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Cosmic magnetic field uncertainties and the constraints in top-down ultra-high energy cosmic ray models

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The propagation of ultra-relativistic particles, photons in particular, through the intergalactic medium leads unavoidably to the production of secondary photons which trigger extensive electromagnetic cascades through the interplay of pair production and inverse Compton in interactions with the photon background. These processes rapidly shift down in energy the secondary photons until the threshold for pair production is attained in the vicinity of the TeV region. Therefore, top-down models, under very general conditions, should produce a sizable signature in TeV photons, which imposes a severe observational constraint. An important mechanism leaking energy out of the electromagnetic cascades into the radio region of the photon spectrum and, therefore, softening TeV constraints, is the synchrotron emission of electrons and positrons in the intervening magnetic fields. In the present work we analyze the stability of the TeV constraints generally imposed on top-down models with respect to the present uncertainties in the topology and intensity of the magnetic fields in the Local Group, Galactic Halo and Galactic disk.