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A next-generation gamma-ray observatory powered by Machine Learning techniques

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The Southern Wide-field Gamma-ray Observatory (SWGO) is the next generation ground-based gamma-ray observatory to survey the Southern hemisphere sky. The experiment, currently in an R&D phase, is expected to have a large array of the order of a few km2 composed of water Cherenkov detectors (WCDs) placed at a high altitude (4.4 km a.s.l. or higher) in South America.

Such an ambitious project requires the design of a high-performance and cost effective WCD able to cope with the observatory needs, particularly the capability to identify shower muons, essential to ensure an excellent gamma/hadron discrimination. Several detector concepts are currently being considered in the SWGO Collaboration. At LIP, we are exploring an innovative WCD concept with reduced surface area and height comprising three PMTs whose signals are analysed by Machine learning techniques. In this talk, a general overview of the SWGO Observatory will be given. Later, I will show that with this method it is possible to achieve an excellent gamma/hadron discrimination and muon counting. Therefore, the proposed WCDs would highly boost the physics capabilities of SWGO, enabling it to cover, with a wide field of view, a wide energy range, from low energies (~ 100 GeV) up to the PeV region.

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