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Hadronic- and electromagnetic-cores of air-showers observed by hybrid experiments at high mountains

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The Chacaltaya hybrid experiment together with emulsion chamber and EAS-array can detect air-showers by the air-shower array, the accompanied atmospheric families (a bundle of high energy electrons and gamma-rays) by emulsion chambers and hadrons by burst detectors just under the emulsion chambers.

We study overall characteristics of the experimental data, gamma-families and hadron burst accompanied by air-showers, by studying various correlations between the three observable data, i.e. between families and air-showers, between bursts and air-showers, and between families and bursts, comparing with those of CORSIKA simulations using interaction models of QGSJET, SIBYLL and EPOS.

The analysis shows that changes of chemical composition alone can not describe the global characteristics of the Chacaltaya hybrid data. That is, distributions of family energies are favorable to heavy-dominant composition of primary cosmic-rays but lateral distributions of families are favorable to proton-dominant composition.

The Chacaltaya hybrid data are also compared with those of Tien-Shan and Tibet hybrid experiments. There are some discrepancies among the three experimental data though the details of experimental procedure is different.

Discussions are given on the possible reason of the disagreement by comparing these experimental data with simulations.

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