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Maximum Likelihood Method for Ultrahigh Energy Cosmic Ray Cross Correlations with Astrophysical Sources

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Abstract content

We introduce a new Maximum Likelihood method for analyzing cross correlations between a catalog of candidate astrophysical sources and Ultrahigh Energy Cosmic Rays (UHECRs), which allows for variable source luminosities and provides a ranking of individual sources according to their likelihood of having emitted the correlated UHECRs. We use simulated data to test the validity of this and the previous Maximum Likelihood-type method. Specifically, we address the methods' validity in the limits of large source and/or event densities, clustering of sources, and mis-estimation of the experimental resolution. In most cases, both methods give the same total number of true correlations within errors and that is the correct number. However in some instances one or the other method fails, underlining the importance of using both methods for any real analysis. We apply our approach to the question of whether a significant correlation exists between UHECRs and BLLacs and between UHECRs and x-ray clusters.

If this papers is presented for a collaboration, please specify the collaboration

Summary

Reference

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