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Probing the Intergalactic Magnetic Field with Gamma-Ray Observations

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Our Universe is permeated by magnetic fields across a vast range of scales. The key to the origin of cosmic magnetism may lie in the emptiest regions of the Large Scale Structure, called the cosmic voids, where primordial fields from the early Universe are expected to have remained intact. The strength of this weak Intergalactic Magnetic Field (IGMF) can be constrained from below by observations of specific active galactic nuclei called blazars. The latter have jets pointing at the observer that produce high-energy gamma-rays which deposit electron-positron pairs in the intergalactic medium. These pairs are deflected by the IGMF, leading to a suppression of the secondary photon flux produced by inverse Compton scattering. The absence of this flux in current observations allows us to put a lower limit on the strength of the IGMF.

In this talk, I will introduce the motivations and methods behind the IGMF studies. I will present a revision of conservative lower bounds on the IGMF using joint observations from the Fermi Large Area Telescope (LAT) and ground-based Cherenkov telescopes, resulting in a lower limit of $B \sim 2 \times 10^{-17}$ G. I will then discuss on the importance of the instrumental modelling, specifically the modelling of Fermi-LAT Point Spread Function (PSF) with pulsars and its impact on the study of extended emission around sources. Finally, I will outline further investigations and improvements for IGMF studies including the role of next-generation gamma-ray telescopes and cosmological simulations.

Speaker information

PhD 2nd year

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