High Energy Physics - Phenomenology

Chiral symmetry breaking and the spin content of the rho and rho' mesons

L.Ya. Glozman, C.B. Lang, M. Limmer

(Submitted on 6 Jun 2011)

Using interpolators with different SU(2)_L \times SU(2)_R transformation properties we study the chiral symmetry and spin contents of the rho- and rho'-mesons in lattice simulations with dynamical quarks. A ratio of couplings of the $\qbar\gamma^i{\tau}q$ and $\qbar\sigma^{0i}{\tau}q$ interpolators to a given meson state at different resolution scales tells one about the degree of chiral symmetry breaking in the meson wave function at these scales. Using a Gaussian gauge invariant smearing of the quark fields in the interpolators, we are able to extract the chiral content of mesons up to the infrared resolution of ~1 fm. In the ground state rho meson the chiral symmetry is strongly broken with comparable contributions of both the (0,1) + (1,0) and (1/2,1/2)_b chiral representations with the former being the leading contribution. In contrast, in the rho' meson the degree of chiral symmetry breaking is manifestly smaller and the leading representation is (1/2,1/2)_b. Using a unitary transformation from the chiral basis to the {2S +1}L_J basis, we are able to define and measure the angular momentum content of mesons in the rest frame. This definition is different from the traditional one which uses parton distributions in the infinite momentum frame. The rho meson is practically a 3S_1 state with no obvious trace of a "spin crisis". The rho' meson has a sizeable contribution of the 3D_1 wave, which implies that the rho' meson cannot be considered as a pure radial excitation of the rho meson.

Comments:	10 pp
Subjects:	**High Energy Physics - Phenomenology (hep-ph)**; High Energy Physics - Experiment (hep-ex); High Energy Physics - Lattice (hep-lat); Nuclear Theory (nucl-th)
Journal reference:	Phys.Lett. B 705 (2011) 129-133
DOI:	10.1016/j.physletb.2011.09.102
Cite as:	**arXiv:1106.1010 [hep-ph]**
	(or **arXiv:1106.1010v1 [hep-ph]** for this version)

Submission history

From: Leonid Glozman [view email]
[v1] Mon, 6 Jun 2011 10:34:41 GMT (31kb)

Which authors of this paper are endorsers?