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A Statistical Study of 3EG Source Characteristics

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Abstract. A detailed statistical study of 3EG source characteristics and their variation as a function of galactic latitude shows that a majority of Unidentified sources at mid galactic latitudes are so-far undetected AGN.

Keywords : EGRET source characteristics, galactic and extragalactic components, pulsars

1. Introduction

The 3EG catalogue of gamma ray sources(Thompson et al, 1993) lists ~170 unidentified objects(UIO) which have no counterparts at other wavelengths. Associations have been sought with galactic sources like pulsars, SNR, WR stars XRB systems and millisecond pulsars etc. and extragalactic sources like AGN, radio galaxies etc. (Mukherjee, 2002). Here we show on the basis of a statistical analysis that very few UIO in the galactic plane region are likely to be pulsars while a majority of sources in the galactic mid-latitude region are likely to be so-far undetected AGN.

2. Parameters Studied

The three source parameters studied are defined as below:

Weighted Flux:

$$< \mathrm{F} > = \left[\sum_{i=1}^{N_{vp}} \frac{F(i)}{\epsilon(i)^2}\right] * \left[\sum_{i=1}^{N_{vp}} \frac{1}{\epsilon(i)^2}\right]^{-1} \left[F(i) = \text{Flux in the ith period; } \epsilon(i) = \text{error in } F(i)\right]$$

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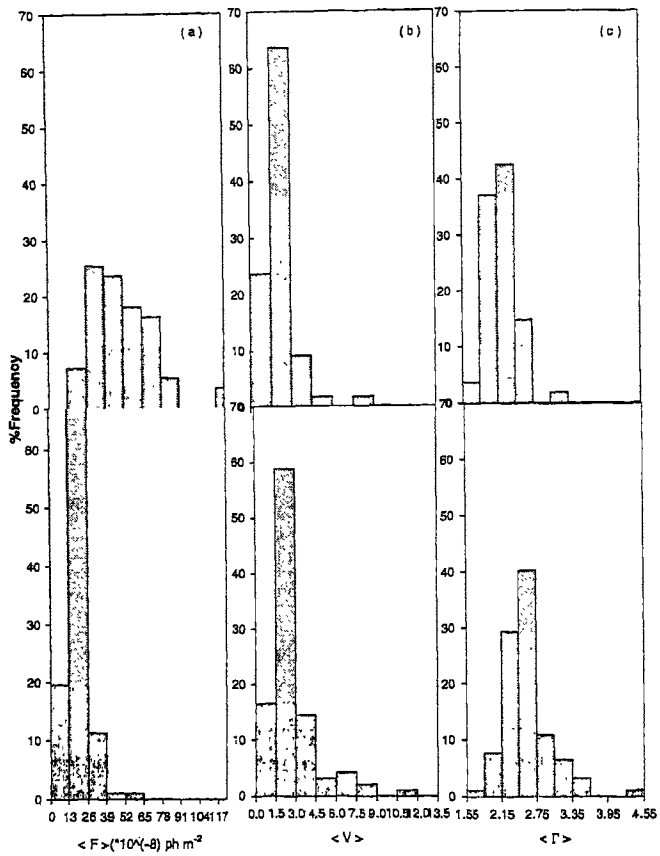

Fig. 1: Frequency distribution of (a)<F>,(b)<V> and (c)<Γ> for galactic plane(top) and mid-latitude (bottom) UIO.

Variability Index:

$$< V > = \frac{\mu_{\text{source}}}{< \mu >_{\text{pulsar}}} = \frac{\mu_{\text{source}}}{26.9}, [\mu_{\text{source}} = 100 * \sigma_{sd} * < F >^{-1}]$$

Spectral Index (Γ) : The source differential spectral index Γ (100MeV-1GeV).

3. Results and Conclusions

Fig.1(a,b,c) shows a comparison of the frequency distribution of $< F >$, $< V >$ and $< \Gamma >$ for UIO in the two galactic latitude bands, $|b| \leq 5^0$ (zone A) and $5^0 \leq |b| \leq 45^0$ (Zone B).The flux distribution

of mid latitude sources is narrower than that of galactic plane sources and is almost identical to that derived for confirmed AGN(not shown here). The distribution of $< V >$, fig.(1b) does not show a significant difference with latitude.Galactic plane UIO have the lowest average variability index of 2.3 as compared to an average value of 3.2 for confirmed AGN and 2.7 for mid-latitude sources.The above result may suggest an extragalactic origin for a majority of mid-latitude UIO. The distribution of Γ fig.(1c) shows that the avarage value of spectal index for sources in zone A (2.17 ± 0.33) is indistinguishable from the Γ for zone B (2.43 ± 0.31) sources. It is interesting to note that 60% of the sources in zone A have spectral index ≥ 2.15(cf. ≤ 2.0 for pulsars) suggesting a possible non-pulsar origin.

References

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Thompson et al., 1993, ApJS, **86**, 629.