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Insights into Extragalactic Background Light constraints with MAGIC archival data

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The Extragalactic Background Light (EBL) is the accumulated light emitted throughout the history of the universe, spanning the UV, optical, and IR spectral ranges.
Stars and dust in galaxies are expected to be the main source of the EBL. However, recent direct measurements performed beyond Pluto's orbit (less affected by foregrounds than those performed from the Earth) hint at an EBL level in the optical band larger than the one expected from the integrated contribution of known galaxy populations.
One approach that could solve this controversy uses Very High Energy (VHE) photons coming from sources at cosmological distances. These photons can interact with the EBL producing electron-positron pairs, a process that leaves an imprint on the observed VHE spectrum. This technique, however, requires assumptions on the intrinsic spectrum of the source, which can compromise the robustness of EBL constraints.
In this contribution, we used Monte Carlo simulations and archival data of the MAGIC telescopes to study the impact that the assumptions adopted in the literature have on the estimate of the EBL density, and how using more generic ones would modify the results.
Our results show how the EBL density constraints obtained highly depend on the intrinsic spectral shape assumed for the source. We have studied two different methods to reduce the assumptions on the intrinsic spectral shape to get more robust results. This will be especially important for upcoming observations with new facilities, where systematic uncertainties are expected to play a more significant role compared to statistical ones.

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