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Looking inside volcanoes with the Imaging Atmospheric Cherenkov Telescopes

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Imaging Atmospheric Cherenkov Telescopes (IACT) are dedicated to the very high energy Astrophysics. An IACT consists of an optical system formed by high reflectivity mirrors that focus the Cherenkov light onto a multi-pixel focal camera with fast read-out electronics. IACT telescopes image the very short flash of Cherenkov radiation generated by the cascade of relativistic charged particles produced when a very high-energy gamma-ray strikes the atmosphere. In particular, the Cherenkov light emitted by muon is imaged by an IACT as an annular pattern that contains the information needed to assess both direction and energy of the incident muon.

We present a new application of the IACT that could be used to perform the muon radiography of volcanoes. The quantitative understanding of the inner structure of a volcano is a key-point to forecast the dangerous stages of activity and mitigate volcanic hazards. Muon radiography shares the same principle as X-ray radiography: muons are attenuated by higher density regions inside the target so that, by measuring the differential attenuation of the muon flux along different directions, it is possible to determine the density distribution of the interior of a volcano. To date, muon imaging of volcanic structures has been mainly achieved with detectors made up of scintillator planes. The advantage of using Cherenkov telescopes is that they are negligibly affected by background noise and allow improved spatial resolution, compared to more widely used detectors. This new approach will be tested by means of observations carried out by the ASTRI dual-mirror small-sized telescope (SST-2M), which is operative on the side slope of the Etna volcano (Italy). ASTRI SST-2M is a prototype telescope, developed by the Italian National Institute of Astrophysics, INAF, in the framework of the ambitious Cherenkov Telescope Array (CTA) project in order to verify the innovative technological solutions adopted on the CTA small-sized telescopes.

Registered

Yes

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