The Imprint of Large Scale Structure on the UHECR Sky

ApJL, arXiv 2101.04564 by Chen Ding, Noemie Globus, Glennys R. Farrar

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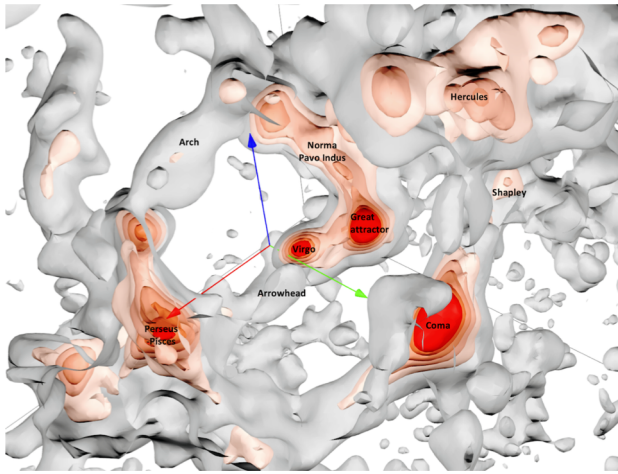


Modelling:

We build the model to test whether the Auger anisotropies above 8 EeV can be explained by the assumption that UHECR sources follow the mass density of the large-scale structure.

Modelling: extragalactic attenuation, extragalactic diffusion, galactic deflection (JF12), composition uncertainty

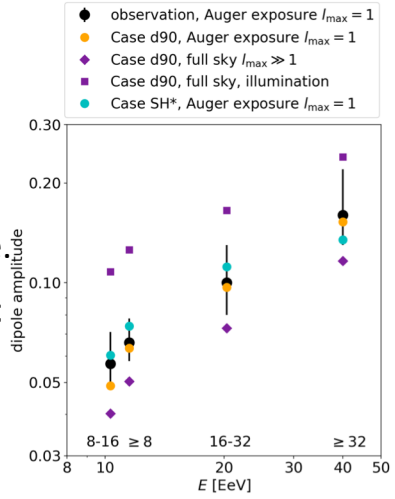
Fit to: dipole components, arrival directions of events above 38 EeV, $\langle \ln A \rangle$ and $\sigma^2(\ln A)$ inferred from Auger Xmax

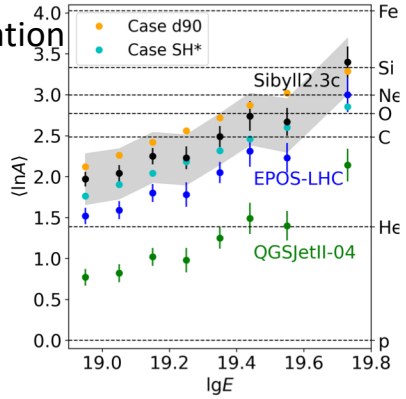
Results:

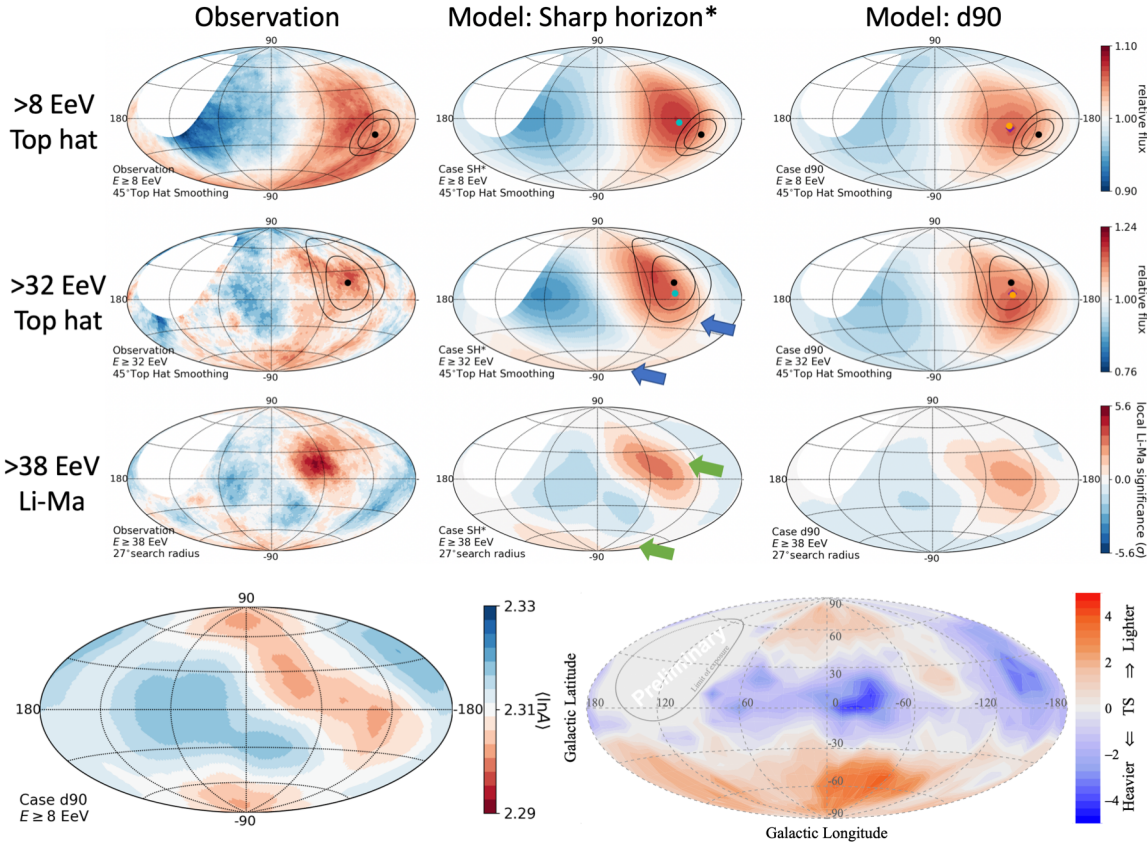
It gives a **good accounting of Auger dipole anisotropy** measurements above 8 EeV.

Auger hotspot may not require individual source, whereas TA hotspot is much more likely to be resulted from a nearby source.

If sources follow LSS, **pure proton composition can be ruled out** on anisotropy grounds alone.







Sky map of cosmic ray composition of the d90 model for E ≥ 8 EeV, smoothed by 30 degree (same as right plot)

Figure 8: Sky map of comic ray composition for $E \geq 10^{18.7}$ eV (Mayotte for Auger ICRC2021_321)

Future work:

More accurate treatment of attenuation with **CRPropa** simulation

Directly fit **source** spectrum and composition

Update the fit to the anisotropy, maybe possible to subtract inhomogeneous background to better reveal the individual sources

give predictions of compositional anisotropy

Investigate source density