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Studying Cosmic Rays with the IceTop and IceCube Detectors

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The IceTop detector is the surface component of the IceCube Observatory. Its 81 stations of frozen water tanks are sensitive to multiple particle components of cosmic ray air showers, and can be used in coincidence with the deeply-buried in-ice component of IceCube for additional sensitivity to high-energy penetrating muons from air showers. This work focuses on measurements of cosmic rays between the knee and the ankle: the all-particle spectrum using IceTop alone, individual spectra for four different nuclear groups (protons, helium, oxygen, and iron) using IceTop and IceCube in coincidence, and the density of muons measured in IceTop tanks far from the shower's core.

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