

Observing Ultra-High Energy Cosmic Rays using Camera Image Sensors

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We propose a new approach for observing UHECR by detecting charged particles in the core region of EAS using a cost-effective and compact detector with a CMOS camera image sensor. In general, the core region of EAS is excluded from the measurement due to the very high particle density at which the signal saturates. However, the results of the EAS simulation predict that the particle density in the core depends on the distance from the axis and the angular distribution depends on the arrival direction of the primary cosmic ray. Therefore, the core might be useful for collecting information about EAS effectively.

Meanwhile, Camera image sensors are sensitive to ionizing radiations in addition to optical photons. It is advantageous to use thin and small sensors to detect particles in the dense region, such as the EAS core. The length of the particle-track is related to depletion thickness and incident angle to the surface of the sensor. If depletion thickness is evident, we can reconstruct the incident angles of primary particles roughly.

We demonstrate the result of simulation to show the characteristics of UHECRs core as well as the reaction of sensors for charged particles. We also report the result of our experiment using a prototype of the CMOS sensors with Raspberry PI to detect radiations.

Keywords

UHECR; EAS; CMOS sensor

Collaboration

other Collaboration

Subcategory

Experimental Methods & Instrumentation

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