

The 320 EeV Fly's Eye event: a key messenger or a statistical oddity?

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Content

Almost three decades ago, the Fly's Eye experiment recorded the most energetic cosmic-ray ever observed. With an energy of 320 EeV, this event is well beyond the suppression region of the ultra-high energy cosmic rays (UHECR) spectrum. Modern and larger observatories, with an exposure up to 60 times larger, have never observed an event with even remotely comparable energy. Thus, if the energy of the Fly's Eye event was indeed well measured, as strongly suggested by the data, then it remains a great mystery or an unbelievable stroke of luck. At such high energies, the Universe is very opaque to electromagnetic interacting particles, whether photons, protons or heavy nuclei, and therefore its source must be relatively close. Using numerical simulations for the propagation of protons and nuclei, we reexamine the problem by testing different possibilities for the nature of the primary, the injection spectrum and the location of the source. Based on these calculations, we show that the most feasible scenario corresponds to a nearby ($\sim 2 - 3$ Mpc) bursting source of heavy nuclei in the northern sky, which injected a hard spectrum ($\gamma \leq 1.5$) with an energy cut-off between 300 and 1000 EeV. Such scheme generates a significant probability for the observation of one event by Fly's Eye combined with a null result of Telescope Array at the same energy.

Summary

Presenter(s) : Dr. FITOUSSI, Thomas (ICN-UNAM)