Low-energy properties of hadrons in the relativistic quark model[1]

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Following the Bogolyubov's contribution to the quark pattern of hadrons we developed the relativistic quark model. The model is based on the quasipotential approach in quantum field theory with the QCD motivated interaction. This interaction consists of the perturbative one-gluon exchange part and the nonperturbative confining part. The Lorentz structure of the latter part includes the scalar and vector linearly rising interactions. The vector vertex contains the Pauli term which enables vanishing of the spin-dependent chromomagnetic interaction in accord with the flux tube model.

Initially the model was formulated for the hadrons containing heavy c and b quarks: charmonium, bottomonium, B_c meson, heavy D and B mesons, heavy baryons with both one and two heavy quarks. Mass spectra and electroweak decay rates of heavy quarkonia, heavy mesons and heavy baryons were calculated in good agreement with experimental data. It was shown that the relations following from the heavy quark effective theory (HQET) and large energy effective theory are satisfied. The model was also applied to studying exotic charmonium-like states discovered by BaBar, Belle, CDF and Cleo Collaborations. These states were treated as tetraquark systems in the diquark-antidiquark picture. The found tetraquark mass spectra are in accord with the mass spectra of the observed states.

Recently the model was extended to the description of light mesons and diquarks. The masses, decay constants and electromagnetic form factors of the pion and kaon were obtained in good agreement with experiment. The calculated mass spectra including both orbital and radial excitations of light mesons well reproduce the available data. The constructed Regge trajectories exhibit linearity and equidistance.

In total the presented model containing 10 free parameters permits to describe several hundreds of observable quantities.

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