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InterGalactic Magnetic Fields and Gamma-Ray Bursts with CTAO

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The InterGalactic Magnetic Field (IGMF) is believed to be a remnant of the Big Bang and the origin of cosmological magnetic fields. However, it has yet to be detected. In this context, the Cherenkov Telescope Array Observatory (CTAO) will have the potential to place competitive constraints on the IGMF by analyzing data from Active Galactic Nuclei (AGN) and Gamma-Ray Bursts (GRBs). In this study, we propose to simulate CTAO observations of the few GRBs detected in the TeV range, using its available instrument response functions, as well as realistic observation conditions. The expected IGMF signatures are modeled with a dedicated simulation code, and the analysis of the synthetic data is performed using a joint spectral and temporal fit. By assuming a power-law behavior in energy with an unknown cut-off, we will extrapolate the detected GRBs into the tens of TeV energy range. We will show that CTAO can constrain the IGMF in the range $[10^{-19}$ G, 10^{-15} G] for various coherence lengths and place limits on fields stronger than 10^{-15} G.

Speaker information

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Author: KEITA, Ténéman (CEA Paris-Saclay)

Orateur: KEITA, Ténéman (CEA Paris-Saclay)

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