S21a   Revisiting EBL Constraints from Gamma-Ray Observations: A Critical Assessment and Methodological Improvements

R. Grau (ICRR, The University of Tokyo), A. Moralejo (IFAE), MAGIC collaboration

The extragalactic background light (EBL) is the second most intense photon field in the universe. It spans from the infrared to the ultraviolet bands, and it is primarily generated by starlight in galaxies, either directly or through dust absorption and re-emission at longer wavelengths. Measuring the EBL total intensity is challenging due to its faintness compared to foreground diffuse light such as zodiacal light. EBL photons can absorb very high energy (VHE, > 100 GeV) photons via gamma-gamma interactions during their propagation across cosmological distances. This provides an indirect method for probing the EBL by studying its effects on the energy spectra of distant VHE sources. This contribution examines the robustness of EBL constraints obtained with gamma-ray data and critically assesses the assumptions made in previous studies about the intrinsic source spectra, the uncertainties of the observations, and the validity of the analysis tools. Our results show that previous studies have likely underestimated the uncertainties in the EBL intensity constraints, showing the importance of a comprehensive evaluation of systematic uncertainties. Using a Monte Carlo simulation and a plausible model for unknown systematic errors, we compute more realistic uncertainties. We additionally propose two alternative methods that require fewer assumptions about the intrinsic spectra of gamma-ray sources, to obtain EBL constraints, leading to looser, albeit more robust constraints.