

The X/ γ -ray correlation in NGC 4945 and the nature of its γ -ray source

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We report hints for the correlation between the X-ray and γ -ray emission in the nearby galaxy NGC 4945, which harbors both an active galactic nucleus and a nuclear starburst region. We have divided the *Fermi*/LAT observations of NGC 4945 into two datasets, comprising events detected during the low (L) and high (H) level of X-ray emission from the active nucleus of this galaxy, determined using the *Swift*/BAT light curve. Both datasets contain an equal amount of 3.8 years of LAT data and NGC 4945 is detected with a similar statistical significance of $\sim 15\sigma$ in L and 14σ in H. However, the slope of the γ -ray spectrum hardens with the increase of the X-ray flux, with the photon index $\Gamma = 2.47 \pm 0.07$ in L and 2.11 ± 0.08 in H. The change is confirmed by a systematic variation of the spectral energy distribution as well as a substantial reversal of the γ -ray signal in significance maps for low and high γ -ray energies. The X/ γ -ray correlation indicates that the γ -ray production is dominated by the active nucleus rather than by cosmic rays interacting with the interstellar medium. We discuss possible locations of the γ -ray source. We also compare NGC 4945 with other starburst galaxies detected by LAT and we note similarities between those with active nuclei, e.g. unlikely high efficiencies of γ -ray production in starburst scenario, which argues for a significant contribution of their active nuclei to the γ -ray emission.

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