



The curious case of the γ -NLS1 galaxy PKS 2004-447

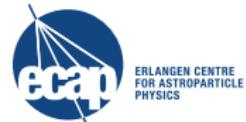
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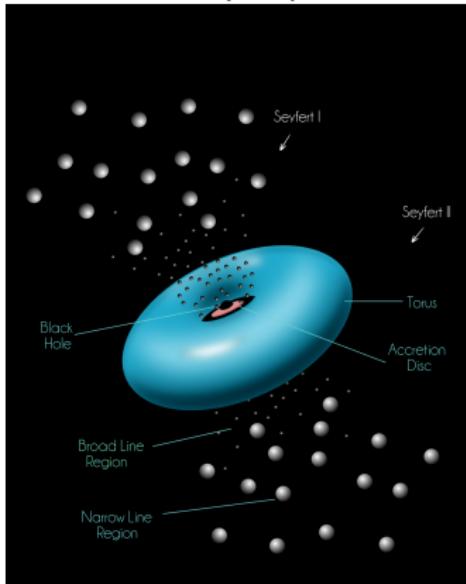


ERLANGEN CENTRE
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PHYSICS

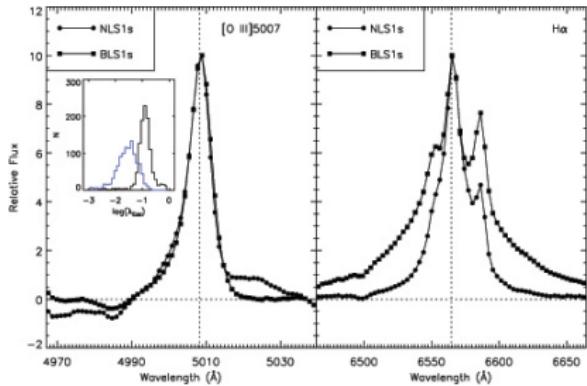
Narrow-Line Seyfert 1 Galaxies



Radio-quiet (RQ) AGN



Peculiar optical line spectrum:



Left: Forbidden [OIII] line from the NLR.

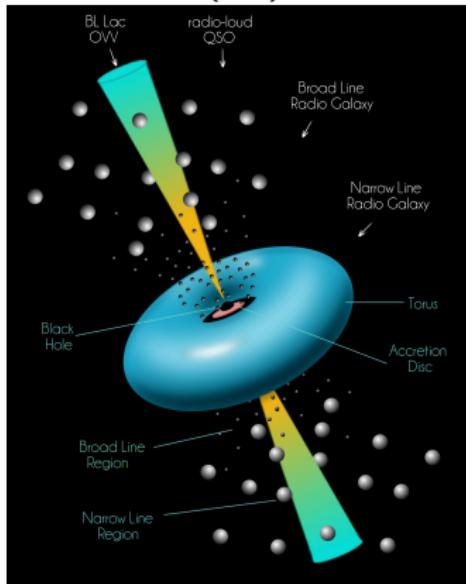
Right: Permitted Balmer H α line from the BLR.
Inset: Accretion rates of S1 and NLS1 galaxies.

Mullaney et al. (2013), MNRAS 433, 622-638

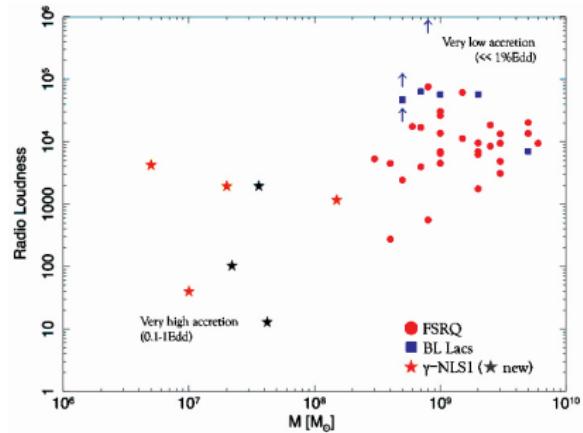
Narrow-Line Seyfert 1 Galaxies



Radio-loud (RL) AGN



7% of NLS1 are radio-loud:



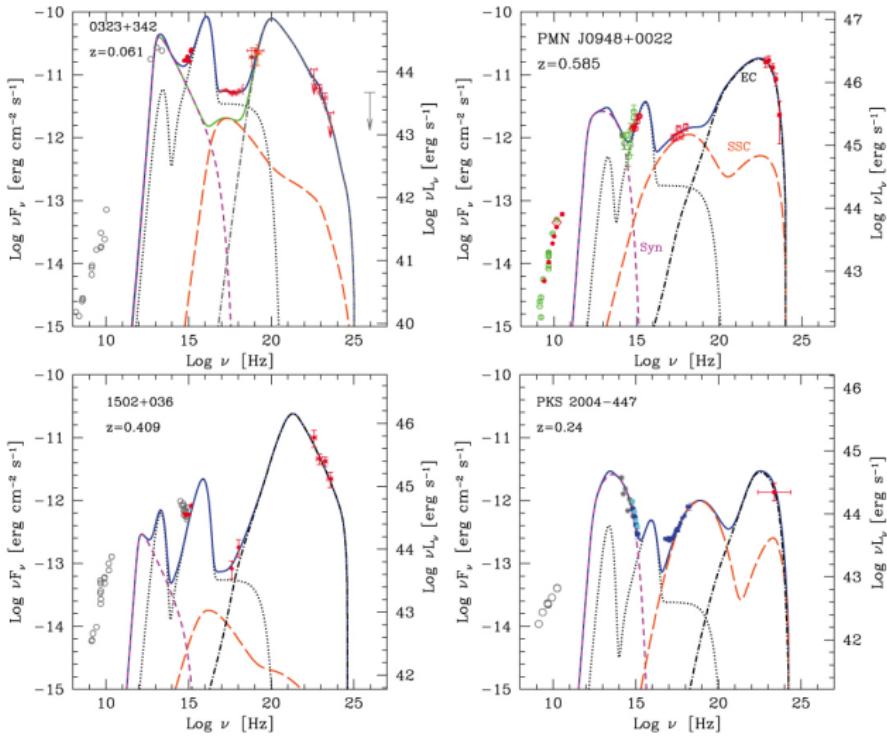
Radio loudness as a function of mass of the central super massive black hole.

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

Narrow-Line Seyfert 1 Galaxies



γ -ray detection of 5 radio-loud NLS1 by *Fermi*/LAT



Calderone, et al. (2011), MNRAS 413, 2365-2370



γ -NLS1

Seyfert 1 galaxies, but

- Reculiar optical line spectrum: narrow "broad lines"
- Exhibit strong radio emission: first indication for jets
- γ -ray emission in radio-loud NLS1: evidence for relativistic jets!

→ New class of RL-AGN?

Challenge to the RL-AGN Paradigm!

■ RL-AGN:

High M_{BH} ($10^8 \dots 10 M_{\odot}$)
Low accretion rates
Elliptical host galaxies

■ γ -NLS1:

Low M_{BH} ($10^6 \dots 8 M_{\odot}$)
High accretion rates
Spiral or merger host galaxies

The γ -NLS1 PKS 2004–447



PKS 2004-447:

- Radio-loudest γ -NLS1!
- Only γ -NLS1 on Southern Hemisphere!

Multiwavelength campaign:

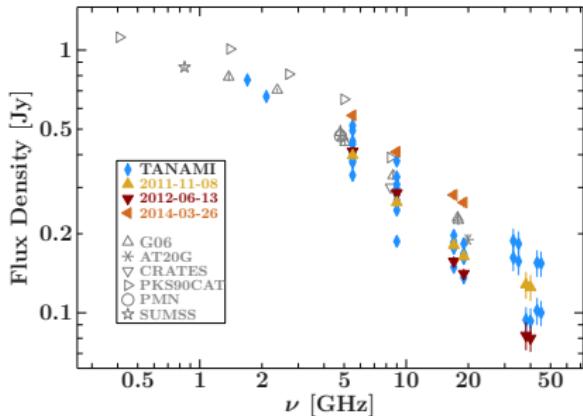
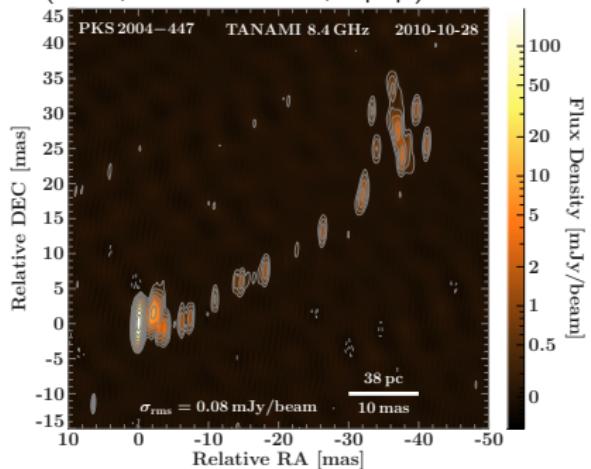
- Radio: TANAMI, ATCA
- X-rays & opt./UV: XMM-Newton, Swift
- γ -ray: Fermi LAT





TAMANI VLBI and multifrequency radio observations

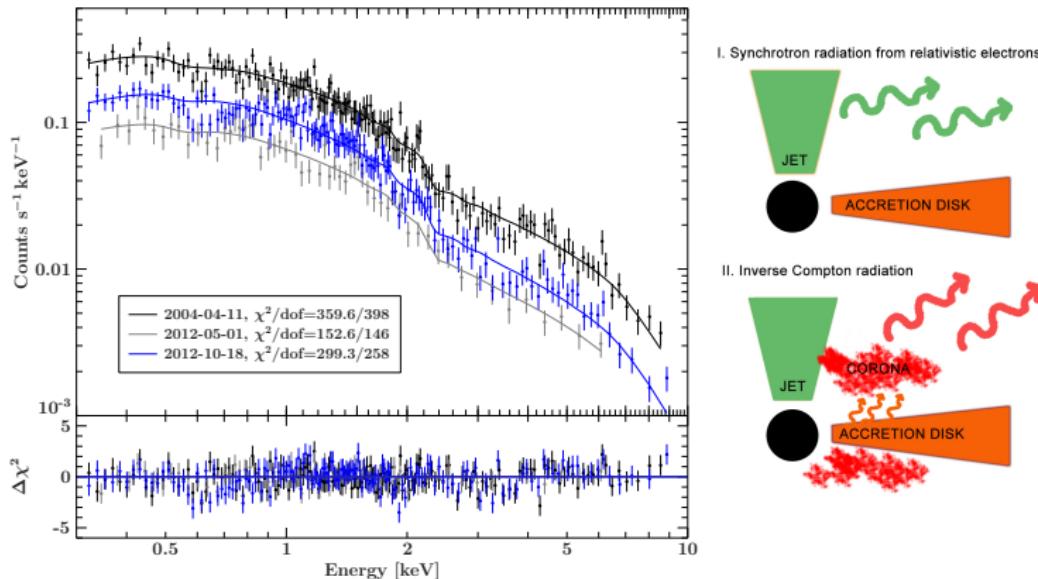
(Schulz, Kreikenbohm et al., in prep.)



- One-sided jet with dominant core (strong beaming)
- Compact Steep Spectrum (young radio galaxy candidate!)



High-quality XMM-Newton/EPIC in 2004 and 2012

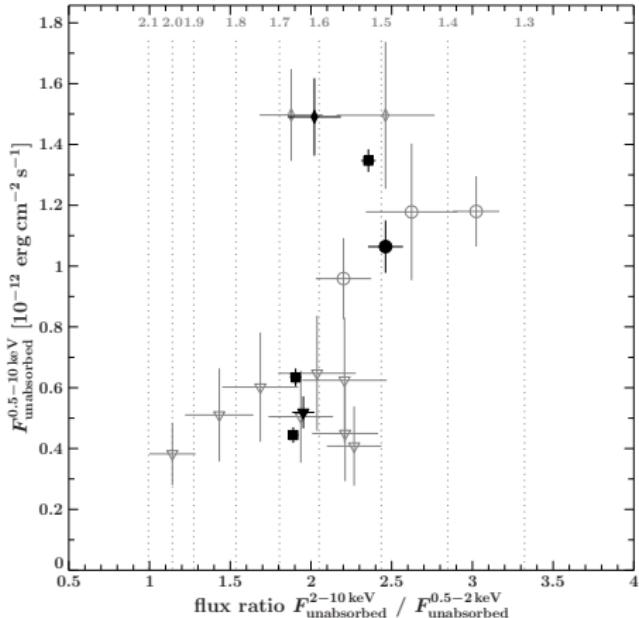


Blazar-like flat powerlaw spectrum ($\Gamma_X \sim 1.5...1.6$)

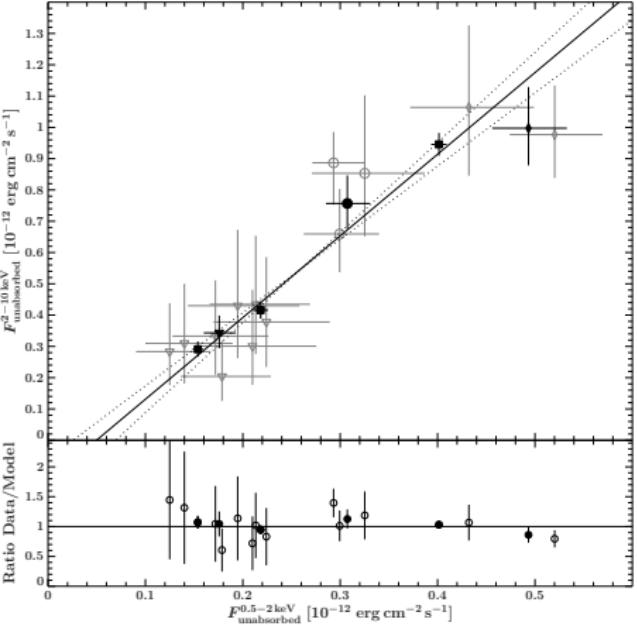


Swift monitoring from 2011 to 2014

Kreikenbohm, Schulz et al., subm. to A&A

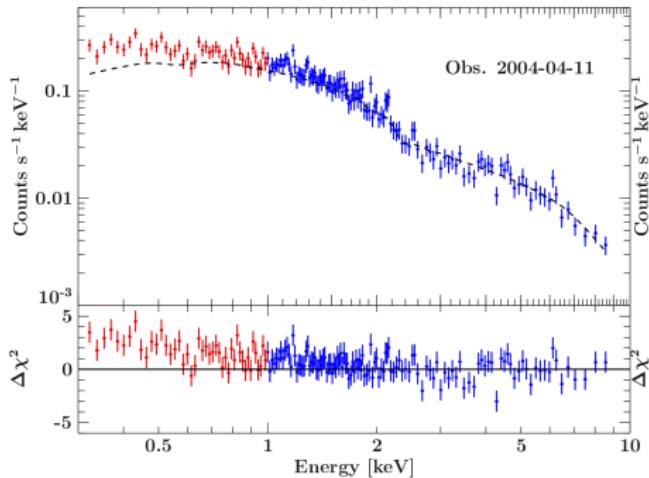


Total X-ray flux vs. hardness ratio.

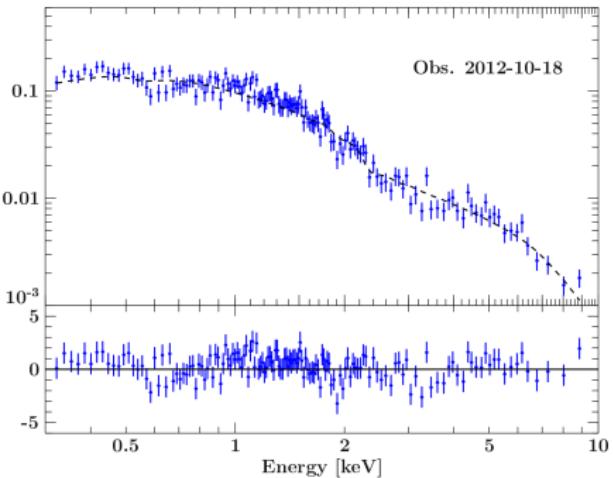


Correlated flux in soft and hard band.

PKS 2004–447 - The X-ray View



Obs. 2004-04-11



Obs. 2012-10-18

Tentative soft excess in 2004?**Not observed in 2012!**

→ Soft excess emission - real? origin?

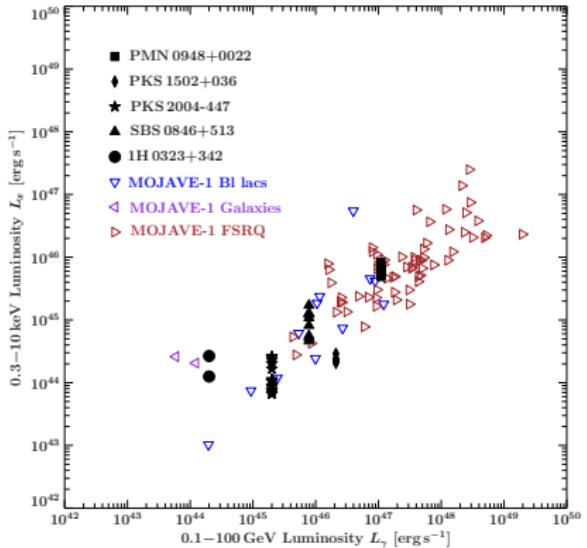
→ Joint *XMM-Newton/NuSTAR* proposal submitted!



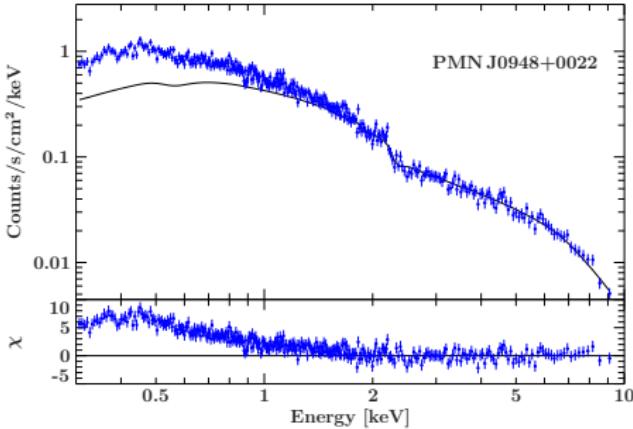
- **γ -NLS1 challenge our understanding of RL-AGN:**
 - Seyferts observed in radio & γ -rays
 - **Multiwavelength study of PKS 2004–447**
 - peculiar source among original γ -NLS1
 - compact steep spectrum source in radio
 - flat X-ray blazar-like spectrum (soft excess?)
- **PKS 2004-447 - An intriguing young blazar candidate?**

Outlook

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The connection between typical blazars and γ -NLS1s.



The nature of the soft excess in
 γ -NLS1s. (Proposal subm. for
XMM-Newton AO14)