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Ultra high energy particle physics and astrophysics. The need for multicomponent EAS measurement and primary particle identification.

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We show that a fundamental element for future generations of UHECR observatories is the multicomponent measurements of extensive air shower.

Such measurements may allow an event-by-event identification of the primary cosmic ray type and would radically impact on the study of various aspects of UHECR physics. From detailed hadronic physics studies to sources discovery via Galactic and extra-galactic magnetic fields determination and LIV tests we expose some of the expected progresses. We also present a promising detection system, based on the close integration of particles and microwave radio detectors, which allows, in principle, to measure separately the EM and muon cascade evolution of EAS. Our purpose is illustrated by presenting the progress of the EASIER upgrade currently underway at the Pierre Auger Observatory.

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