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Constraints on the extragalactic magnetic field strength based on 145 months of Fermi-LAT observations and observable blazar spectrum modelling (online)

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The parameter values of the extragalactic magnetic field (EGMF) presumably filling the intergalactic medium remain largely unknown. One of the possible methods to better constrain the EGMF parameter values is to observe blazars with hard spectra and compare the characteristics of the observed gamma-ray emission with model results, since observed gamma rays may be secondary in nature, with their characteristics depending on the EGMF parameters. In our work, we use 145 months of Fermi-LAT observations of the blazars 1ES 1218+304, 1ES 1101-232, and 1ES 0347-121, and imaging atmospheric Cherenkov telescope observations of the same sources. The observed spectral energy distributions (SEDs) are compared to those modelled with the full 3-dimensional intergalactic particle propagation Monte-Carlo simulation ELMAG 3.01 program for various values of the EGMF strength B between 10^{-19} G and 10^{-12} G dispensing of any a priori assumptions about a possible contribution of cascade gamma rays to the observed blazar gamma-ray emission and under various assumptions about the shape of the intrinsic source gamma-ray spectra and assuming the blazars are steady sources. We exclude $B \leq 10^{-17}$ G at 4σ level (for the assumed correlation length of 1 Mpc) for all four options of the intrinsic spectral shape considered, and demonstrate that under some values of B the cascade contribution to the observed SED may be dominant and still fit to the data reasonably well. The talk is based on the paper <https://doi.org/10.1093/mnras/stac2509>.

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