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Results from Cosmic Ray Experiments

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The highest-energy cosmic rays are expected to be strongly attenuated through interactions with the cosmic microwave background (the GZK cutoff), so that such particles reaching the Earth must only be sampling the local, strongly anisotropic, universe volume. Recently, cosmic ray experiments HiRes and Pierre Auger have probed the cosmic ray energy spectrum in the GZK cutoff regime and have established the existence of a spectrum rollover; at the same time, the arrival directions of the highest-energy events detected by the Pierre Auger Observatory were shown to be anisotropic, and correlated with nearby extragalactic structure. These results are consistent with expectations for cosmic ray energy losses during cosmological propagation, are opening up the era of charged particle astrophysics and astronomy, and are providing a direct way to probe the sources of the highest-energy particles in the universe.