Monthly Notices of the Royal Astronomical Society 2020 N3, pages 3829-3848

Multiwavelength behaviour of the blazar 3C 279: Decade-long study from γ -ray to radio

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Abstract

© 2020 The Author(s). We report the results of decade-long (2008-2018) γ -ray to 1 GHz radio monitoring of the blazar 3C 279, including GASP/WEBT, Fermi and Swift data, as well as polarimetric and spectroscopic data. The X-ray and γ -ray light curves correlate well, with no delay ≳ 3 h, implying general cospatiality of the emission regions. The γ -ray-optical flux-flux relation changes with activity state, ranging from a linear to amore complex dependence. The behaviour of the Stokes parameters at optical and radio wavelengths, including 43 GHz Very Long Baseline Array images, supports either a predominantly helical magnetic field or motion of the radiating plasma along a spiral path. Apparent speeds of emission knots range from 10 to 37c, with the highest values requiring bulk Lorentz factors close to those needed to explain γ -ray variability on very short time-scales. The MgII emission line flux in the 'blue' and 'red' wings correlates with the optical synchrotron continuum flux density, possibly providing a variable source of seed photons for inverse Compton scattering. In the radio bands, we find progressive delays of the most prominent light-curve maxima with decreasing frequency, as expected from the frequency dependence of the τ= 1 surface of synchrotron self-absorption. The global maximum in the 86 GHz light curve becomes less prominent at lower frequencies, while a local maximum, appearing in 2014, strengthens toward decreasing frequencies, becoming pronounced at ~5 GHz. These tendencies suggest different Doppler boosting of stratified radio-emitting zones in the jet.

http://dx.doi.org/10.1093/mnras/staa082

Keywords

3C 279, Active, Galaxies, Individual, Methods, Observational, Photometric, Polarimetric, Quasars, Spectroscopic, Techniques

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