The curious case of γ-NLS1 galaxies

Results from a multiwavelength study

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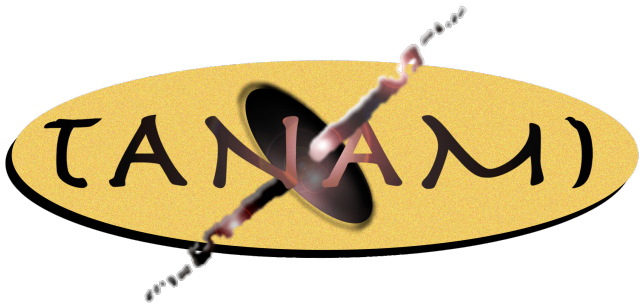
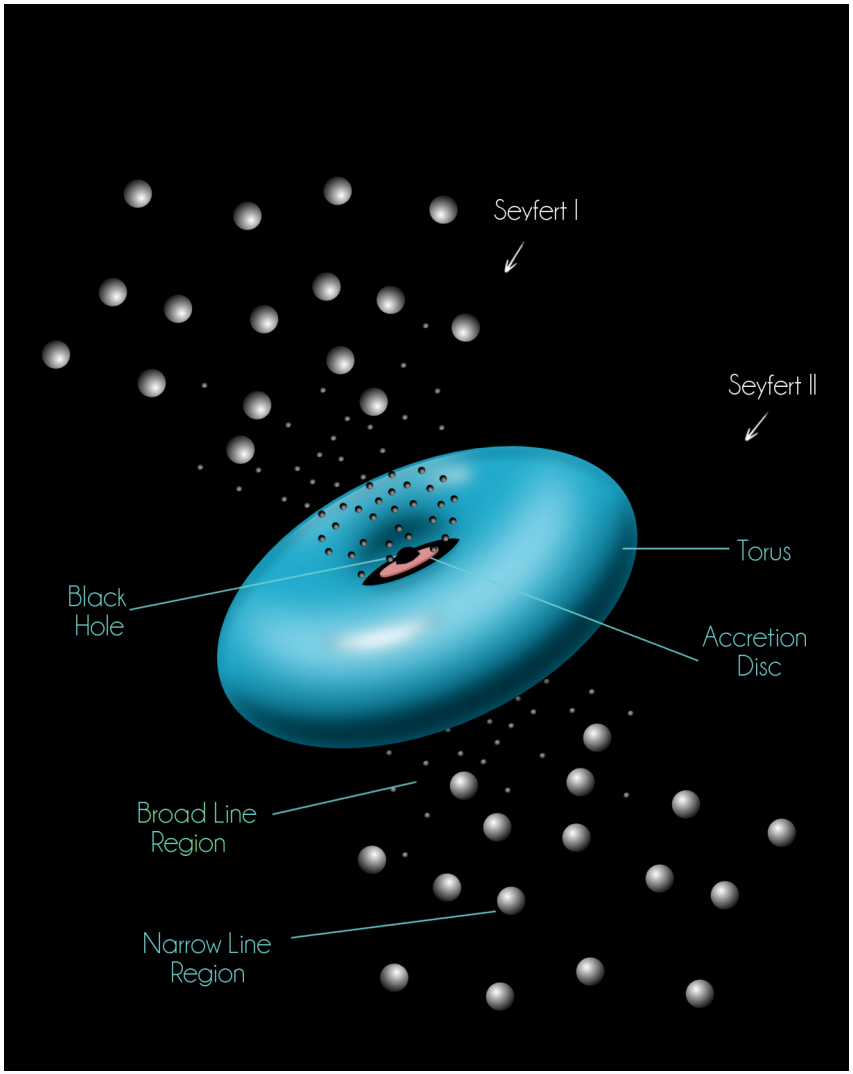
University Würzburg



May 30, 2014

Active Galactic Nuclei

Radio-quiet (RQ) AGN



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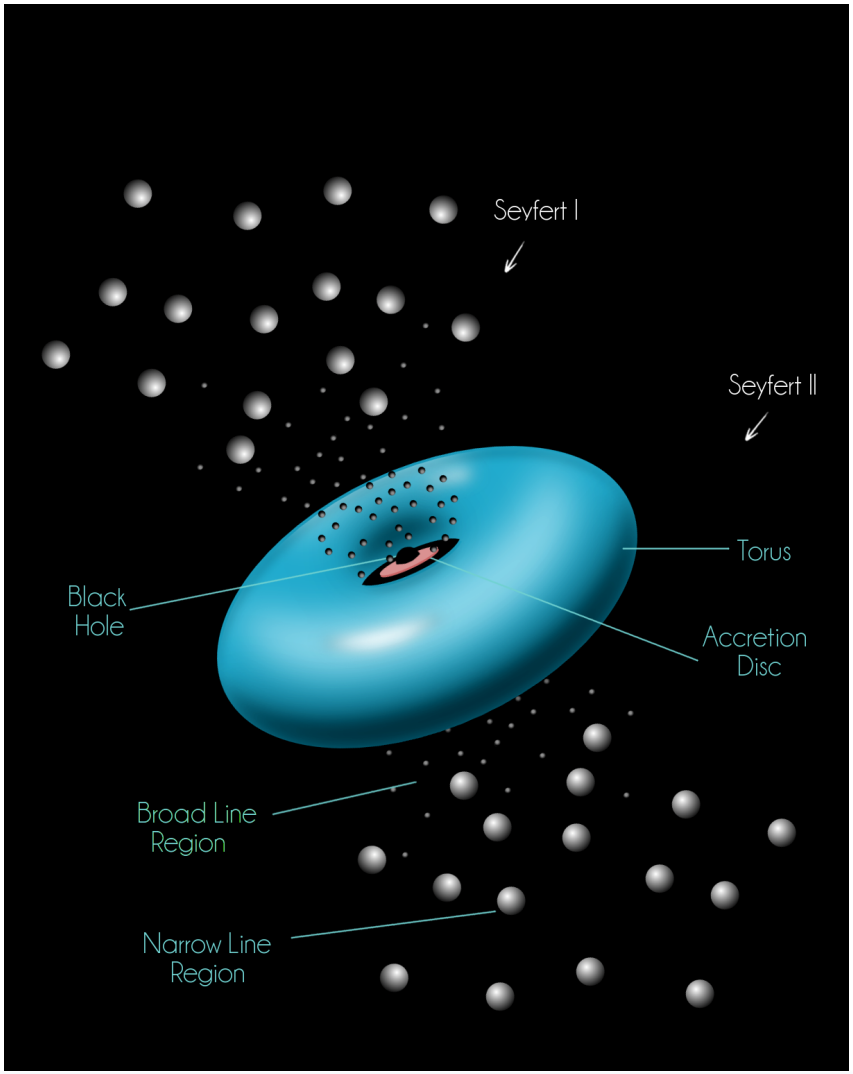
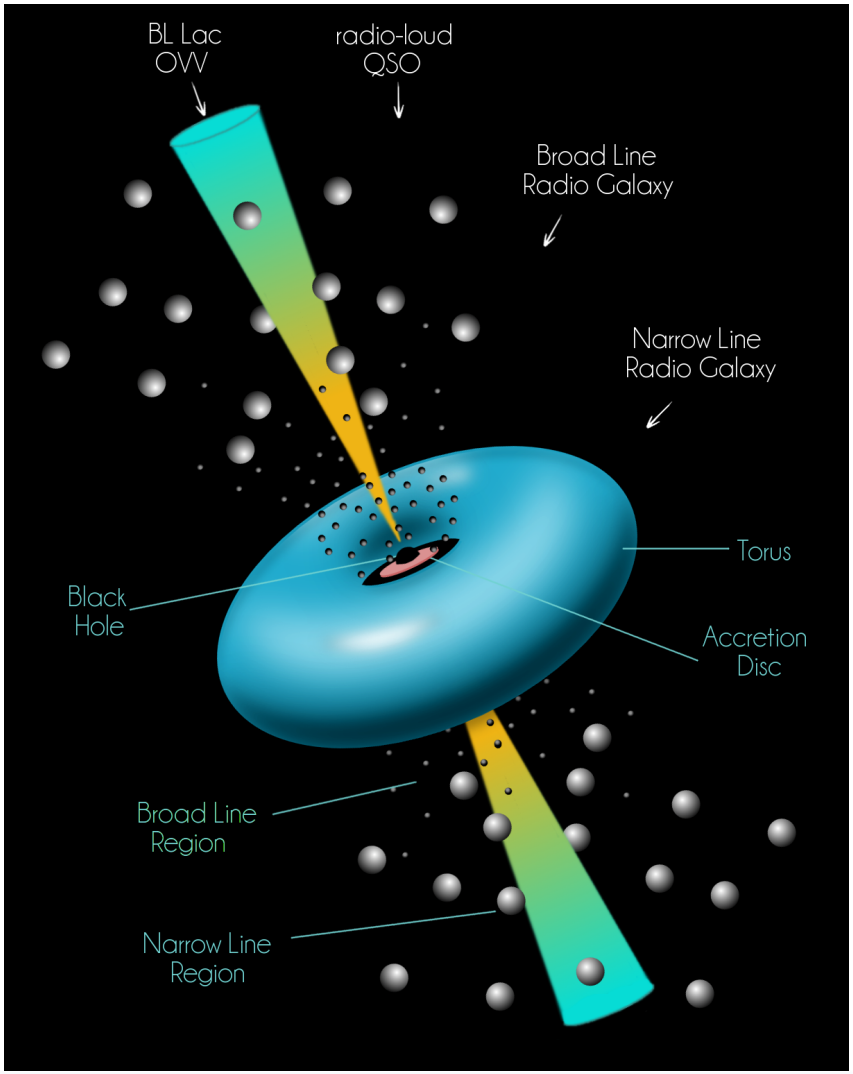


Radio-loud (RL) AGN

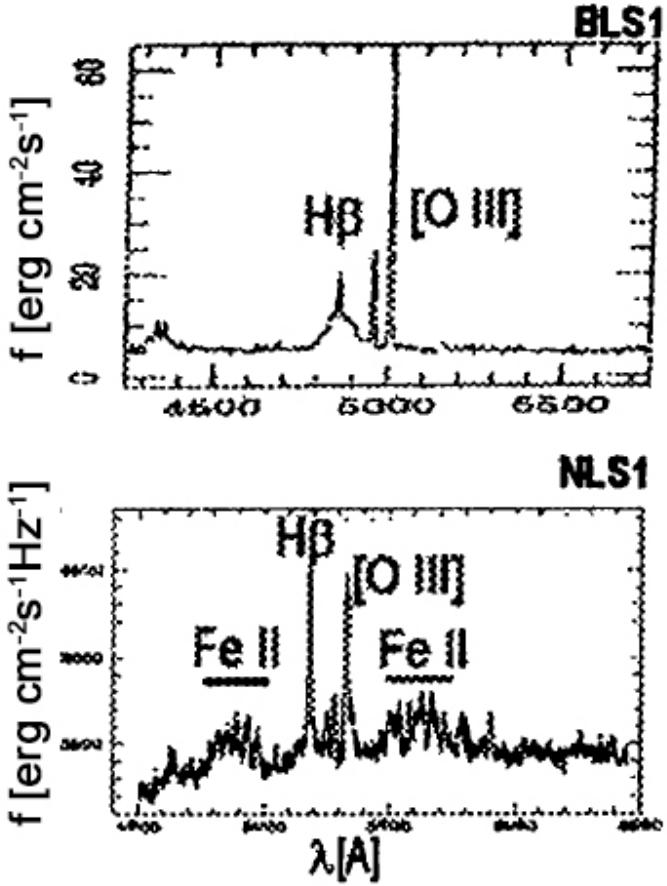


Narrow-Line Seyfert 1 Galaxies

γ-NLS1

Seyfert 1 galaxies, but

- peculiar optical line spectrum
- exhibit strong radio emission (jet? star formation?)
- γ-ray emission in radio-loud NLS1: evidence forrelativistic jets!



Boller, T., 2003, ASPC 290, 69B

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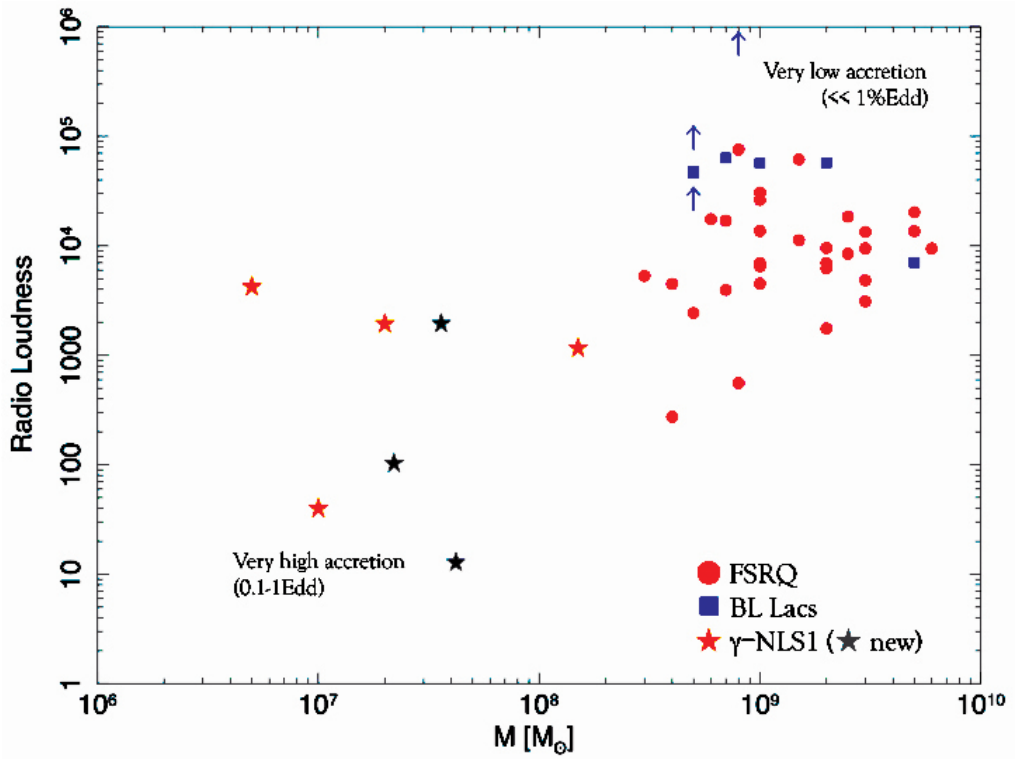

Foschini, L. (2011), POS(NLS1) 024

Narrow-Line Seyfert 1 Galaxies

γ-NLS1

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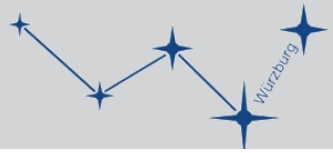
Challenge to the RL-AGN Paradigm!

- **γ-NLS1:**
  low M_{BH}
  high accretion rates
  Spiral host galaxies
- **RL-AGN:**
  high M_{BH}
  low accretion rates
  Elliptical host galaxies

The γ-NLS1 PKS 2004−447



Typical NLS1 properties:

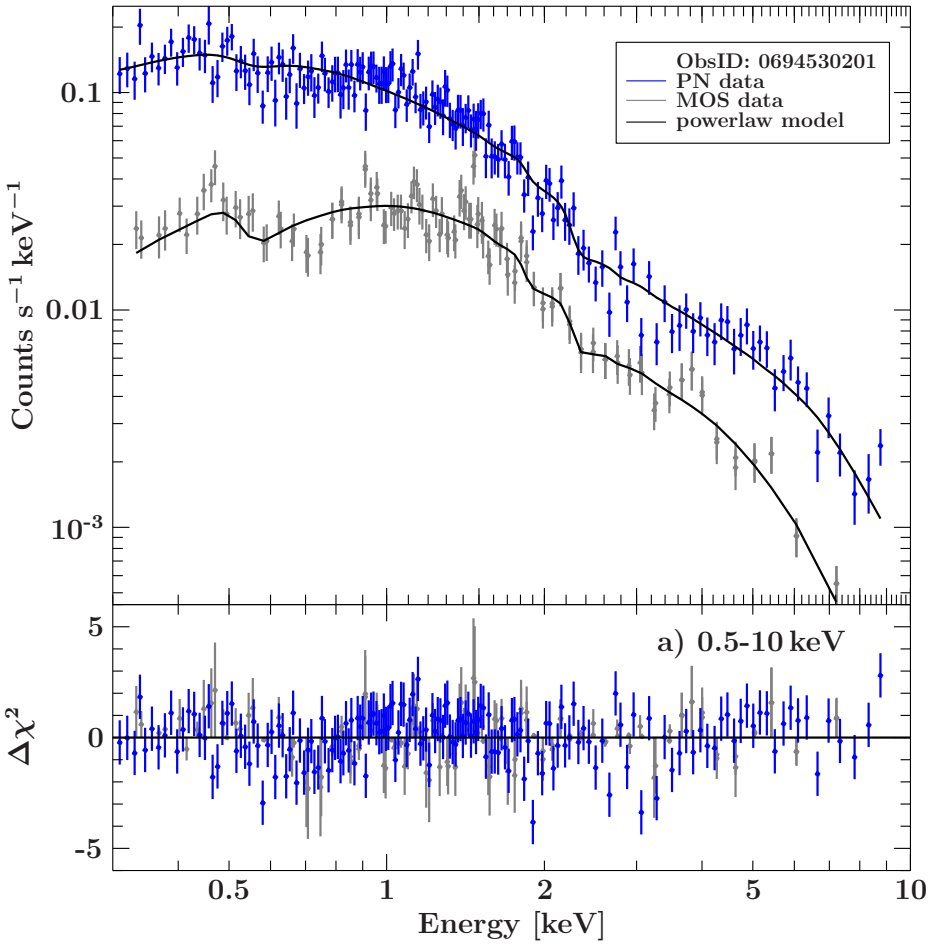
(Oshlack et al. 2001, ApJ 558, 578)

- $M_{BH} \sim 10^{6.7}\,M_{\odot}$
- FWHM(H_{β})=1447 km s^{-1}, [O III]/H_{β}=1.6

Peculiarities:

- Radio-loudest γ-NLS1 ($RL \sim 1700...6300$)!
- Only γ-NLS1 on Southern Hemisphere!
- Weak Fe II emission!

X-ray Monitoring PKS 2004−447

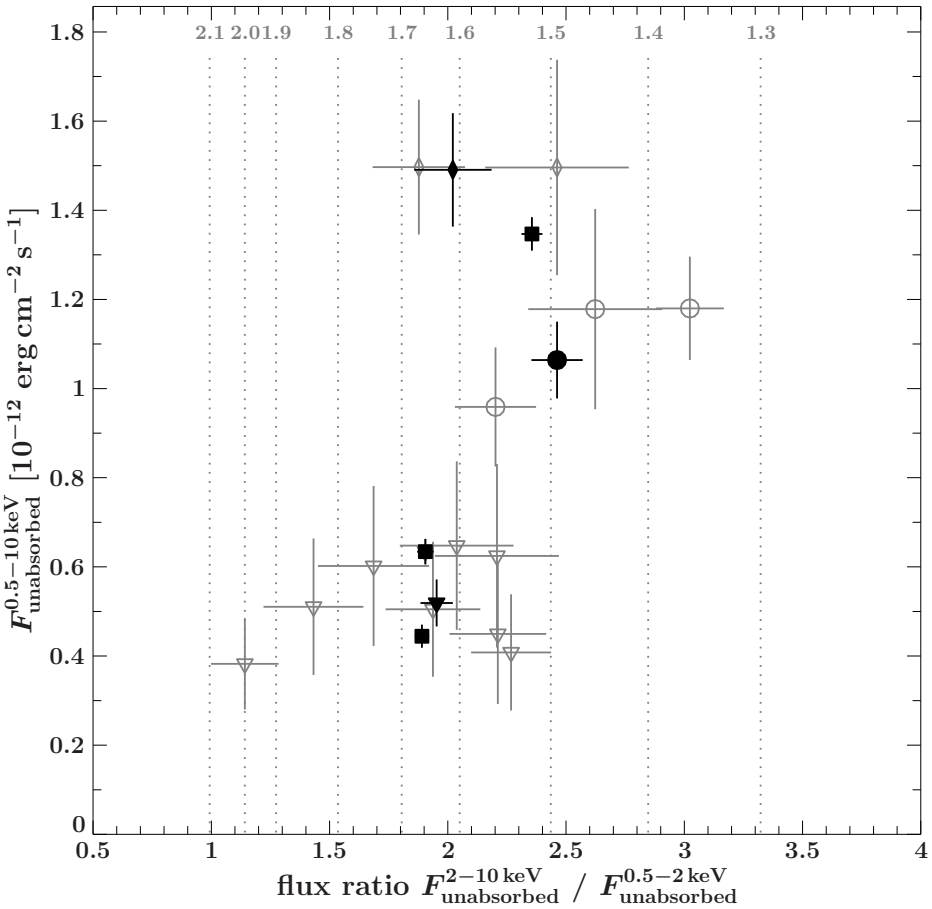


XMM-Newton/EPIC spectrum observed on 2012-20-18.

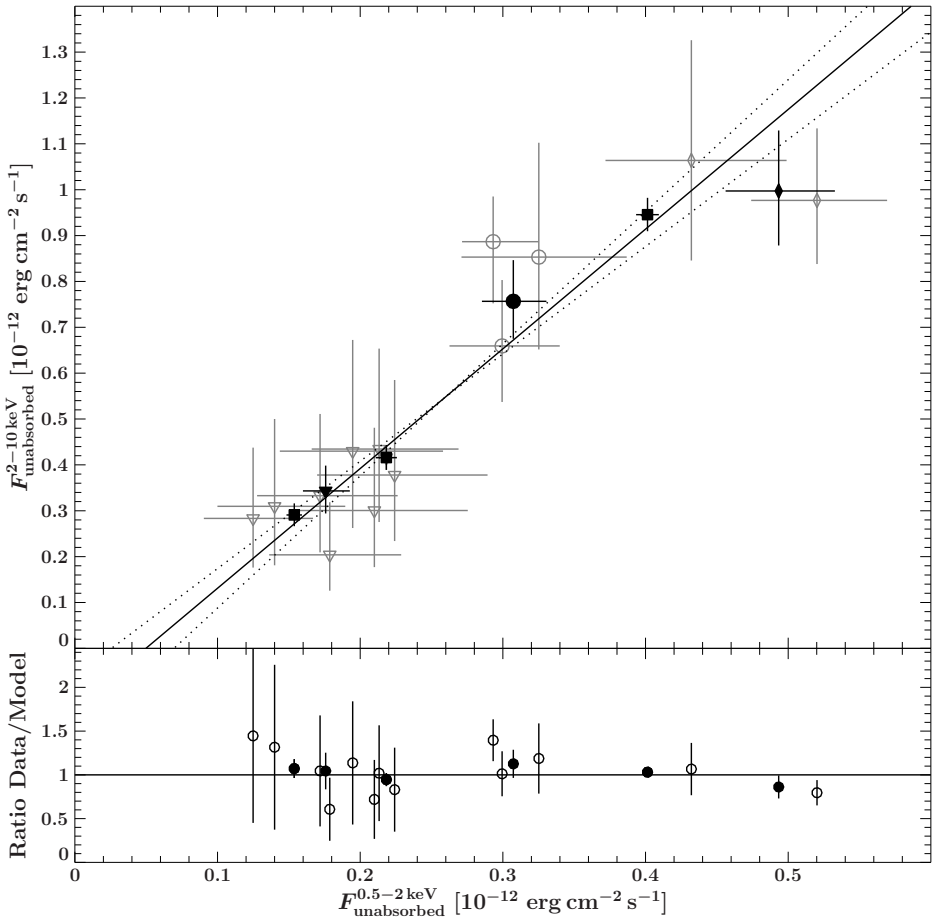
- dense *Swift*/XRT & *XMM-Newton*/EPIC monitoring since 2012 & archival data since 2004
- flat simple powerlaw spectrum ($\Gamma_X \sim 1.6$, similar to blazars)
- flux and spectral variability

Kreikenbohm, A., Schulz, R. et al. in prep.

X-ray Monitoring of PKS 2004−447



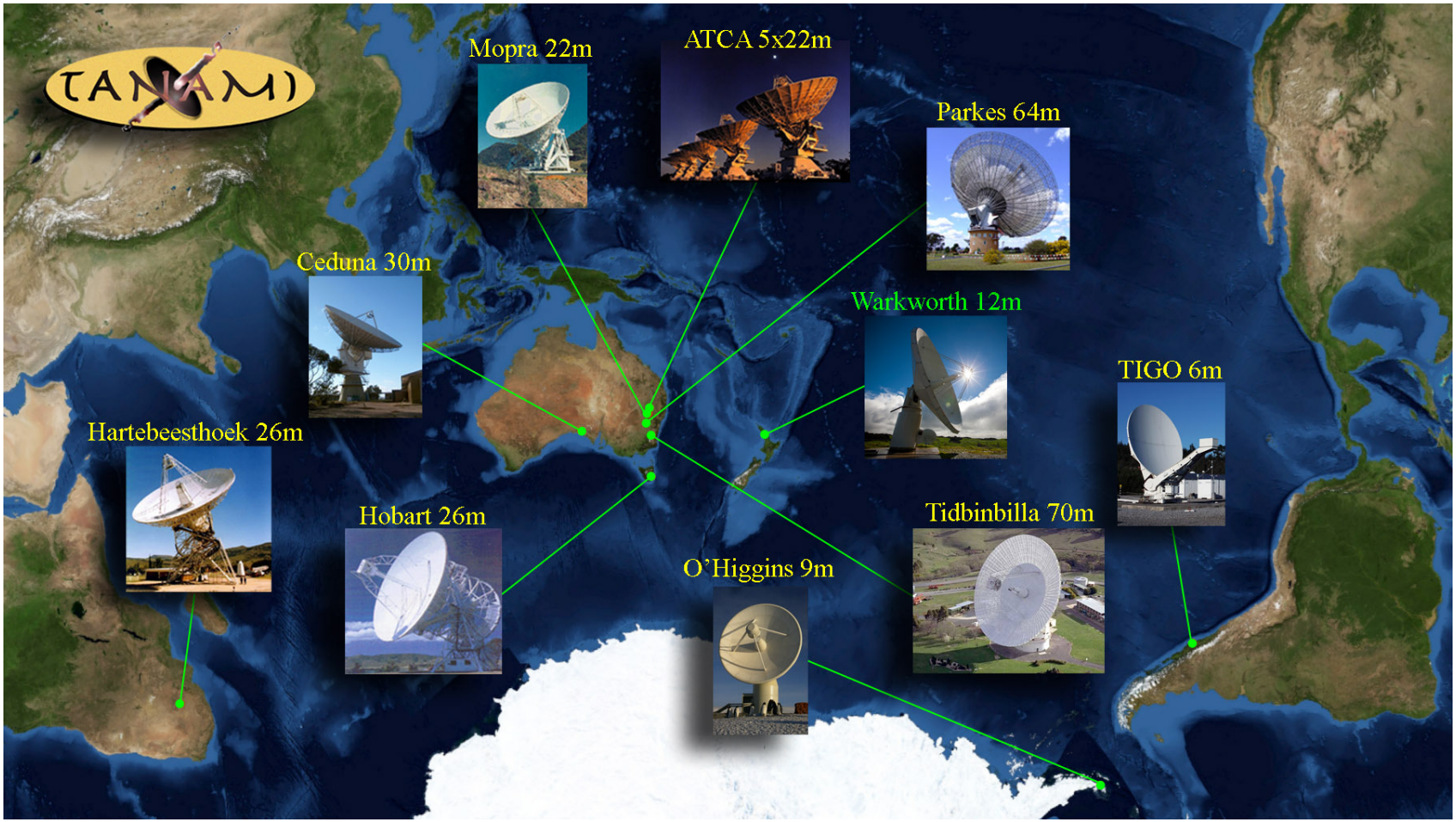
Total X-ray flux vs. hardness ratio.



Correlated flux in soft and hard band.

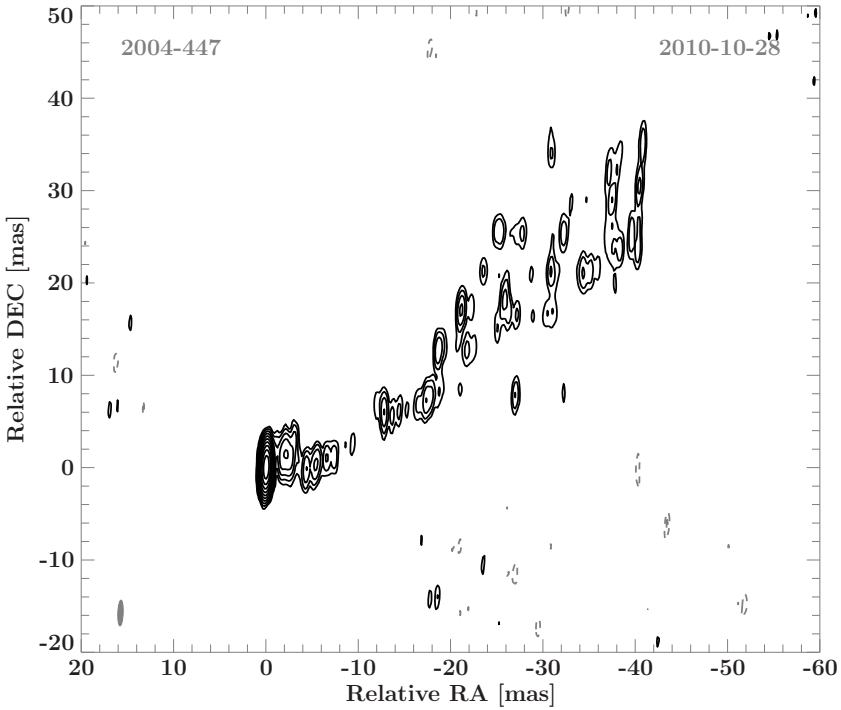
Kreikenbohm, A., Schulz, R. et al. in prep.

The TANAMI VLBI Program

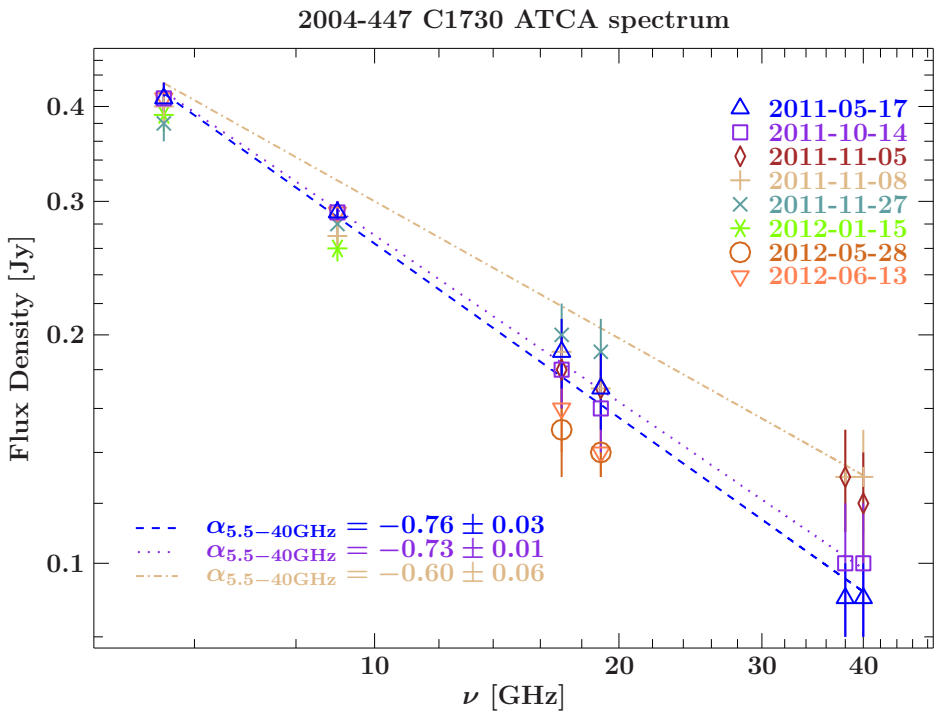


Radio Observations of PKS 2004−447

- TANAMI VLBI image at 8.4 GHz: extended jet structure, bright core
- ATCA monitoring: a steep and variable 5.5−40 GHz spectrum



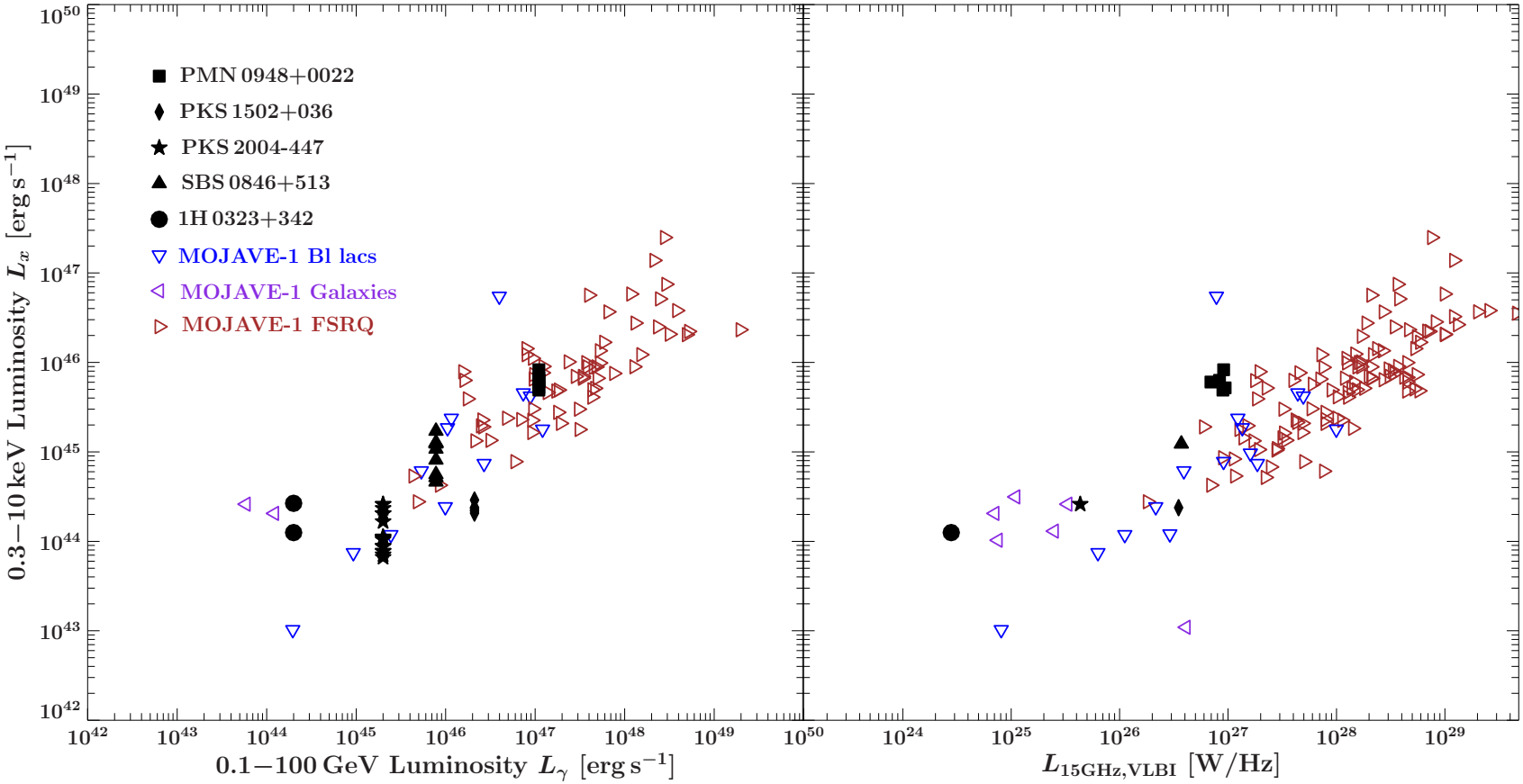
TANAMI image at 8.4 GHz.



ACTA 5.5 to 40 GHz spectrum.

Schulz, R., Kreikenbohm, A. et al. in prep.

γ-NLS1s and Typical Blazars



Kreikenbohm, A., Schulz, R. et al. in prep.

Summary

- **γ-NLS1 challenge our understanding of RL-AGN:**
  $\rightarrow$ Seyferts observed in radio & γ-rays
- **Multiwavelength study of PKS 2004−447**
  $\rightarrow$ peculiar source among original γ-NLS1
  $\rightarrow$ typical X-ray spectrum of blazars
  $\rightarrow$ first TANAMI VLBI image shows extended sub-parsec jet
- **γ-NLS1 show similar spectral properties and energy outputs as typical blazars!**
  $\rightarrow$ jets are driven by similar processes, despite differences in physical conditions