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The contribution from blazar cascade emission to the extragalactic gamma-ray background: What a role does the extragalactic magnetic field play?

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We estimate the contribution to the extragalactic gamma-ray background (EGRB) from both intrinsic and cascade emissions produced by blazars using a simple semi-analysis method for two models of the blazar gamma-ray luminosity function (GLF). For the cascade emission, we consider two possible contributions: one is due to that the flux of the cascade emission is lower than the Fermi LAT sensitivity (case I), which is independent on the extragalactic magnetic field (EGMF), another is due to the fact that the flux of the cascade emission is larger than the Fermi LAT sensitivity but the emission angle is larger than LAT point-spread-function (PSF) angle (case II), which depends on the EGMF. Our results indicate that (1) blazar contribution to the EGRB is dominant although it depends on the GLF model and the EGMF; (2) the EGMF plays an important role in estimating the contribution from the cascade emission produced by blazars, the contribution from the cascade emission will significantly alter the EGRB spectrum when the strength of the EGMF is large enough (say BEGMF > 10-12 G); and (3) since the cascade emission in case II reaches a saturation when the strength of the EGMF is $\sim 10^{11}$ G, it is very possible that the contribution from the cascade emission produced by blazars can be considered as another method to probe the upper limit of the strength of the EGMF.

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