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The ever-surprising blazar OJ 287: Multiwavelength study and appearance of a new component in X-rays

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Abstract

© 2018 The Author(s) Published by Oxford University Press on behalf of the Royal Astronomical Society. We present a multiwavelength spectral and temporal investigation of OJ 287 emission during its strong optical-to-X-ray activity between 2016 July and 2017 July. The daily γ -ray fluxes from Fermi-Large Area Telescope (LAT) are consistent with no variability. The strong opticalto- X-ray variability is accompanied by a change in power-law spectral index of the X-ray spectrum from < 2 to > 2, with variations often associated with changes in optical polarization properties. Cross-correlations between optical-to-X-ray emission during four continuous segments show simultaneous optical-ultraviolet (UV) variations, while the X-ray and UV/optical are simultaneous only during the middle two segments. In the first segment, the results suggest X-rays lag the optical/UV, while in the last segment X-rays lead by ~5-6 d. The last segment also shows a systematic trend with variations appearing first at higher energies followed by lower energy ones. The LAT spectrum before the very high-energy (VHE) activity is similar to preceding quiescent state spectrum, while it hardens during VHE activity period and is consistent with the extrapolated VHE spectrum during the latter. Overall, the broad-band spectral energy distributions (SEDs) during high-activity periods are a combination of a typical OJ 287 SED and a high-energy peaked (HBL) SED and can be explained in a two-zone leptonic model, with the second zone located at parsec scales, beyond the broad line region, being responsible for the HBL-like spectrum. The change of polarization properties from systematic to chaotic and back to systematic, before, during, and after the VHE activity, suggests dynamic roles for magnetic fields and turbulence.

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Keywords

BL Lacertae objects: individual: OJ 287, Galaxies: active, Galaxies: jets, Gamma-rays: galaxies - X-rays: galaxies, Radiation mechanisms: non-thermal

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