

Multi-wavelength emission of blazars: connecting theories with observations

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Blazars are the most numerous extragalactic gamma-ray sources seen by Fermi. While their multi-wavelength emission is often considered as leptonic, recent detection of a very high energy neutrino event by IceCube in coincidence with a Fermi gamma-ray flare of the blazar TXS 0506+056 suggested a potential hadronic origin. This talk reviews the recent progress in multi-wavelength studies of blazars, focusing on connecting theories with observations. In the past decade, numerical simulations of the blazar jet, including magnetohydrodynamics, Fokker-Planck treatment of particle evolution, particle-in-cell simulations, have revealed the dynamical evolution of the jet plasma and particles based on solid physics. Comprehensive radiation transfer simulations have enabled the direct comparison of these numerical results with multi-wavelength blazar observations, yielding important new insights into the jet physics. This approach will continue to serve as a powerful tool in the multi-messenger era of blazar studies.

Track

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