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Cosmic Ray Science Potential for an Extended Surface array at the IceCube Observatory

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IceTop is the 1 km^2 surface array of the IceCube Neutrino Observatory. Measurements of ground level particles by IceTop have been used for high precision measurements of the cosmic ray spectrum for energies of 3-300 PeV. Composition has been studied by considering coincident measurements of TeV muon bundles in the 2 km deep IceCube neutrino detector. Including IceTop data for GeV muons may reduce uncertainties inherent to hadronic interaction models; however, all three parts of this program are somewhat limited by the size of IceTop. We explore the potential to improve the IceCube cosmic ray science program with a surface array of order 10 km^2, permitting a factor of ~5 increase in spectral range, nearly an order of magnitude in coincident composition studies, and enabling lateral and production depth muon measurements for every event. Our studies are parameterized by the spacing and size of detector array elements, as well as time resolution and discrete assumptions concerning particle identification. We consider coincidence of an extended surface array with 1st and 2nd generation in-ice arrays.

Collaboration

IceCube

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