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Ultrahigh-energy cosmic-ray interactions as the origin of very high-energy gamma-rays from BL Lacertae objects

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We explain the observed multiwavelength photon spectrum of some high energy BL Lac objects, using a lepto-hadronic model. The one-zone leptonic emission is employed to fit the synchrotron peak. Subsequently, the SSC spectrum is calculated, such that it extends up to the highest energy possible for the jet parameters considered. The data points beyond this and also in the entire VHE range (E>30 GeV) are well explained using a hadronic origin. The UHECRs escaping from the source interacts with the EBL background during propagation over cosmological distances to initiate electromagnetic cascade down to GeV energies. The resulting photon spectrum peaks at ˜ TeV energies. We consider a random turbulent EGMF with a Kolmogorov power spectrum to find the survival rate of UHECRs within 0.1 degrees of the direction of propagation in which the observer is situated. We restrict ourselves to an RMS value of EGMF ˜ 10ˆ-5 nG for a significant contribution to the photon SED from UHECR interactions. The kinetic power in UHECRs required in this scenario is estimated and compared with the Eddington luminosity of the sources. We discuss the possibility of UHECR detection from these sources and find the neutrino fluxes produced from each source. The uncertainties posed due to the choice of EBL models are also presented.

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