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Atmospheric Aerosols Light Attenuation using the Telescope Array Central Laser Facility

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The Telescope Array (TA) experiment measures the properties of ultra-high energy cosmic ray (UHECR) induced extensive air showers. TA employs a hybrid detector comprised of a large surface array of scintillator detectors overlooked by three fluorescence telescopes stations. TA has been collecting data since ~2008. The TA Low Energy extension (TALE) detector, comprised of 10 fluorescence telescopes has operated as a monocular Cherenkov/fluorescence detector for since ~2013, and for the past few years has been operating as a hybrid detector, along with a closely-spaced surface array, optimized for CR energies around 1017 eV. Currently, The TAx4 upgrade is underway and aims to, as the name suggests, quadruple the size of the surface array to improve statistics at the highest energies. TAx4 employs three additional fluorescence-detector stations with telescopes pointing at low elevation angles and overlooking the expanded surface detector deployment sites.

The analysis of the air fluorescence detectors (FD) data requires knowledge of the degree of the atmospheric attenuation of UV light produced by shower particles. This attenuation depends on the Rayleigh scattering by air molecules and also on the amount of aerosols present in the atmosphere at the time of shower observation. Being highly variable, real-time measurement of the aerosols light attenuation is accomplished through the use of a central laser facility (CLF) located at the center of the surface array, and in the field of view of the three main TA FDs, as well as, the TALE FD.

In this talk we will provide an overview of the analysis and use of the CLF data for the calibration of the energy of observed cosmic ray showers. I will briefly describe some of the other atmospheric monitoring systems and studies used for various analyses of TA, TALE, and TAx4.

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