Proposal for constraining the UHECR flux using SED

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Context and Justification: The origin of the ultra-high-energy cosmic rays (UHECR) remains one of the major conundrums of astrophysics nowadays. The majority of UHECR studies suppose that the UHECR luminosity is equal to every source or proportional to a particular wavelength of the electromagnetic spectrum.

Aim: In this project we want to constrain the contribution of cosmic ray flux at the Earth from extragalactic sources using spectral energy distribution (SED) of known sources. Since we can only measure gamma-rays up to the TeV range we also want to include the neutrino prediction of the sources at earth to simulate how much neutrino data can help to constrain the CR flux to even higher energies.

Method: The gamma-ray data can be taken from Fermi or publications like [aJPL14]. We want to focus especially on published SEDs, which will be used as a model to astrophysical objects of the same class without SED. Supposing gamma rays from hadronic origin, we will estimate the CR density at the source, using recently published models which can also predict the associated neutrino flux. The predicted fluxes can be propagated to the Earth and compared to the data measured by, i.e. the Pierre Auger and/or Telescope Array Observatories.

Expected results: We will obtain a CR spectrum at the source from the electromagnetic prediction at Earth where the latter can be compared to published measurements. Additionally, we will compare the predicted CR spectrum at Earth to measurements by Auger and test in what energy ranges gamma-ray and neutrino telescopes can constrain that flux.

References

[aJPL14] and JEAN-PHILIPPE LENAIN. The H.E.S.S. extragalactic sky. *International Journal of Modern Physics: Conference Series*, 28:1460163, jan 2014.