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Constraints on super-heavy UHECR source model with a large-scale structure simulation

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Current observations of arrival directions of ultra-high energy cosmic rays (UHECR) whose energies are above 100 EeV do not show significant anisotropy. To explain this situation, we may assume higher source density, heavier mass composition of UHECR, or stronger magnetic fields.
Recently the idea of super-heavy UHECR (r-process nuclei like uranium) has been suggested G. Farrar 2024, B.T. Zhang et al. 2024). The super-heavy UHECR may explain the non-anisotropy of UHECRs with a longer propagation distance and larger deflection by magnetic fields.
In this talk, we assume that the arrival directions of UHECRs are isotropic, and try to constrain the possible range of source density, mass composition, and strength of magnetic fields. Based on mock events calculated from a large-scale structure simulation (Millenium Run, Springel et al. 2005), we set the limits on source density and strength of magnetic fields, in the case of single-proton/iron/uranium.

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