

# Prospects for Cross-correlations of UHECR Events with Astrophysical Sources with Upcoming Space-based Experiments

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## Executive Summary

Ultra-high energy cosmic rays (UHECRs) are the messengers of the most extreme physics in the cosmos; however, efforts to identify their origins have thus far been thwarted by the fact that they don't point back to their sources. Using statistical studies cross-correlating UHECR arrival directions with astrophysical catalogs, the ground-based Pierre Auger Observatory has reported hints of a correlation with nearby starburst galaxies, as well as lower-significance correlations with other classes of astrophysical sources. Space-based UHECR experiments, such as POEMMA and ZAP, will monitor large interaction volumes on the Earth or the Moon. Within a few years of mission operation time, both missions will achieve unprecedented exposures at energies above 50 EeV across the entire sky.

In this poster, we present studies of the cross-correlation between UHECR event arrival directions and astrophysical catalogs as motivated by expectations for the detector performance for POEMMA and ZAP. We find that both POEMMA and ZAP will achieve  $5\sigma$  discovery reach for many plausible astrophysical scenarios.

37<sup>th</sup> International Cosmic Ray Conference (ICRC 2021)  
July 12th – 23rd, 2021  
Online – Berlin, Germany

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