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Cosmic magnetic fields, and implications for HE particle anisotropies

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A review will be given of what is known, and surmised about magnetic fields in space, from our Milky Way to the distant Universe well beyond the GZK horizon.
Various analysis methods are described. These include Faraday rotation (RM)
measures of extragalactic radio sources, Faraday probes of the cosmic background radiation, and the recent detection of faint diffuse synchrotron radiation in extragalactic space. I also review preliminary results of Faraday RM
probes of the intergalactic medium within clusters of galaxies, the Cen A environment, and some nearby filaments of cosmic large scale structure (LSS).
Faraday RM probes have also been applied to distant galaxies and quasars, out to z ⊠ 2 and beyond. I briefly discuss near-term possibilities for improving on some of the above probes.
I describe what is known about the local magnetic structure of the Milky Way in connection of UHECR propagation, and discuss what more progress needs to be made to better interpret the observed data on arrival directions, composition and primary particle energy.
The interpretation of UHECR energy/arrival direction/composition data can be clarified by our knowledge of the wider context of intergalactic magnetic fields. This clarification can be of a mutual nature. If the nucleus, jet, or lobes of nearby AGN galaxies within ~ 500 Mpc are the prime UHECR acceleration sites above ~ 1019 eV, it will be important to extend estimates of the magnetic field strength and turbulence scale to other nearby galaxies, galaxy halos, and to the intergalactic space between galaxies, galaxy groups and galaxy clusters. All of these measurements are important for modelling the propagation, deflection, and composition of observed UHECR events. Such studies will be of increasing importance for understanding the steadily growing number of observed UHECR air shower events.

Primary author: Prof. KRONBERG, Philipp (LANL/University of Toronto)

Presenter: Prof. KRONBERG, Philipp (LANL/University of Toronto)

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