

# The Zettavolt Askaryan Polarimeter (ZAP) mission concept: radio detection of ultra-high energy cosmic rays in low lunar orbit.

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Probing the ultra-high energy cosmic ray (UHECR) spectrum beyond the cutoff at  $\sim 40$  EeV requires an observatory with an acceptance that is impractical to achieve with ground arrays. We present a concept, designated the Zettavolt Askaryan Polarimeter (ZAP), for radio detection of UHECRs impacting the Moon's regolith from low-lunar orbit. ZAP would observe several thousands of events above the cutoff ( $\sim 40$  EeV) with a full-sky field of view to test whether UHECRs originate from Starburst Galaxies, Active Galactic Nuclei, or other sources associated with the matter distribution of the local universe at a distance  $> 1$  Mpc. The unprecedented sensitivity of ZAP to energies beyond 100 EeV would enable a test of source acceleration mechanisms. At higher energies, ZAP would produce the most stringent limits on super heavy dark matter (SHDM) via limits on neutrinos and gamma rays resulting from self-annihilation or decay.

## Keywords

radio detection; ultra-high energy cosmic rays; space-based

## Collaboration

## other Collaboration

## Subcategory

Future projects

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