Search for Gamma-ray Emission From X-ray Selected Radio-quiet Seyfert Galaxies with Fermi-LAT


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Gamma-ray: 20 MeV -> 300 GeV

Fermi-LAT (All sky survey)

extend up to a few 100 keV
unknown > 1 MeV
Sample Selection

1. use the 58-month *Swift*-BAT catalog
   “Galaxies” or “Seyfert” (as defined in the catalog)
   - $F_{14-195\,\text{keV}} > 2.5 \times 10^{-11} \, \text{[erg/cm}^2/\text{s]}$
2. high-galactic-latitude sources
   - $|b| > 10\,\text{deg}$ ($|b| > 20\,\text{deg}$ for $|l| < 20\,\text{deg}$)
3. `hard X-ray radio loudness parameter`
   (to remove ‘radio-loud’ AGN)

$$R_{\text{RX}} = \frac{[\nu F_{\nu}]_{1.4\,\text{GHz}}}{[\nu F_{\nu}]_{14-195\,\text{keV}}}$$

120 sources are selected !!
Results of LAT data analysis

No new radio-quiet $\gamma$-ray Seyferts is established!

UL distribution of the analyzed sample

The mean value ($>$100 MeV): 
$\sim 4 \times 10^{-9}$ ph cm$^{-2}$ s$^{-1}$

The EGRET results ($>$100 MeV):
(0.5-1.5)$ \times 10^{-7}$ ph cm$^{-2}$ s$^{-1}$ (Lin et al. 1993)
(0.3-1.5)$ \times 10^{-8}$ ph cm$^{-2}$ s$^{-1}$ [stacking]
(Cillis et al. 2004)

possible detections? : ESO 323-G077, NGC 6814 
but the number of chance coincidence is $\sim 2$ sources (2FGL)

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Multiwavelength Comparison-1

ratio of $\gamma$-ray and X-ray fluxes vs. X-ray (luminosities)

Mostly $L_\gamma / L_\chi < 0.1$, and even < 0.01 in some cases.
The derived LAT ULs are still higher than γ-ray luminosities which are expected from $L_{\text{FIR}} - L_\gamma$ or $L_{\text{radio}} - L_\gamma$ relations in starburst galaxies.
Summary

• We systematically search for γ-ray emission of 120 hard X-ray-selected Seyfert galaxies as `radio-quiet’ objects, with 2-year Fermi-LAT data.

• We could not established new γ-ray Seyferts, but the possible exceptions of ESO 323-G077 and NGC 6814

• We found that there is no GeV emission component in the spectra of Seyfert galaxies, which could be related nuclear outflows, jets, accretion disks or disk coronae, down to 1% level of the bolometric accretion-related luminosities.