

## **Gamma-families with halo: main characteristics and possibilities of using for fraction valuation of p+He in mass composition of cosmic rays at the energies $10^{15} + 10^{17}$ eV**

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### Abstract

Estimate of the proportion of protons and helium in the PCR mass composition at the energies 1-100 PeV remains open because of conflicting data obtained in experiments with the EAS and the RECs. According to one of the representations p+He disappears at  $E_0 \sim 1$  PeV and mass composition becomes heavy, according to other points of view the proportion of p+He is essential up to  $E_0 \sim 100$  PeV and the PCR mass composition remains mixed.

In article analyzed data of experiments EAS Karlsruhe (KCDC), REC Pamir and EAS+REC Hadron (Tianshan). According to characteristics of  $\gamma$ -families such as a halo, the fraction structure of halo, EAS' age and muons spectrum is estimated change of the PCR mass composition with energy. It is shown that at  $E_0$  1-100 PeV p+He is present in significant numbers, the fraction of p+He at  $E_0 = 10^{16}$  eV is 20-25% and at  $E_0 = 10^{15} + 10^{17}$  eV mass composition remains mixed with a tendency to become heavy.