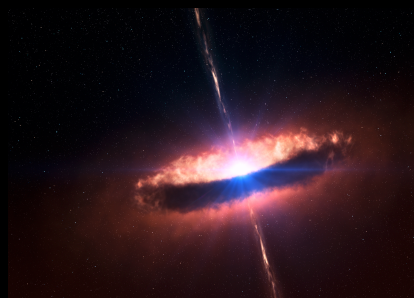


A First Look at the **TESS-*Fermi* Blazars**



Krista Lynne Smith

Einstein Postdoctoral Fellow

KIPAC at SLAC / Stanford University

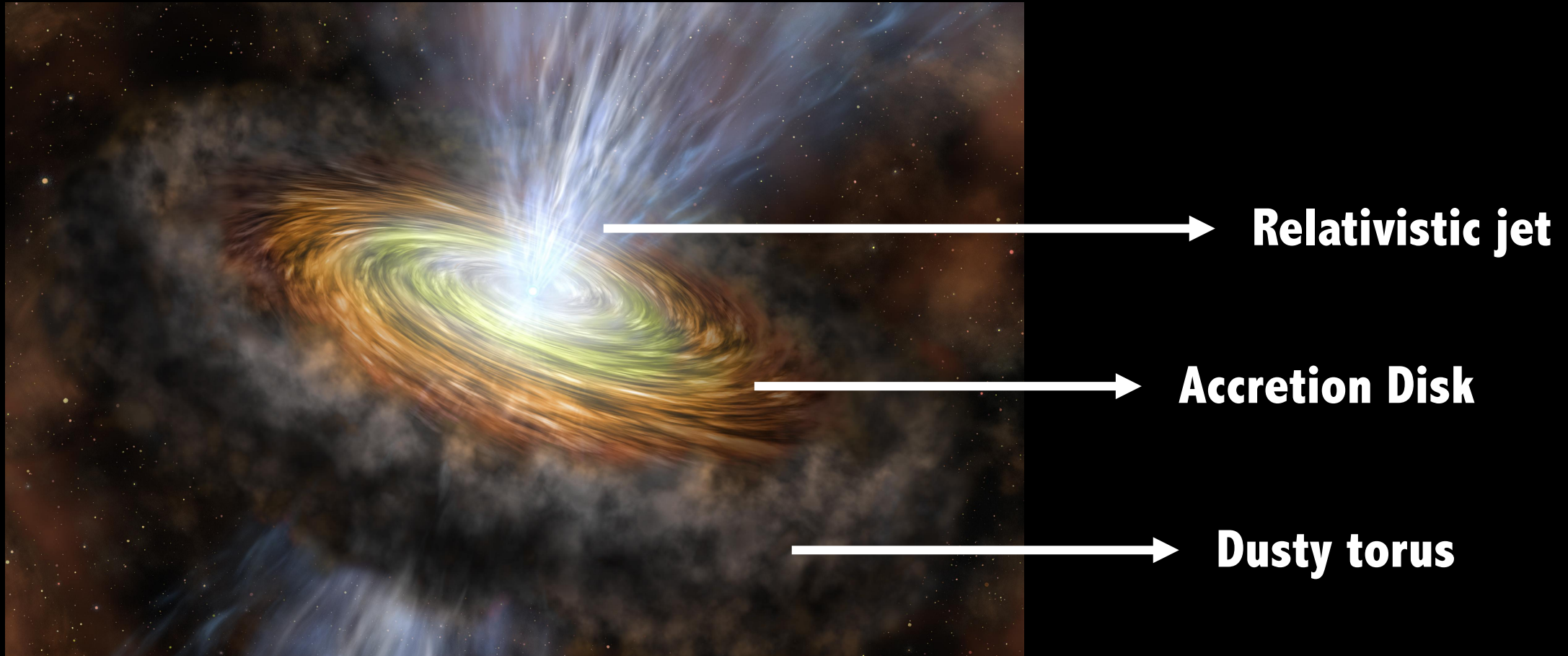
Grzegorz Madejski (SLAC)

Bindu Rani (GSFC)

TESS Science Conference

MIT, July 29 2019

Active Galactic Nuclei

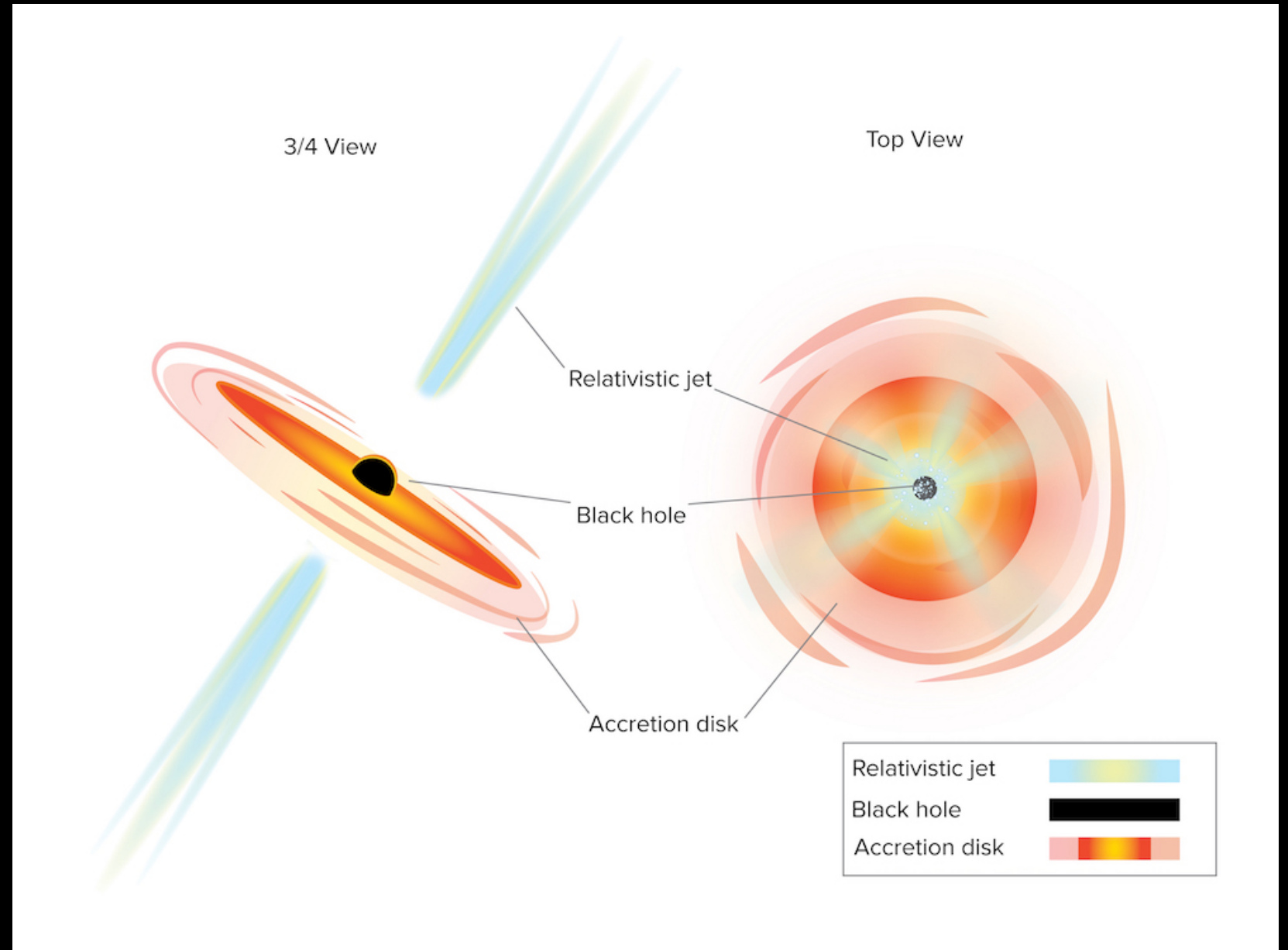


NASA

Blazars

In blazars, we are staring “down the barrel” of a **relativistic jet**.

- Detailed probes of microphysics due to Doppler boosting.
- Simultaneous multiband monitoring -> the origin of the high energy emission.

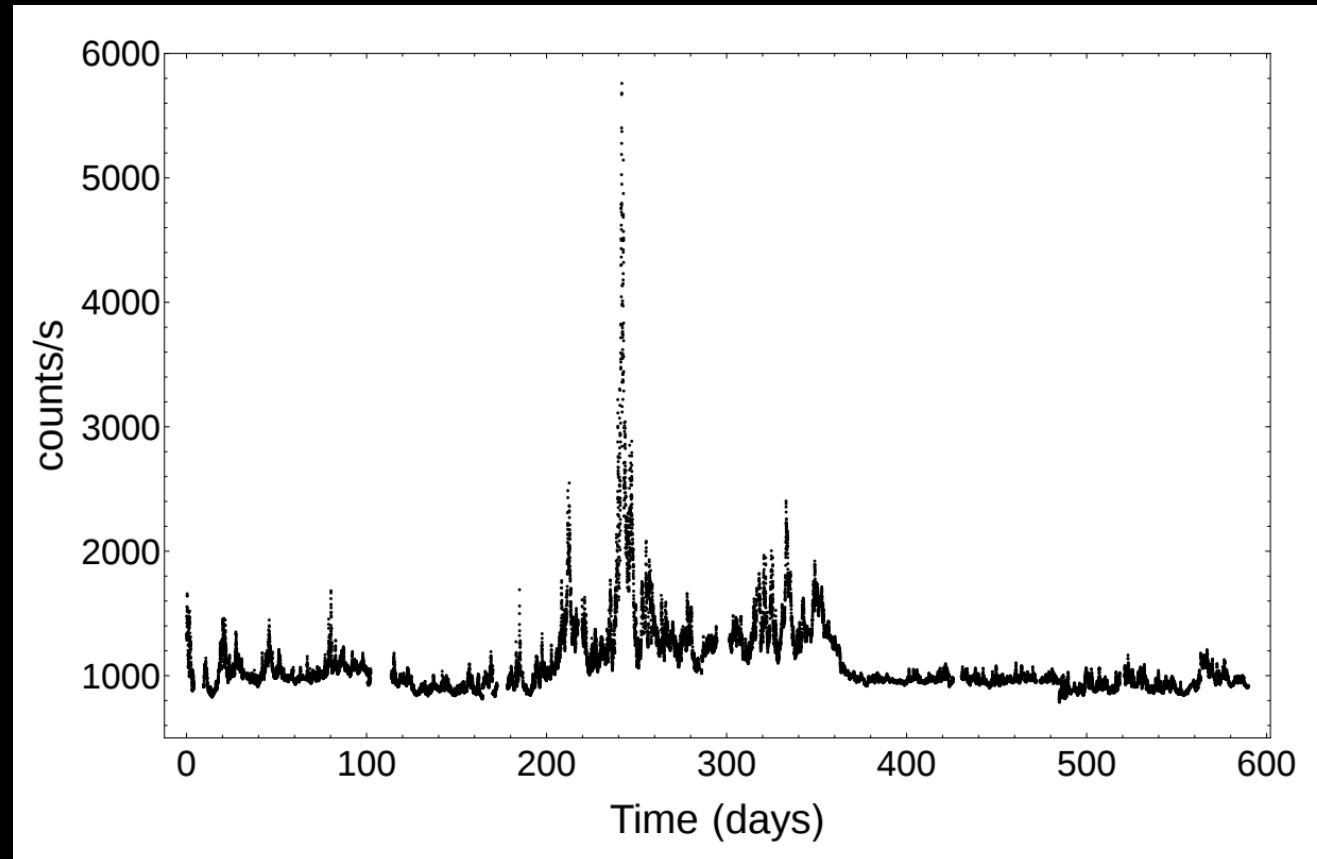


Blazars



An AGN in which the optical emission (and variability) comes from the relativistic jet.

The Kepler Blazar W2R 1926+42



-Flare asymmetries indicating possible **acceleration / dissipation timescales**

-**Emission region sizes** $\sim 10^{15}$ cm (or about 70 AU).

Blazars

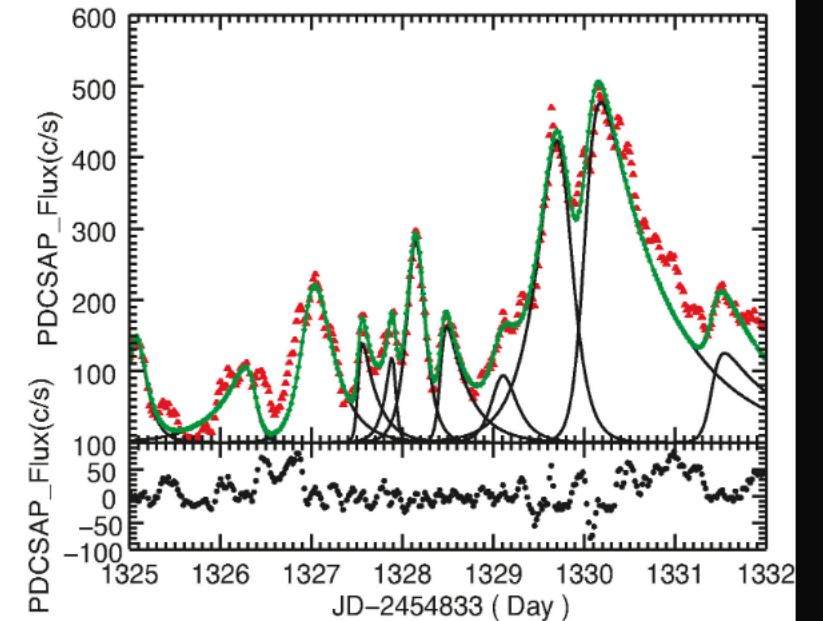
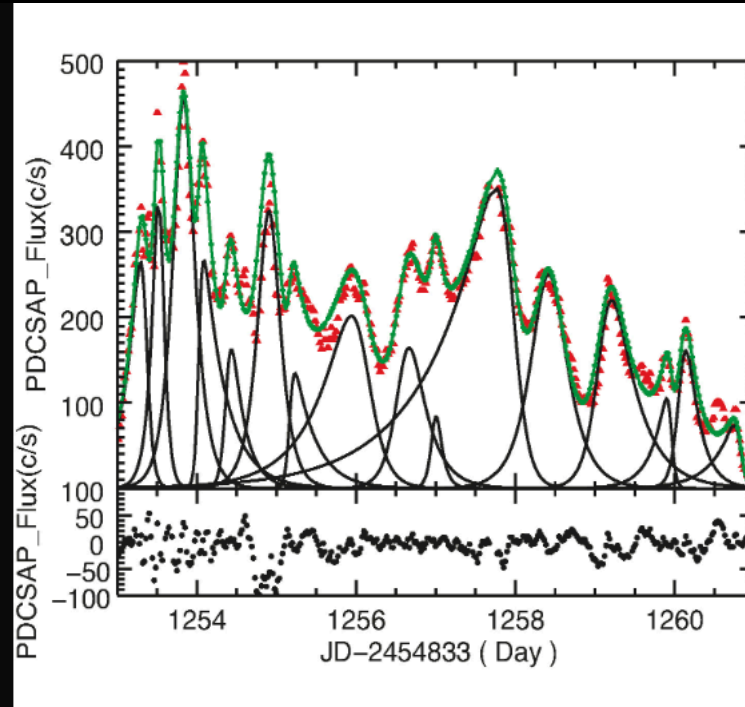


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TESS and the *Fermi* Blazars

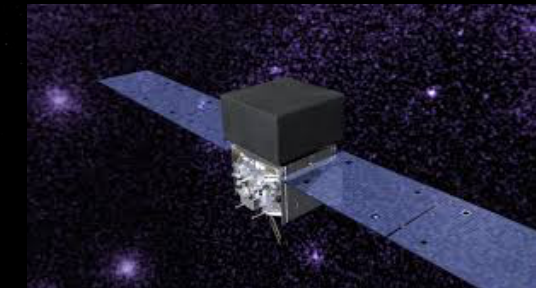
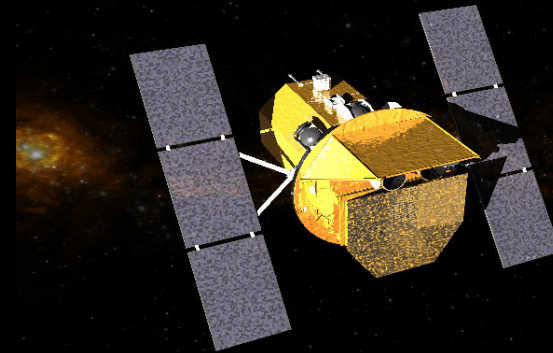
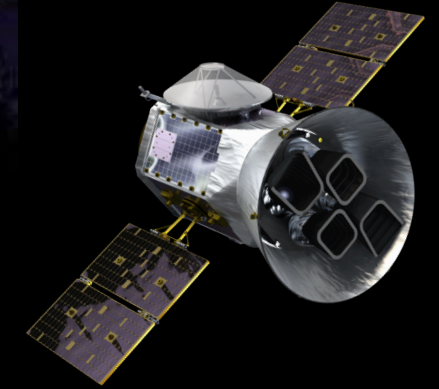
(Northern Hemisphere)

Simultaneous radio, optical, UV, X-ray, and γ -ray light curves:

- Location of flaring activity
- Origin of the high energy (γ -ray) emission

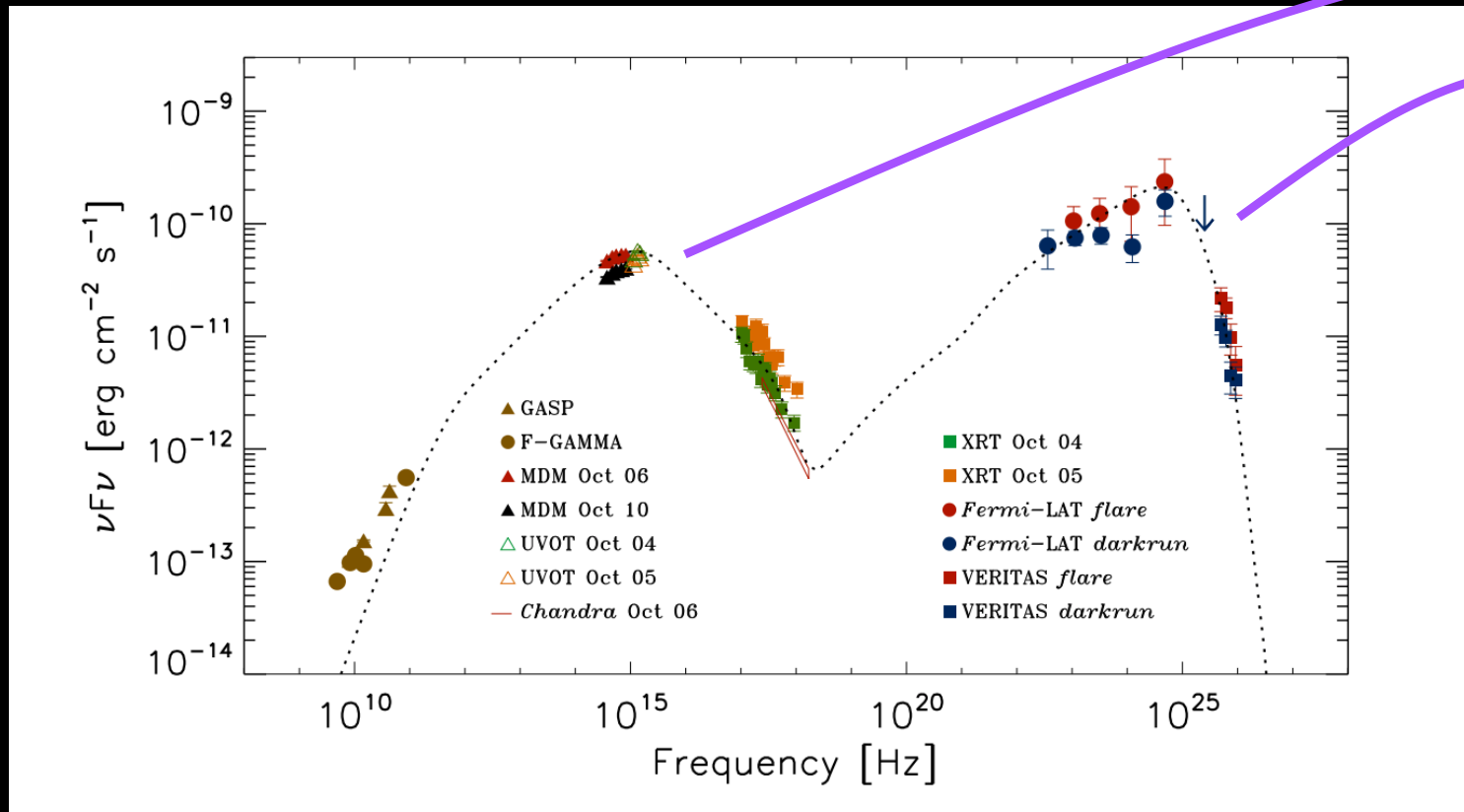
Ongoing *Swift* program in northern hemisphere!

- 3.5 day cadence
- 1 year baseline



TESS and the *Fermi* Blazars

Spectral Energy Distribution of 3C 66A: Optical to γ -ray



Fermi-LAT, VERITAS
Collaboration, 2011

Low-energy peak:
synchrotron
emission

High-energy
peak: ???

Multiband:
watch entire
SED vary!

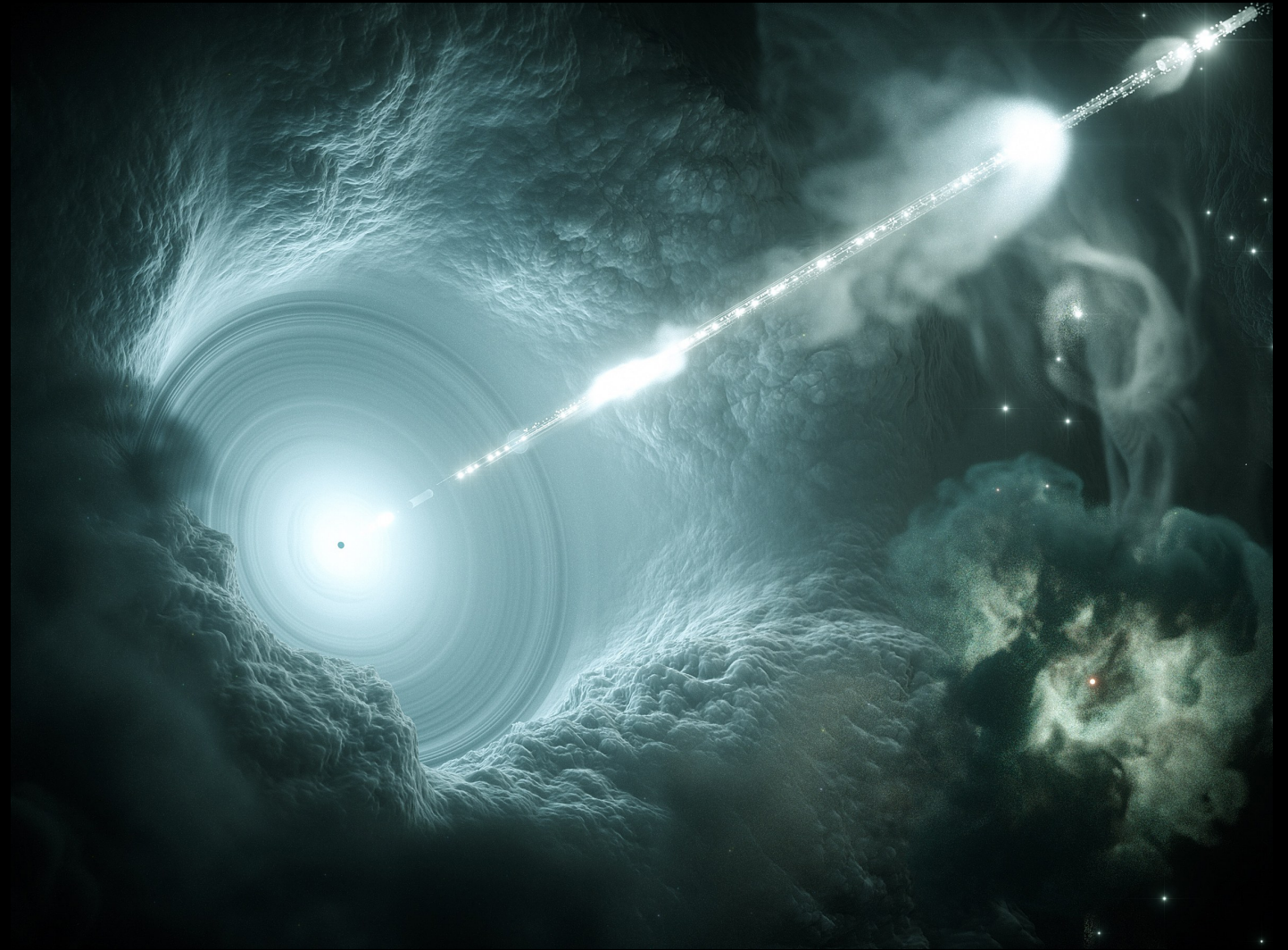
What is the origin of the high energy emission?

Leptonic: Synchrotron
Self-Compton or External
Compton scattering

Hadronic: photo-pion
production $\rightarrow \pi^0$ decay
photons



Neutrino detection
from TXS 0506+056!



Maraschi et al. 1992, Sikora et al. 1994,
Mannheim & Biermann 1992, Aharonian
2000, Mücke 2003, Böttcher 2013

TESS and the *Fermi* Blazars

Swift-monitored:

Four blazars in each polar viewing zone.

South

PKS 0506-61

1RXS J0543-55

PKS 0637-75

PMN J0730-6602

North

4C +56.27

S4 1749+70

S5 1803+784

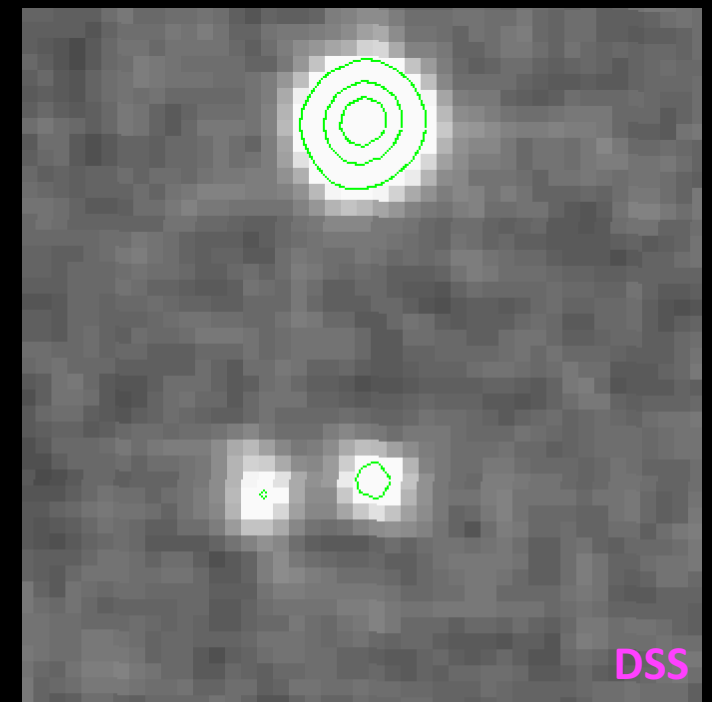
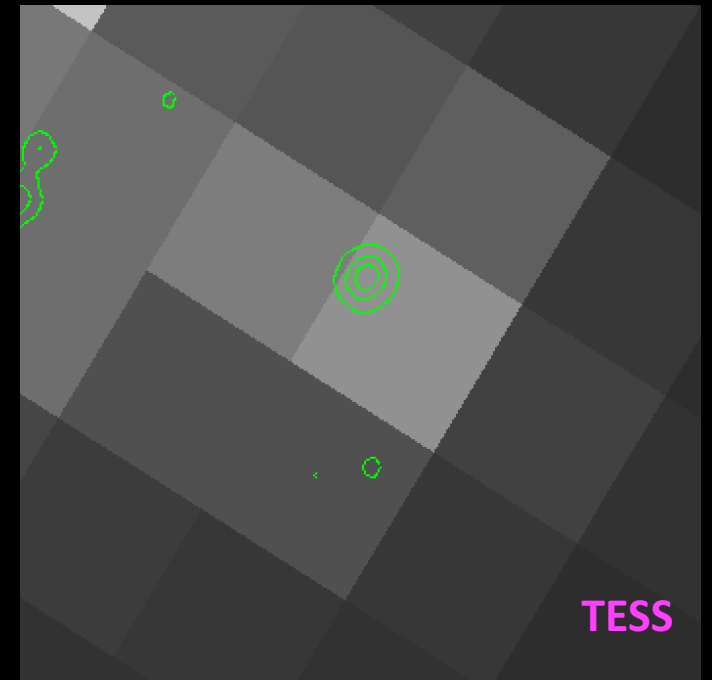
3C 371

Need to be
X-ray bright!

Fermi + TESS only:

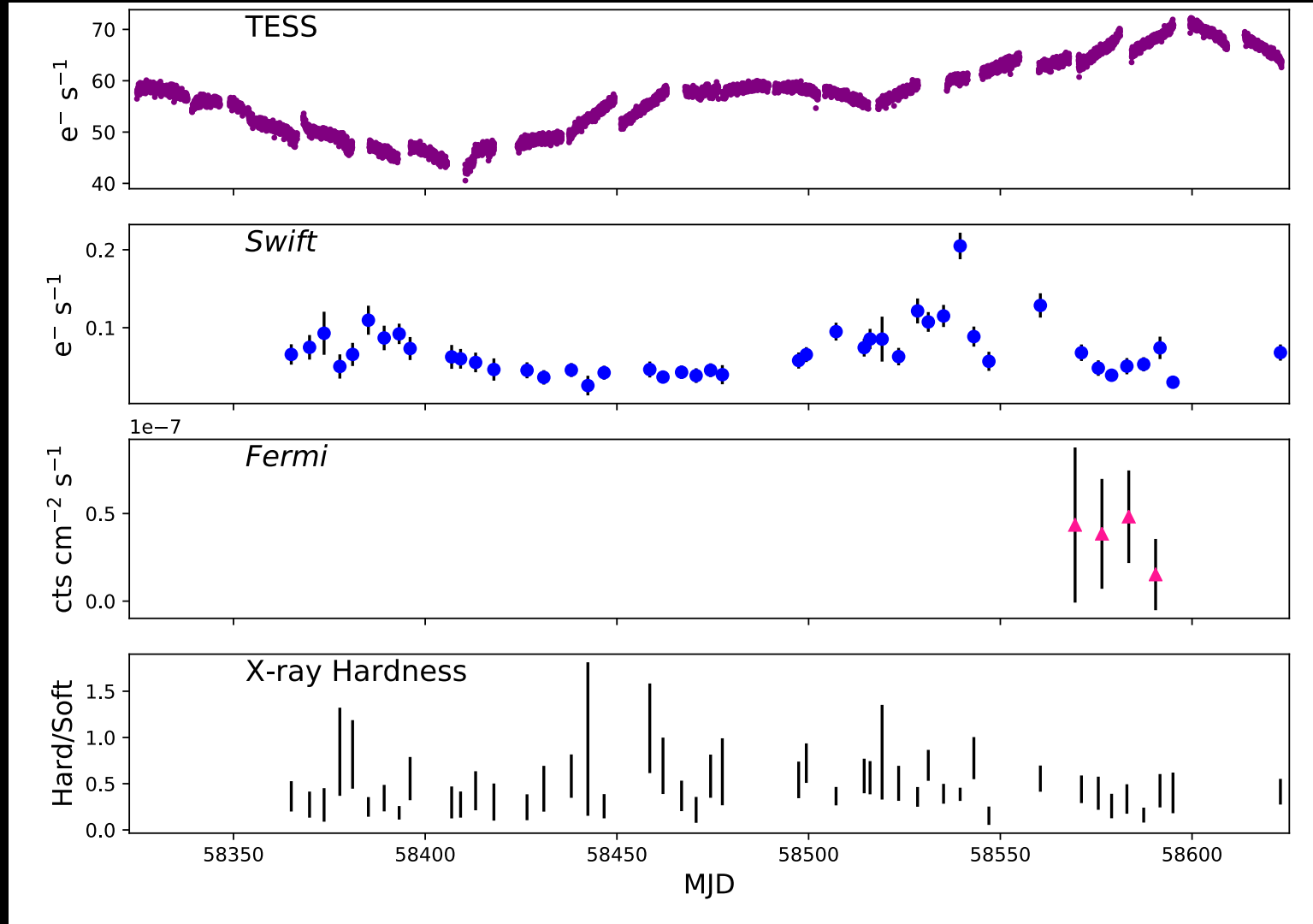
Five so far across the sky, and counting!

Only five??



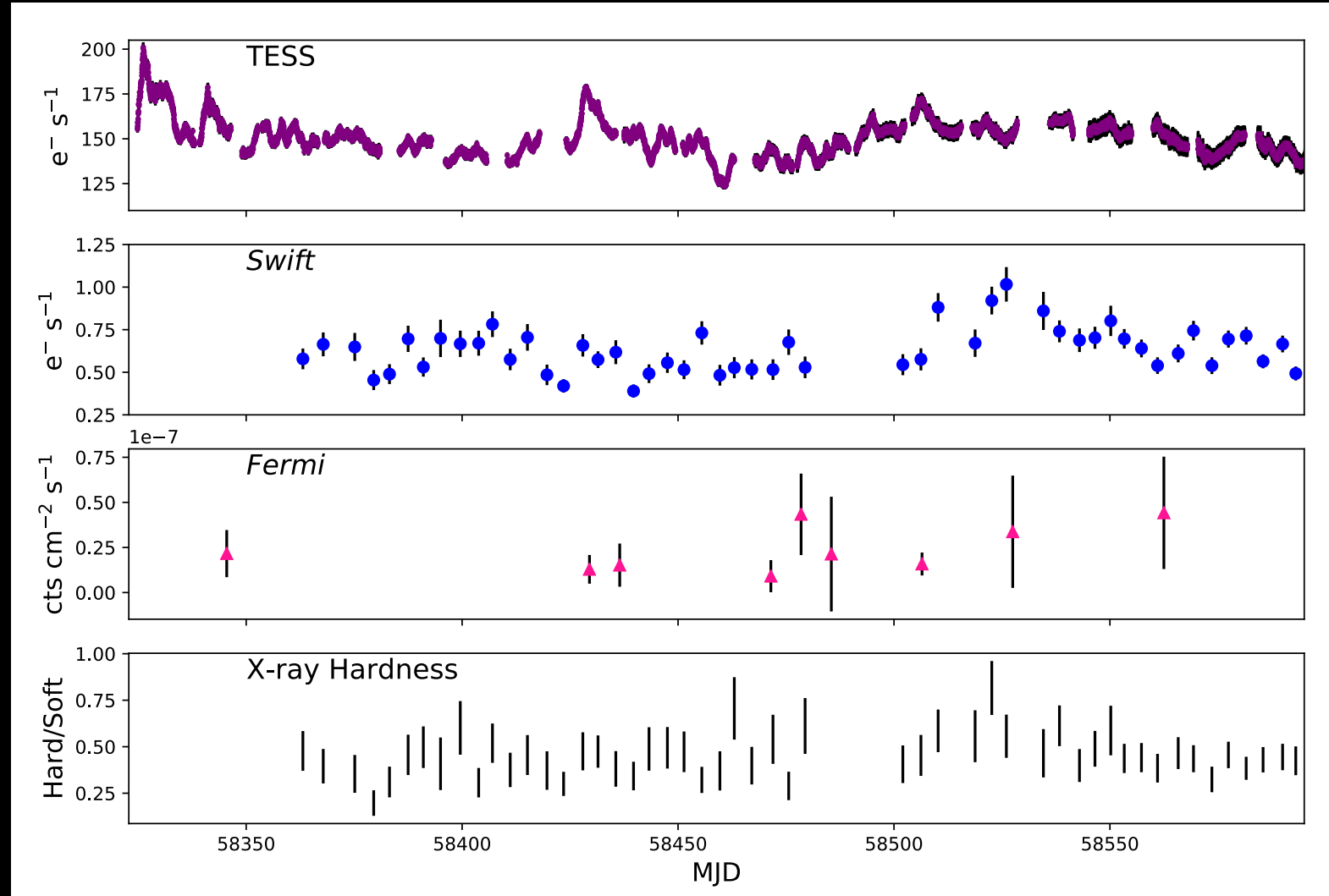
TESS and the *Fermi* Blazars

PMN 0730-6602



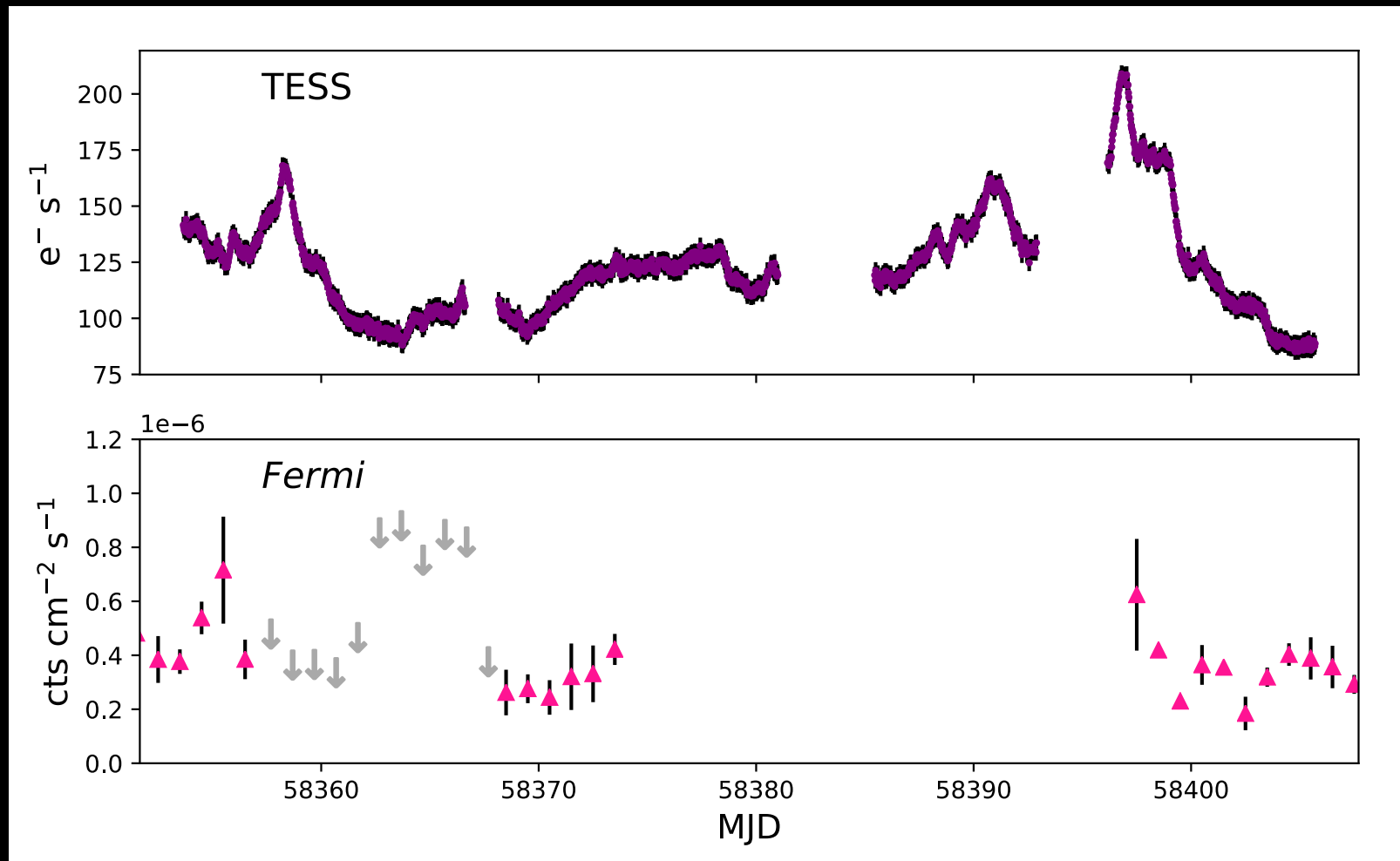
TESS and the *Fermi* Blazars

1RXS J0543-55



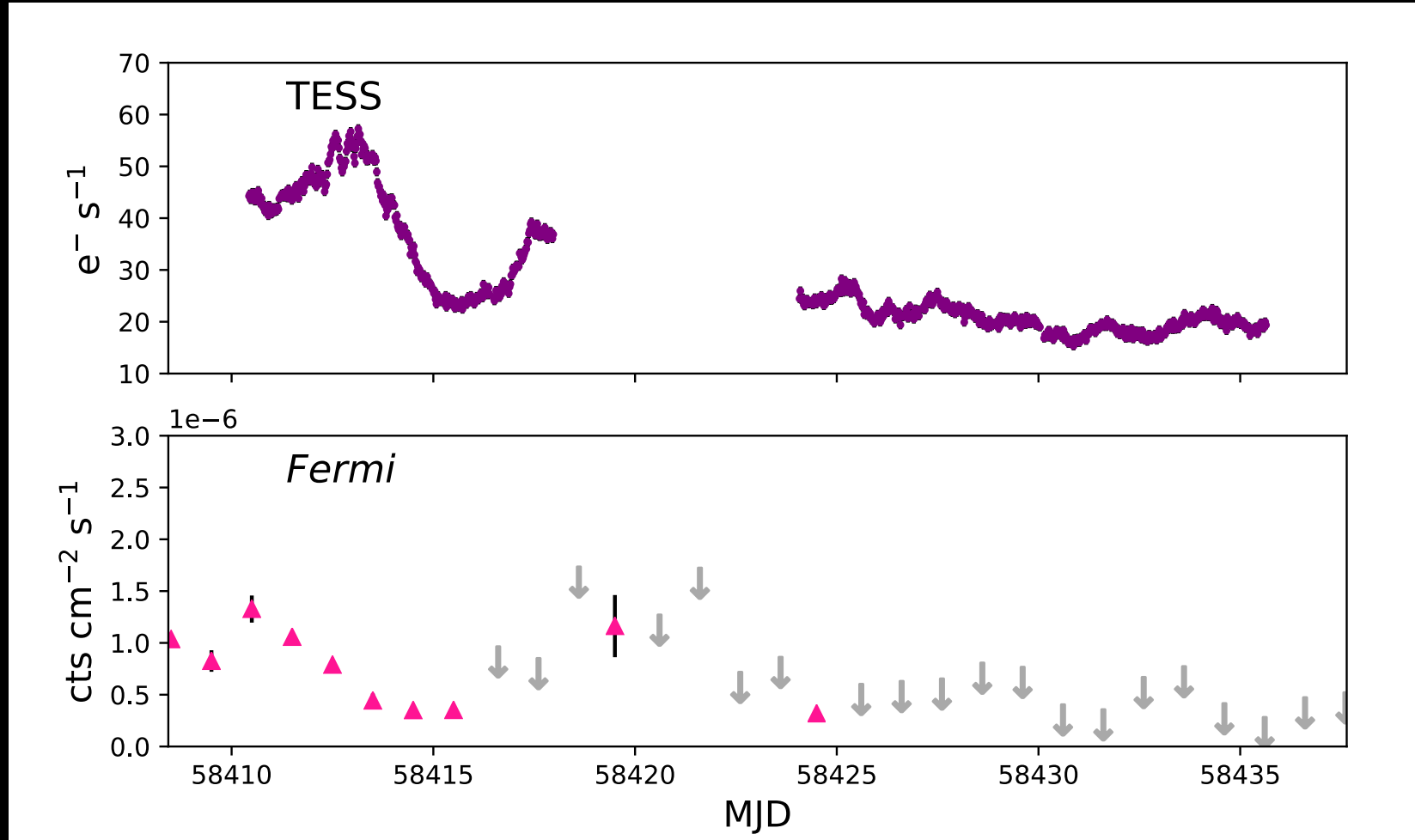
TESS and the *Fermi* Blazars

PKS 0208-512

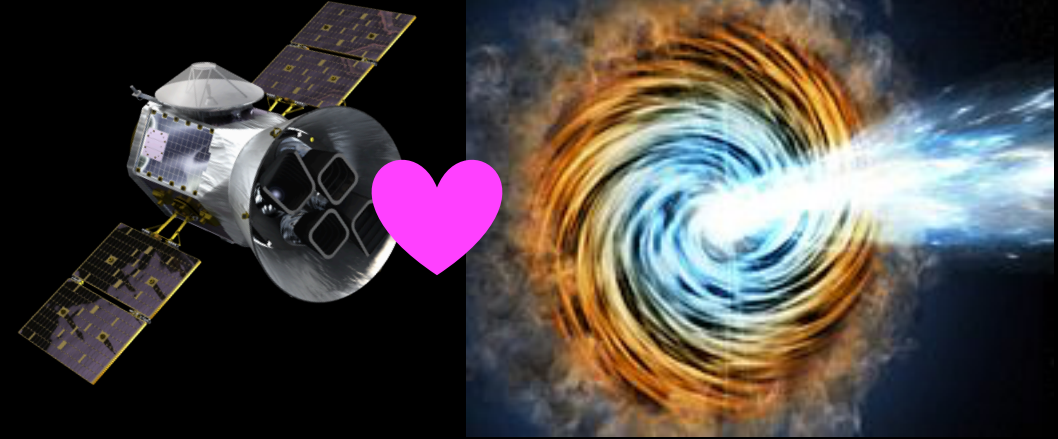


TESS and the *Fermi* Blazars

PKS 0346-27



TESS and the *Fermi* Blazars: What's next?



Lots of questions!

Why do X-ray bright blazars show weaker gamma / optical correlation?

Time-dependent SED modelling + radio data

Quantification of lags and leads: Bayesian block analysis, Gaussian processes...

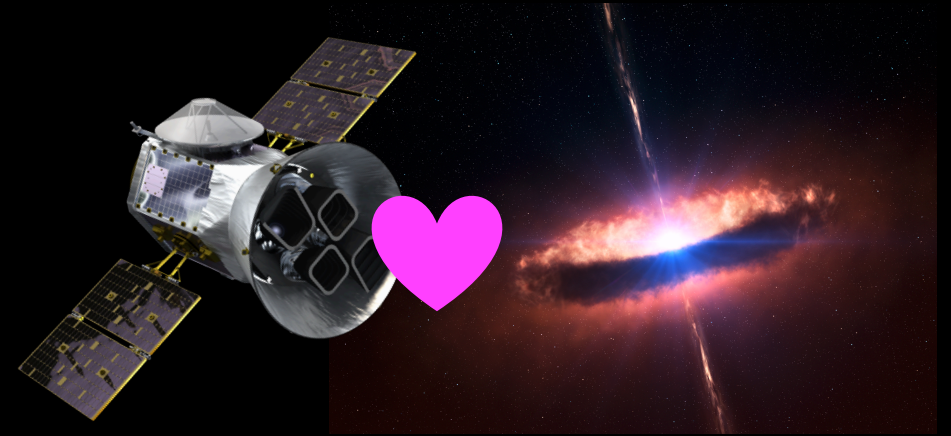
Lots of challenges!

Careful decorrelation and decomposition required.

Lots to look forward to!

Classification of UFOs (unidentified Fermi objects)?

TESS and AGN: **What's next?**



Classify unknown Fermi targets?

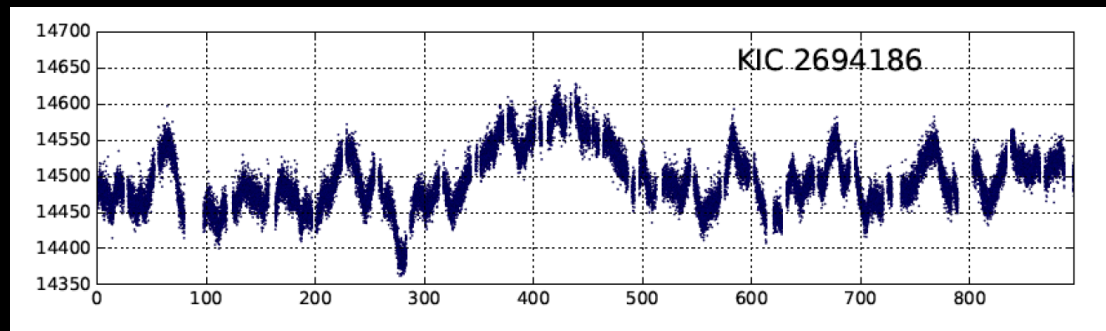
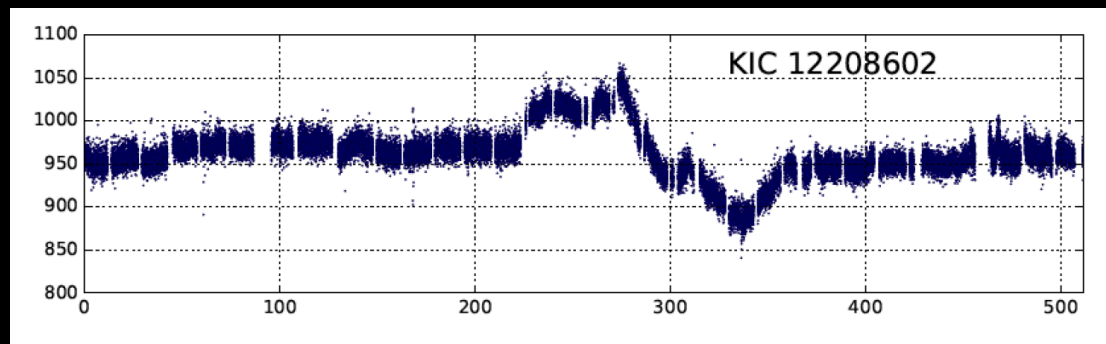
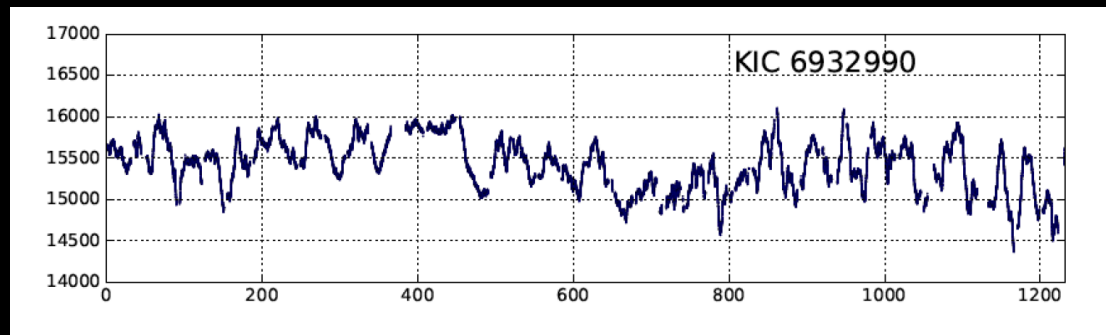
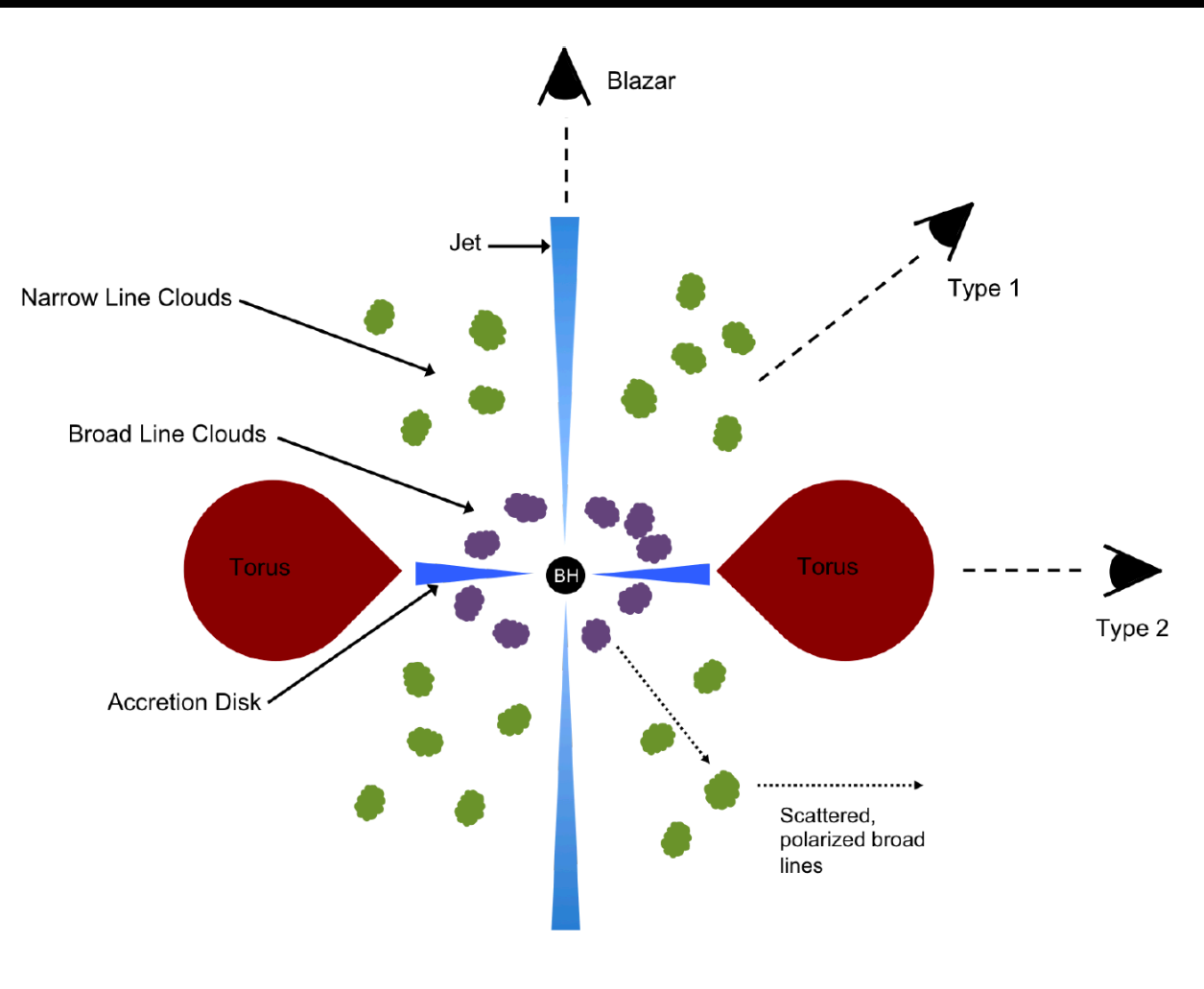
Radio-loud vs radio-quiet AGN: jet production and accretion disks

Optical quasiperiods (QPOs): probes of black hole mass

...and on and on!

Types of AGN

Classification depends on viewing angle!



Time (rest frame days)

K.L. Smith et al. 2018a