

Design and upgrade of the prototype Schwarzschild-Couder Telescope

The Cherenkov Telescope Array (CTA) is the next-generation ground-based observatory for very-high energy gamma-ray astronomy. CTA will have unparalleled sensitivity and angular resolution and will detect gamma-ray sources nearly 100 times faster than current arrays, enabling valuable multiwavelength and multimessenger observations. The Schwarzschild-Couder Telescope (SCT) is a candidate for the medium-sized telescope in CTA. A prototype SCT (pSCT) has been constructed at the Fred Lawrence Whipple Observatory in Arizona USA. Its camera is currently partially instrumented with 1600 pixels (2.7 degree FOV). The small plate scale of the optical system allows densely packed silicon photomultipliers to be used, which combined with high-density trigger and waveform readout electronics enable the high-resolution camera. The camera's electronics are capable of imaging air shower development with waveform readout with nanosecond resolution. The pSCT was inaugurated in January 2019, with commissioning continuing throughout that year. The first campaign of observations with the pSCT was conducted in January and February of 2020. Gamma-ray emission from the Crab Nebula was detected with a significance of 8.6 sigma. An upgrade to the pSCT camera is currently underway. The upgrade will fully populate the focal plane, increasing the field of view to 8 degrees diameter, and lower the front-end electronics noise, enabling a lower trigger threshold and improved reconstruction and background rejection.

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Session Classification: Contributed posters