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Effects of light exposure and temperature on the quantum efficiency of PMTs for the KM3NeT Neutrino Telescope

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The cubic-kilometre neutrino telescope (KM3NeT), currently under construction on the Mediterranean seabed, is a deep-sea infrastructure composed of two neutrino telescopes, consisting of large-scale 3D-arrays of photomultiplier tubes (PMTs).

PMTs play a fundamental role in detecting Cherenkov radiation emitted by charged particles. Their reliable performance is critical, due to their exceptional sensitivity to low-intensity light, which is crucial for detecting high-energy particles such as astrophysical neutrinos. PMTs, being highly sensitive photosensors, can suffer significant damage to the photocathode coating when exposed to intense light. This scenario, uncommon in controlled environments, could become relevant during certain phases of the experiment.

We therefore intend to present a work on the analysis of the damage threshold and recovery time of bialkali metal-coated photomultipliers. The investigation involved the measurement of Quantum Efficiency (QE) before and after exposing the PMTs to the illumination of a Xenon lamp for different durations with the intention of simulating sun exposure for several days. In addition, QE was also measured before and after subjecting PMTs to thermal stress to comprehensively evaluate their performance under different conditions.

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