

Cosmic-ray anisotropy studies at TeV and PeV energies with AMANDA, IceCube, and IceTop

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The study of the cosmic ray anisotropy in the TeV-PeV energy range could provide clues about the origin and propagation of cosmic rays in our galaxy. The measurement of this per-mille-anisotropy requires data sets with several billion cosmic-ray events. A sample of this size has been collected over the last six years by the IceCube neutrino telescope at the south pole, which detects cosmic ray muons at a rate of about 2 kHz. In the IceCube data, we observe a significant anisotropy in the southern sky for primary energies between 20 and 400 TeV.

The anisotropy has a large-scale component of per-mille strength, accompanied by localized excess and deficit regions with smaller amplitudes and typical angular sizes between 10° and 20° .

A study of the time variability of the anisotropy is performed by combining data from IceCube and its predecessor experiment, AMANDA, which operated between 2000 and 2007. Finally, A change in the shape and an increase in the amplitude of this anisotropy is observed at PeV energies by including events of IceTop, the air shower array above IceCube.

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