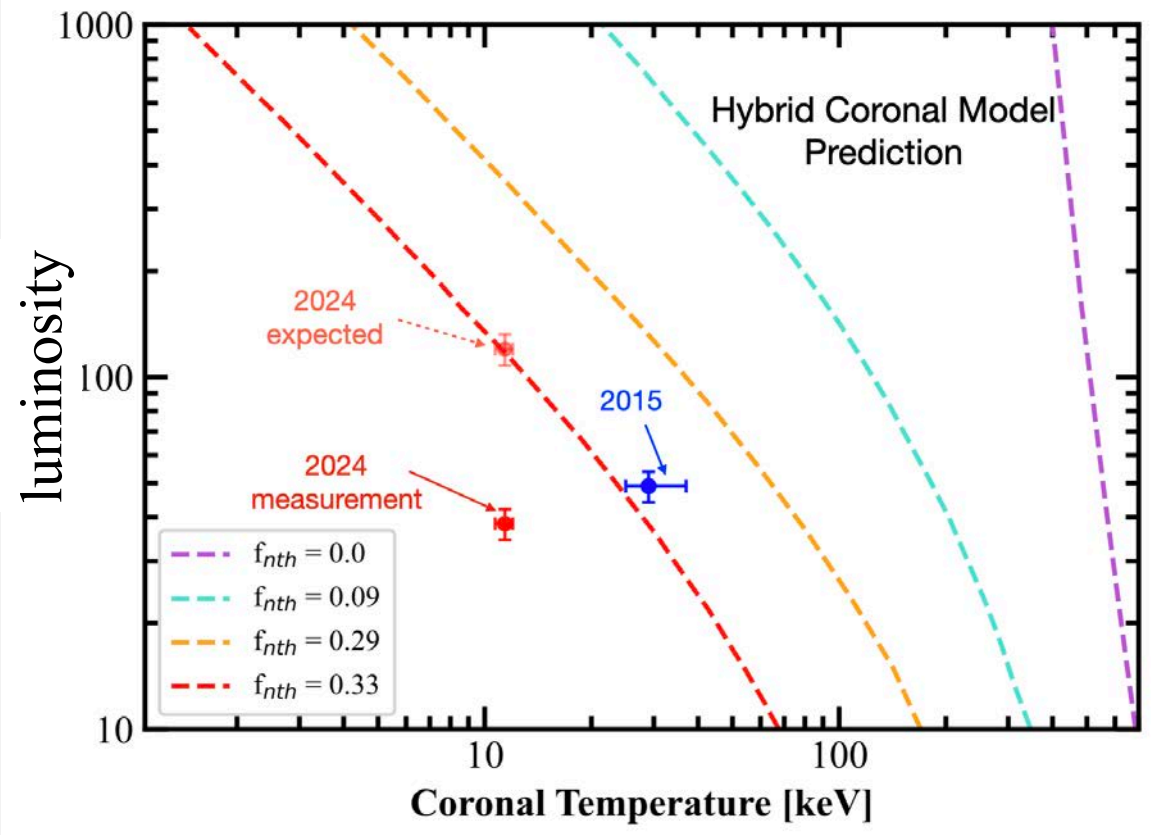
Corona

We initiate a long-term monitoring of Mrk 509 with NuSTAR



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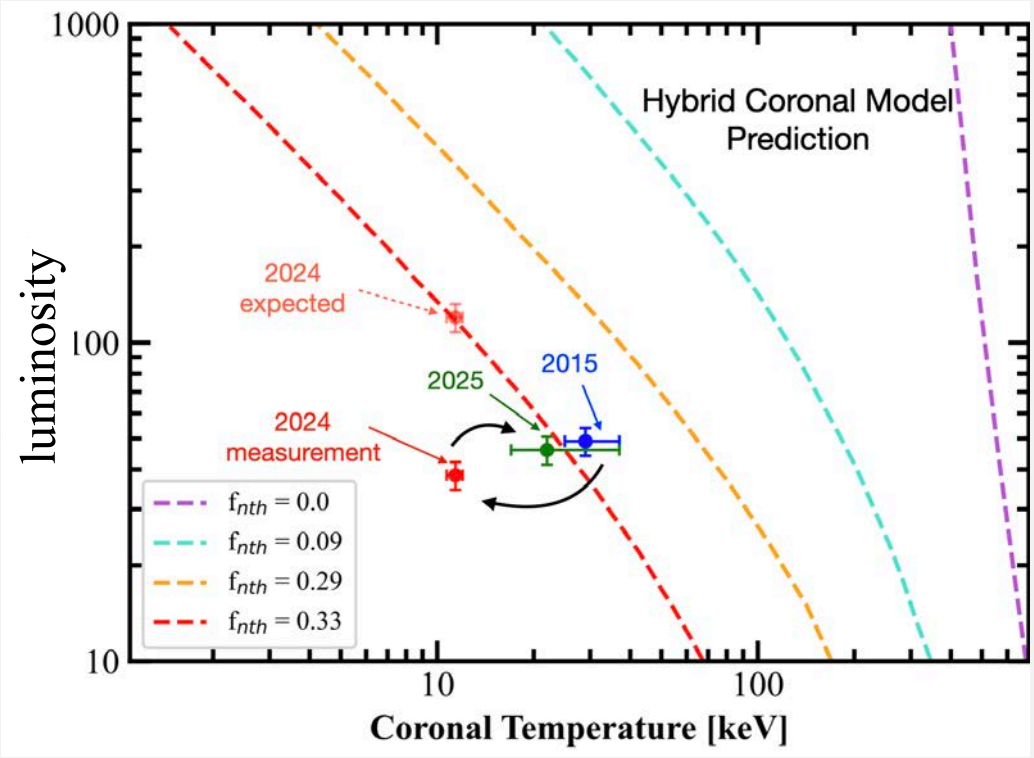
Corona

Three NuSTAR observations were approved in 2025-2027

First observation in 2025



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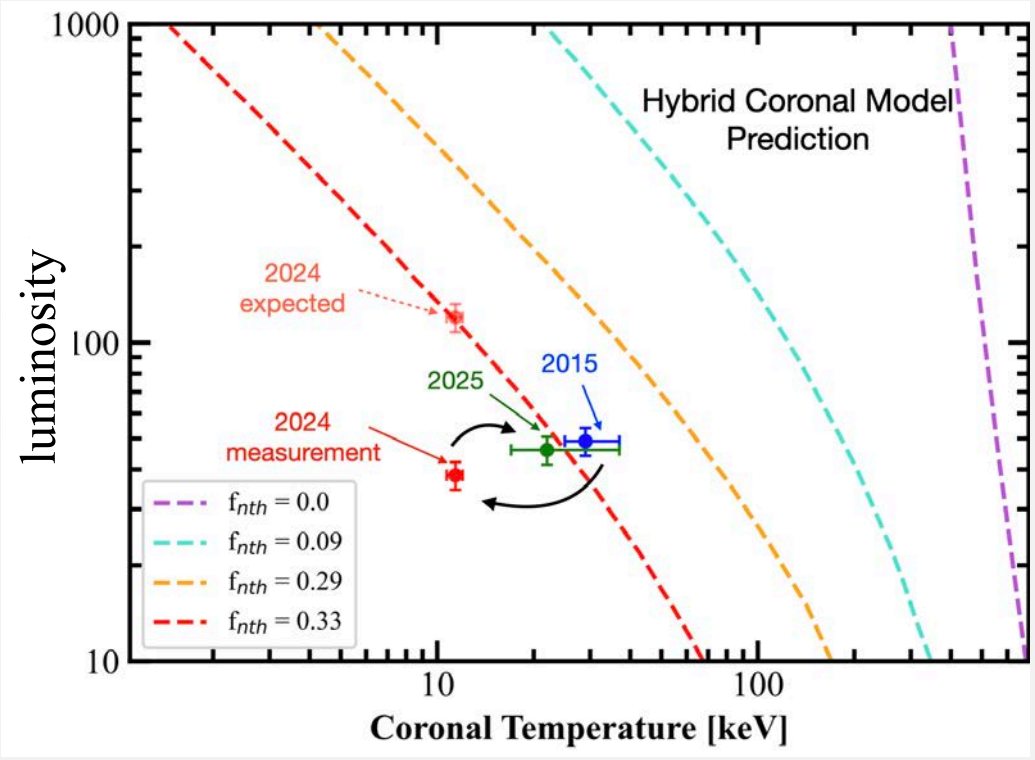
Corona

- **This is the first time that significant coronal temperature variations have been observed!**
- **This challenges our current understanding of the accretion of supermassive black holes.**



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