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Constraints on UHECR sources and extragalactic magnetic fields from directional anisotropies

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A dipole anisotropy in the ultra-high-energy cosmic ray (UHECR) arrival directions, of extragalactic origin, is now firmly established at energies >8 EeV. Furthermore, the UHECR angular power spectrum shows no power at smaller angular scales than the dipole, apart from hints of possible individual hot or warm spots for energy thresholds ⊠40 EeV. We model the extragalactic source distribution following the large-scale structure of the universe and use a fit to the data of the Pierre Auger Observatory to constrain parameters of the source injection. The effects of the Galactic magnetic field are taken into account, and possible variations due to different models are presented. The model gives good agreement with both the direction and magnitude of the measured dipole anisotropy as well as their energy evolutions. We exploit the magnitude of the dipole and the limits on smaller-scale anisotropies to place constraints on two quantities: the extragalactic magnetic field and the number density of UHECR sources or the volumetric event rate if UHECR sources are transient.

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