

A New Analysis Method for High-Energy CR Hadron Arrival Directions

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A new approach to understanding the VHECR / UHECR sky is presented. I describe a multi-parameter analysis that is based on the observed CR arrival direction distribution. The sky plot origin can be any chosen reference source of cosmic rays. This source-centered sky (unlike [l,b] etc.) displays simulated energy-species-direction data. I discuss a preliminary UHECR-determined estimate of the intergalactic magnetic field out to ~ 4 Mpc on the assumption that Cen A is the principal UHECR source. Other assumptions and models can be applied within this general conceptual framework.

The analysis method (Yüksel, Stanev, Kistler & Kronberg ApJ 2012) can be applied to data from AUGER, HiRes, TA, and their successors. A specific example shows, within our reference assumptions, how the strength and structure of $B(\text{sub}\{\text{IGM}\})$ is approximately constrained at $> \sim 20$ nG out to $D \sim 4$ Mpc, based on recent AUGER data. This is new “territory” for IGM magnetic field probes, and also the first VHECR sky-based probe of $B(\text{sub}\{\text{IGM}\})$ on nearby-Universe supra-galactic scales. It is a potentially powerful template for the understanding, and future modeling, of VHECR / UHECR propagation at greater distances. I also discuss the dependence of CR energy and species on the observed distribution of arrival directions.

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