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Probing the Intergalactic Magnetic Fields by means of high-energy pair halos around extreme blazars

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The origin of cosmic magnetic fields permeating galaxies and clusters is still unknown.To undertstand the origin and the evolution of the primordial cosmic magnetic fields we need to probe the existence and to characterize magnitude and correlation length of magnetic field in voids (Intergalactic magnetic field, IGMF), where pollution from magnetic fields associated to structures is expected to be minimal. Techniques like Faraday Rotation and Zeeman splitting permit to compute upper limits on IGMF of the order of 10ˆ-9 G. Nevertheless our knowledge on IGMF is still poor.
Very High Energy (VHE) photons (E>50 GeV) coming from extreme Blazars interact with Optical/Infrared Extragalactic Background Light (EBL). Because of these interactions electron-positron pairs are produced. These, in turn, upscatter via inverse Compton the CMB photons producing a reprocessed emission. If the primary photons have energies higher than 10 TeV this component will be in the GeV domain. IGMF deflects the pairs so this component will be in the form of extended emission whose angular extension depends on the strength of IGMF. The detection of this component is an unique tool to measure the IGMF.
The measurement of halo emission by Cherenkov telescopes like MAGIC depends strictly on its capability to disentangle the extended from the point-like emission of the source. For the first time the detailed characterization of the PSF of MAGIC has allowed to assess the possibility to reveal the extended emission due to IGMF. We first found a good analytical model for the MAGIC PSF and then, comparing the emission profiles of several AGN with the PSF reference, we obtained that all souces are point like. Using two different halo emission models we computed for all sources upper limits on extended emission. For the source Markarian 421 our procedure provided an upper limit which is more than three times better than a previous published measurement. In addition we found that the sources 1ES 0229+200 and RX J1136.5+6737 though well described by a point-source profile, do not exclude the presence of extended emission. In this case the implied strenghts of IGMF are of the order of 10ˆ-14 G.

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