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Advancing the atmospheric Cherenkov-method to detect gamma-rays with one Giga electron Volt

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Imaging atmospheric Cherenkov-telescopes are powerful detectors for cosmic gamma-rays. Yet the detection of gamma-rays with lower energies in the domain of Giga electron Volts (so far reserved to satellites) at the high rates provided by the large collective area of the atmospheric Cherenkov-method, can be a potential advance. This will improve our understanding of short lived transients and of distant sources which have their gamma-rays with higher energies absorbed by infrared light. With telescopes, the detection of gamma-rays with lower energies implies larger mirrors, which narrow the depth-of-field, and blur the image. Larger mirrors imply an exponential increase in costs to prevent deformations of the optics. In addition, the mirror's aberrations further blur the image and limit the field-of-view. To advance, we propose a new class of instrument (the Cherenkov-plenoscope) which senses not only the direction of Cherenkov-photons but also their point of reflection on the mirror. The Cherenkov-plenoscope turns a narrow depth-of-field into the perception of depth, compensates deformations, and compensates the mirror's aberrations. We will discuss the possibility of a Cherenkov-plenoscope dedicated to the detection of gamma-rays with energies as low as one Giga electron Volt, and our current estimate of its capabilities.

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