

AstroSat View of Blazar OJ 287: A complete evolutionary cycle of HBL Component from end-phase to disappearance and Re-emergence

Pankaj Kushwaha,^{a,†,*} K. P. Singh,^b A. Sinha,^{c,d} Main Pal,^e G. Dewangan^d and A. Agarwal^f

^aAryabhatta Research Institute of Observational Sciences (ARIES), Nainital 263001, India

^bIndian Institute of Science Education and Research Mohali, Knowledge City, Sector 81, SAS Nagar, Punjab 140306, India

^cLaboratoire Univers et Particules de Montpellier, Université de Montpellier, CNRS/IN2P3, CC 72, Place Eugène Bataillon, F-34095 Montpellier Cedex 5, France

^dInter-University Centre for Astronomy and Astrophysics, Ganeshkhind, Pune 411 007, India

^eCentre for Theoretical Physics, Jamia Millia Islamia, New Delhi-110025, India

^fRaman Research Institute, C. V. Raman Avenue, Sadashivanagar, Bengaluru 560080, India
E-mail: pankaj.kushwaha@aries.res.in

We report three AstroSat observations of BL Lacertae object OJ 287. The three observations caught it in very different flux states that are connected to different broadband spectral states. These observations trace the source spectral evolution from the end-phase of activity driven by a new, additional HBL like emission component in 2017 to its complete disappearance in 2018 and re-emergence in 2020. The 2017 observation shows a comparatively flatter optical-UV and X-ray spectrum. Supplementing it with the simultaneous NuSTAR monitoring indicates a hardening at the high-energy-end. The 2018 observation shows a harder X-ray spectrum and a sharp decline or cutoff in the optical-UV spectrum, revealed thanks to the Far-UV data from AstroSat. The brightest of all, the 2020 observation shows a hardened optical-UV spectrum and an extremely soft X-ray spectrum, constraining the low-energy peak of spectral energy distribution at UV energies – a characteristic of HBL blazars. The contemporaneous MeV-GeV spectra from LAT show the well-known OJ 287 spectrum during 2018 but a flatter spectrum during 2017 and a hardening above 1 GeV during 2020. Modeling broadband SEDs show that 2018 emission can be reproduced with a one-zone leptonic model while 2017 and 2020 observations need a two-zone model, with the additional zone emitting an HBL radiation.

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*Presenter

†Aryabhatta Postdoctoral Fellow