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Hadron loops in the quark model

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Abstract content

Summary

The constituent quark model has a long and distinguished history dating back to the 1960's. Despite its successes in explaining many properties of baryons and mesons, there is compelling evidence for exotic degrees of freedom (other than valence quarks) in hadrons, in particular for the need to include quark-antiquark pairs.

In this contribution we discuss some general features of an unquenched quark model for baryons in which the effects of the quark-antiquark pairs are taken into account in an explicit form via a microscopic, QCD-inspired, quark-antiquark creation mechanism. In the present approach, the contribution of the quark-antiquark pairs can be studied for any inital baryon and for any flavor of the $q\bar{q}$ pairs ($u\bar{u}$, $d\bar{d}$ and $s\bar{s}$ loops) in a general and consistent way, thus enhancing considerably the applicability of constituyent quark models.

It is shown that, while the inclusion of the $q\bar{q}$ pairs hardly modifies the baryon magnetic moments, it leads to a large contribution of orbital angular momentum to the proton spin and gives rise to an asymmetric sea in the proton with an excess of $\bar{d}$ over $\bar{u}$, in agreement with the available experimental data. Finally, we present some interesting consequences of our model for the spin content of the Λ hyperon and the flavor asymmetry of the Σ^+ hyperon, both of which can be tested in future experiments.

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