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A next-generation ground array for the detection of ultrahigh-energy cosmic rays: the Fluorescence detector Array of Single-pixel Telescopes (FAST)

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The origin and nature of ultrahigh-energy cosmic rays (UHECRs) is one of the most intriguing mys- teries in astroparticle physics. The two largest observatories currently in operation, the Telescope Array Experiment in central Utah, USA, and the Pierre Auger Observatory in western Argentina, have been steadily observing UHECRs in both hemispheres for over a decade. We highlight the latest results from both of these experiments, and address the requirements for a next-generation UHECR observatory. The Fluorescence detector Array of Single-pixel Telescopes (FAST) is a design concept for a next-generation UHECR observatory, addressing the requirements for a large-area, low-cost detector suitable for measuring the properties of the highest energy cosmic rays with an unprecedented aperture. We have developed a full-scale prototype consisting of four 200 mm photomultiplier-tubes at the focus of a segmented mirror of 1.6 m in diameter. In October 2016 and September 2017 we installed two such prototypes at the Black Rock Mesa site of the Telescope Array Experiment. Both telescopes have been steadily taking data since installation. We report on preliminary results of the full-scale FAST prototypes, including measurements of artificial light sources, distant ultra- violet lasers, and UHECRs. Futhermore, we discuss our plan to install an additional identical FAST prototype at the Pierre Auger Observatory. Possible benefits to the Telescope Array and the Pierre Auger Observatory include a comparison of the transparency of the atmosphere above both experiments, a study of the systematic uncertainty associated with their existing fluorescence detectors, and a cross-calibration of their energy and X_{max} scales.

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