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What a decade of multi-wavelength observations can tell us about the nature of blazars? The case of 1ES 1215+303

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Blazars are known for their variability on a wide range of timescales at all wavelengths. Their classification into flat spectrum radio quasars, low-, intermediate- or high-frequency-peaked BL Lac (FSRQ, LBL, IBL, HBL, respectively) is based on broadband spectral characteristics that do not account for possible different activity states of the source. Recently, it was proposed that blazars could be classified according to the kinematics of their radio features. Most studies of TeV gamma-ray blazars focus on short timescales, especially during flares, due to the scarcity of observational campaigns or due to the relatively young existence of specialized, sensitive enough detectors.

Thanks to a decade of observations from the Fermi-LAT and VERITAS, we present an extensive study of the long-term multi-wavelength variability of the blazar 1ES 1215+303. This unprecedented data set reveals multiple strong gamma-ray flares and a long-term increase in the gamma-ray and optical flux baseline of the source over the ten-year period, which results in a linear correlation between these two energy bands over a decade.
Typical HBL behaviors were identified in the radio morphology of the source. However, analyses of the broadband SED at different flux states, unveils an extreme shift in energy of the synchrotron peak frequency from IR to soft X-rays. This evidences that the source exhibits IBL characteristics during quiescent states and HBL behavior during high states. A two-component synchrotron self-Compton model is used to describe this dramatic change.

The different methods applied and presented in this work provide a complete and detailed panorama of the intricate nature of blazars, and possibly even challenge our current classification scheme. Moreover, this work demonstrates the rewarding potential of blazars long-term studies that will be accessible, and potentially improved, thanks to future imaging atmospheric instruments, such as the Cherenkov Telescope Array (CTA).

Authors: VALVERDE, Janeth (LLR/Ecole Polytechnique); FENG, Qi (Columbia University); HORAN, Deirdre (Laboratoire Leprince-Ringuet, Ecole Polytechnique, CNRS/IN2P3, 91128 Palaiseau, France); BERNARD, Denis Robert Leon (Centre National de la Recherche Scientifique (FR)); FEGAN, Stehen (Laboratoire Leprince-Ringuet, Ecole Polytechnique, CNRS/IN2P3, 91128 Palaiseau, France)

Co-authors: LISTER, M. L. (Purdue University, 525 Northwestern Avenue, West Lafayette, IN 47907, USA); KOVALEV, Y. Y. (Astro Space Center of Lebedev Physical Institute, Profsoyuznaya 84/32, 117997 Moscow, Russia); PUSHKAREV, A. B. (Crimean Astrophysical Observatory, 98409 Nauchny, Crimea, Russia); SAVOLAINEN, T. (Aalto University Metsahovi Radio Observatory, Metsahovintie 114, FI-02540 Kylmala, Finland); PINER, B. G. (Department of Physics and Astronomy, Whittier College, 13406 E. Philadelphia Street, Whittier, CA 90608, USA); EDWARDS, P. G. (CSIRO Astronomy and Space Science, Australia Telescope National Facility, P.O. Box 76, Epping, NSW 1710, Australia); KIEHLMANN, S. (Owens Valley Radio Observatory, California Institute of Technology, Pasadena, CA 91125, USA); MAX-MOERBECK, W. (Departamento de Astronomia, Universidad de Chile, Camino El Observatorio 1515, Las Condes, Santiago, Chile); READHEAD, A. C. S. (Owens Valley Radio Observatory, California Institute of Technology, Pasadena, CA 91125, USA); TORNIKOSKI, M. (Aalto University Metsahovi Radio Observatory, Metsahovintie 114, FI-02540 Kylmala, Finland); LAHTEENMAKI, A. (Aalto University Metsahovi Radio Observatory, Metsahovintie 114, FI-02540 Kylmala, Finland); LINDFORS, Elina (University of Turku); TAKALO, L. (Tuorla Observatory, Department of Physics and Astronomy, University of Turku, Finland); NILSSON, K. (Finnish Centre for Astronomy with ESO (FINCA), University of Turku, Finland); FALLAH RAMAZANI, V. (Tuorla Observatory, Department of Physics and Astronomy, University of Turku, Finland); HOVATTA, T. (Finnish Centre for Astronomy with ESO (FINCA), University of Turku, Finland); JORMANAINEN, J. (Tuorla Observatory, Department of Physics and Astronomy, University of Turku, Finland)

Presenter: VALVERDE, Janeth (LLR/Ecole Polytechnique)

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