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Baryonic content of charged pions

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Charged pions, which obviously carry no baryon number, possess, however, a nontrivial baryonic structure, stemming from the isospin breaking with the up and down quark mass splitting and the EM effects. We obtain estimates for the corresponding pion baryonic (vector isoscalar) form factor in two ways: from simple constituent quark models on one hand, and from vector meson dominance model fits to the $e^+e^- \rightarrow \pi^+\pi^-$ data on the other hand. All our estimates yield a positive baryon mean square radius of π^+ , in the range $(0.03 - 0.04 \text{ fm})^2$. Hence, a picture emerges where the outer spatial region of π^+ has a net baryon density (u excess), and the inner region a net antibaryon density (d-bar excess), both compensating each other such that the total baryon number is zero. For π^- the effect is equal and opposite. We also discuss the challenging lattice QCD prospects of measuring this fundamental property of the pion.

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Preferred track

Hadron Structure

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