

The Pierre Auger Observatory : latest results and prospects for hunting non-perturbative physics

Tuesday 5 October 2010 16:30 (30 minutes)

The Pierre Auger Observatory was designed to make precise measurements of cosmic ray air showers induced by the highest energy cosmic particles. The apparatus consists of about 1600 water Cherenkov tanks distributed over an area of some 3000 square kilometers, all of which are overlooked by 24 fluorescence telescopes. The instrument has already provided us with the most detailed energy spectrum measurement at the highest energies, information on the primary

composition, and hints of anisotropy in the arrival directions of the highest energy events. The apparatus provides a means to study not only hadron and photon induced showers, but also the showers which may be produced by ultrahigh energy neutrinos interacting in the atmosphere or in the Earth. Interestingly, it may be possible to uncover non-perturbative physics by comparing the rate of nearly horizontal showers generated by deeply penetrating neutrinos to that of up-going showers produced by neutrinos skimming the Earth's surface. Though the technique is agnostic regarding the hypothetical physics underpinning such signatures, an observation could have bearing on our picture of how the baryon asymmetry of the universe was created.

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Session Classification: The Universe - from the Big Bang to the Present