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The observed radio/gamma-ray emission correlation for blazars with the Fermi-LAT and the RATAN-600 data

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Abstract

© 2015 The Authors. We study the correlation between gamma-ray and radio band radiation for 123 blazars, using the Fermi-LAT first source catalogue (1FGL) and the RATAN-600 data obtained at the same period of time (within a few months). We found an apparent positive correlation for BL Lac and flat-spectrum radio quasar (FSRQ) sources from our sample through testing the value of the Pearson product-moment correlation coefficient. The BL Lac objects show higher values of the correlation coefficient than FSRQs at all frequencies, except 21.7 GHz, and at all bands, except 10-100 GeV, typically at high confidence level (>99 per cent). At higher gamma-ray energies the correlation weakens and even becomes negative for BL Lacs and FSRQs. For BL Lac blazars, the correlation of the fluxes appeared to be more sensitive to the considered gamma-ray energy band, than to the frequency, while for FSRQ sources the correlation changed notably both with the considered radio frequency and gamma-ray energy band. We used a data randomization method to quantify the significance of the computed correlation coefficients.We find that the statistical significance of the correlations we obtained between the flux densities at all frequencies and the photon flux in all gamma-ray bands below 3 GeV is high for BL Lacs (chance probability $\sim 10^{-3}$-10^{-7}). The correlation coefficient is high and significant for the 0.1-0.3GeV band and low and insignificant for the 10-100 GeV band for both types of blazars for all considered frequencies.

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Keywords

BL Lacertae objects: general, Galaxies: active, Gamma-rays: general, Radiation mechanisms: non-thermal, Radio continuum: general