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Constraining astrophysical models by using the energy spectrum and mass composition data measured at the Pierre Auger Observatory

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The Pierre Auger Observatory, thanks to its hybrid detection technique, provides information about the energy, the mass composition and the arrival direction of ultra-high energy cosmic rays (UHECRs). Starting from a simple astrophysical scenario for origin and propagation of cosmic rays, it is possible to perform a combined fit to both the energy spectrum and the mass composition data.
We considered only events with energies above the region where the transition between Galactic and extragalactic cosmic rays is supposed to occur (E > few 10^{18} eV), hence data can be interpreted assuming a pure extragalactic origin. The adopted astrophysical model consists of identical sources uniformly distributed in a comoving volume, which accelerate nuclei through a rigidity-dependent mechanism. The fit results suggest that nuclei are injected with a hard spectrum up to a relatively low maximum energy. A quite heavy chemical composition at the acceleration sites is favoured.
The measured fluxes can be sensitive to poorly-known physical quantities relevant to the UHECRs propagation, e.g. the extra-galactic background light spectrum and the photo-disintegration cross sections of nuclei, and to the hadronic interaction models used to take into account the shower development in atmosphere. A discussion of the effects of such choices on the combined fit results will be presented.

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