Contribution ID: **142** Type: **Poster**

Constraining the intergalactic magnetic field with Fermi-LAT observations of seven ultra-high-frequency peaked BL Lac sources.

Tuesday, 13 April 2021 08:03 (6 minutes)

Galaxies and galaxy clusters are separated by large distances of nearly empty
space called the intergalactic space. In these large, nearly empty regions a weak magnetic field of strength < 10 nG is present that is predicted to be of primordial (early universe) origin. This is called the intergalactic magnetic field (IGMF) and knowledge about its strength, coherence length, origin etc. is limited. Understanding the origin of the IGMF is crucial because of the impact it may have had on early star and galaxy formations. Gamma-ray observations of very high energy emitting blazars provide one method to indirectly probe the IGMF. The gamma ray photons emitted from the blazars will undergo gamma-gamma absorption due to their interaction with the extragalactic background light (EBL), producing electrons-positrons pairs. These electron-positron pairs can then upscatter photons from the cosmic microwave background (CMB) to produce a secondary cascade component at lower energies ($\approx 0.1 - 10$ GeV). However the IGMF can scatter the electron-positron pairs away and thus attenuating the emission that will be superimposed on the blazars intrinsic spectrum. This attenuation is highly dependent on the IGMF strength and the coherence length. Seven hard and non-variable sources were selected to be re-analysed, using the Fermi Science Tools package (version 1.0.5 released on 05/21/2019) with the improved Pass 8 analysis pipeline. Using previous IACT observations results, the secondary cascade component was modelled using the Monte Carlo code of Kachelrieß et al. and the primary and total spectrum components were compared to the Fermi-LAT spectrum, allowing constraints to be placed on the strength of the IGMF.

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Session Classification: AGN-1

Track Classification: AGN