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TeV Bayesian Study of the Extragalactic Background Light

The extragalactic background light (EBL) is the aggregate of all optical and infrared emissions from thermal processes since the cosmic dark ages. While the integrated light of galaxies is expected to be the main contribution to the EBL, recent measurements beyond Pluto's orbit from the New Horizon probe show a 4σ excess in the optical band. This tension can be studied within observational gamma-ray cosmology, by reconstructing EBL-induced absorption in the gamma-ray spectra of extragalactic sources at very-high energies (VHE, $E > 100$ GeV). Gamma-ray studies of the EBL remain limited by the size of the spectral corpuses and by the uncertainties on the shape of the spectra emitted at the sources. We developed a new analysis method that aims at tackling these limitations. Unlike existing studies, we employ a fully Bayesian framework, which allows us to remove arbitrary criteria for selecting intrinsic spectral models. Such an approach further enables marginalization over systematics of instrumental origin, such as the uncertainty on the energy scale of current-generation VHE observatories. In this contribution, we apply our method to the most extensive catalog of extragalactic VHE spectra to date, STeVECat. We present our latest constraints on the energy density of the EBL at redshift $z = 0$, obtained with nearly 270 archival VHE spectra from over 50 extragalactic sources with known redshift.

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