First Nustar Observations of the Bl Lac-Type Blazar PKS 2155-304: Constraints on the Jet Content and Distribution of Radiating Particles - DTU Orbit (08/12/2018)

First Nustar Observations of the Bl Lac-Type Blazar PKS 2155-304: Constraints on the Jet Content and Distribution of Radiating Particles

We report the first hard X-ray observations with NuSTAR of the BL Lac-type blazar PKS 2155-304, augmented with soft X-ray data from XMM-Newton and γ-ray data from the Fermi Large Area Telescope, obtained in 2013 April when the source was in a very low flux state. A joint NuSTAR and XMM spectrum, covering the energy range 0.5–60 keV, is best described by a model consisting of a log-parabola component with curvature $\beta = 0.3^{+0.2}_{-0.1}$ and a (local) photon index $3.04^{+0.15}_{-0.13}$ at photon energy of 2 keV, and a hard power-law tail with photon index $2.2^{+0.4}_{-0.3}$. The hard X-ray tail can be smoothly joined to the quasi-simultaneous γ-ray spectrum by a synchrotron self-Compton component produced by an electron distribution with index $p = 2.2$. Assuming that the power-law electron distribution extends down to $\gamma_{\text{min}} = 1$ and that there is one proton per electron, an unrealistically high total jet power of $L_p \sim 10^{47}$ erg s$^{-1}$ is inferred. This can be reduced by two orders of magnitude either by considering a significant presence of electron–positron pairs with lepton-to-proton ratio $n_{e^+ e^-}/n_p \sim 30$, or by introducing an additional, low-energy break in the electron energy distribution at the electron Lorentz factor $\gamma_{\text{br1}} \sim 100$. In either case, the jet composition is expected to be strongly matter-dominated.

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