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Characterisation of the Atmosphere in VHE gamma-astronomy with MAGIC elastic LIDAR and CTAO FRAM

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Ground-based observations of Very-High-Energy (VHE) gamma rays from extreme astrophysical sources are significantly influenced by atmospheric conditions. This is due to the atmosphere being an integral part of the detector when observing with Imaging Air Cherenkov telescopes. Clouds and dust particles diminish atmospheric transmission, thereby impacting Cherenkov showers and the reconstructed spectra within the VHE gamma-ray range.
Precise measurements of atmospheric transmission above Cherenkov observatories play a pivotal role in the analysis of the observed data, the corrections of the reconstructed energies of incoming gamma rays, and in establishing observation strategies for various gamma-ray emitting sources. The Major Atmospheric Gamma Imaging Cherenkov telescopes (MAGIC) and the Cherenkov Telescope Array Observatory (CTAO), both located at La Palma, Canary Islands, use different sets of auxiliary instruments for real-time characterisation of the atmosphere.
The study involves the analysis of contemporaneous sets of data spanning from 2018 to 2020. These data have been obtained from the elastic Light Detection and Ranging (LIDAR) system used in MAGIC and the F/Photometric Robotic Atmospheric Monitor (FRAM) telescope used as part of the future atmospheric characterisation equipment of CTAO. Correlations between the Vertical Optical Aerosol Depth (VAOD) as measured by both instruments are calculated. The effects of various factors influencing their correlations are discussed and an observational strategy considering real-time VAOD measurements is proposed.

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