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The cosmogenic neutrino flux determines the fraction of protons in UHECRs

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When UHECRs propagate through the universe, cosmogenic neutrinos are created via several interactions. In general, the expected flux of these cosmogenic neutrinos depends on multiple parameters describing the sources and propagation of UHECRs. However, using CRPropa, we show that a ‘sweet spot’ occurs at a neutrino energy of ~ 1 EeV. At that energy this flux only depends strongly on two parameters, the source evolution and the fraction of protons in UHECRs. These parameters are already constrained by current neutrino experiments, indicating that the sources of UHECRs cannot have a large proton fraction and a strong source evolution. Upcoming neutrino experiments will be able to constrain the fraction of protons in UHECRs even further, and for any realistic model for the evolution of UHECR sources.

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