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Exploring cosmic gamma rays with the novel Cherenkov plenoscope

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Atmospheric Cherenkov telescopes observe cosmic gamma rays with energies upwards of twenty giga electronvolt in collecting areas which exceed the collecting areas of satellites by orders of magnitude. However, as we further push the concept of the Cherenkov telescope array, the intrinsic limitations of imaging itself become more evident. Aberrations limit our field of view and the angular resolution in the gamma ray sky. Further, the narrowing depth of field in larger telescopes prevents us from lowering the energy threshold for cosmic gamma rays. While aberrations can to some extent be mitigated by more complex optical surfaces, the narrowing depth of field is a physical limitation which can not be overcome by spending more resources. We investigate a novel class of instrument for the atmospheric Cherenkov method which is practically free of aberrations and which turns the narrowing depth of field into the perception of the airshower's depth. We call it the Cherenkov plenoscope. Beside widening the field of view and sharpening our view into the gamma ray sky, the Cherenkov plenoscope might further enable the next generation to build a timing explorer which can collect cosmic gamma rays with energies down to one giga electronvolt in effective areas several orders of magnitude larger than the collecting areas of satellites. We will introduce the concept behind the Cherenkov plenoscope and give an outlook on a specific design for a one giga electronvolt timing explorer.

Primary author: Dr MUELLER, Sebastian Achim (Max Planck Institute for Nuclear Physics)

Presenter: Dr MUELLER, Sebastian Achim (Max Planck Institute for Nuclear Physics)

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