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Systematic physical characterization of the gamma-ray spectra of 2FHL blazars

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We test different physically motivated models for the spectral shape of the gamma-ray emission in a sample of 128 blazars with known redshifts detected by Fermi-LAT at energies above 50 GeV. The first nine years of LAT data in the energy range from 300 MeV to 2 TeV are analyzed in order to extend the spectral energy coverage of the 2FHL blazars in our sample. We compare these spectral data to four leptonic models for the production of gamma-rays through Compton scattering by a population of electrons with different spectral shapes. In the first three models we consider Compton scattering in the Thomson regime with different acceleration mechanisms for the electrons. In the fourth model we consider Compton scattering by a pure power law distribution of electrons with spectral curvature due to scattering in the Klein-Nishina regime. The majority of blazar gamma-ray spectra are preferentially fit with either a power law with exponential cut-off in the Thomson regime or a power law electron distribution with Compton scattering in the Klein-Nishina regime, while a log-parabola with a low-energy power-law and broken power-law spectral shape in the Thomson regime appear systematically disfavoured, which is likely a consequence of the restriction to pure Thomson scattering which we imposed on those models. This finding may be an indication that the gamma-ray emission from FSRQs in the 2FHL catalog is dominated by Compton scattering of radiation from the dusty torus, while in the case of bL Lac objects, it is dominated by synchrotron self-Compton radiation.

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