

Identification of the cosmic ray primaries

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Abstract. In order to resolve the GZK puzzle and more generally to elucidate the source and acceleration mechanism for cosmic rays above the ankle (approx $10^{18.7}$ eV), it is of crucial importance to know their particle type. One of the fundamental challenges is to distinguish between a proton primary and a heavier nucleus. Within a given model of the primary interaction and subsequent showering, there are clear differences between the average properties of the longitudinal profiles of proton and heavy nucleus showers. However there

is such a wide dispersion between model results that a given observed average depth of shower maximum is not a good means of deciding on the true composition. We explore alternative approaches, exploiting individual shower properties, to find a model independent method of discrimination. Preliminary results on photon-nucleon discrimination may also be discussed.