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Features of a single source describing the very end of the energy spectrum of cosmic rays

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The energy spectrum of cosmic rays extends over many orders of magnitude with a steep suppression of the flux at the highest energies. The energy spectrum of ultra-high energy cosmic rays (UHECR) is measured with great precision by the Pierre Auger Observatory (Auger) and Telescope Array. However, the two measured spectra show different slopes of the decrease at the highest energies. This disagreement can be caused by the ability of these two experiments to see different parts of the night sky and, therefore, in principle, different sources of UHECR as well. In our study, we investigate the possibility that the energy spectrum measured by Auger at energies above $log(E/eV) \geq 19.5$ could be explained by a dominant single strong source. We explore the space of possible features of such a source including its distance, spectral index and mass composition, and compare the resulting flux after propagation using simulations within CRPropa 3 with the data measured by Auger. No restrictions are made on the measurement of shower maximum tightly connected with the mass composition due to large uncertainties at the highest energies. We show the possible parameters of such a source and explore possible mass composition mixes that could explain the data well.

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