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The $\Sigma_{\pi N}$ Term, Chiral Multiplet Mixing and Hidden Strangeness in the Nucleon

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The nucleon Σ term's large "observed" value (> 55 MeV) has long been interpreted as a sign of hidden strangeness in the nucleon. We have calculated the $\Sigma_{\pi N}$ term on the basis of mixing of chiral multiplets, and using known constraints on the current quark masses m_u^0, m_d^0 and the flavor-singlet and isostriplet axial couplings. We show that the $[(1, 1/2) \oplus (1/2, 1)]$ chiral multiplet, that is necessary for the reproduction of the isotriplet axial coupling, makes a contribution enhanced by a factor of $\frac{19}{3} \simeq 6.33$, due to $SU_L(2) \times SU_R(2)$ algebra, that leads to $\Sigma_{\pi N} \geq \left(1 + \frac{16}{3} \sin^2 \theta\right) \frac{3}{2} \left(m_u^0 + m_d^0\right) = 60$ MeV, in general accord with "experimental" values of $\Sigma_{\pi N}$. The chiral mixing angle θ is given by $\sin^2 \theta = \frac{3}{8} \left(g_A^{(0)} + g_A^{(3)}\right)$, where $g_A^{(0)} = 0.33 \pm 0.08$, or 0.28 ± 0.16, and $g_A^{(3)} = 1.267$, are the flavor singlet and the isotriplet axial couplings, respectively. These results show there is no need for $q^4\bar{q}$ components, and in particular, no need for an $s\bar{s}$ component in the nucleon.

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