Объединенный институт ядерных исследований
ЛАБОРАТОРИЯ ТЕОРЕТИЧЕСКОЙ ФИЗИКИ
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Семинар
"ТЕОРИЯ АДРОННОГО ВЕЩЕСТВА ПРИ ЭКСТРЕМАЛЬНЫХ УСЛОВИЯХ"

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Семинар состоится в среду,
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в аудитории им. Д. И. Блохинцева (4 этаж)

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Low energy QCD in terms of gauge invariant dynamical variables.

Using a generalized polar decomposition of the gauge fields into gauge-rotation and gauge-invariant parts, which Abelianises the Non-Abelian Gauss-law constraints to be implemented, a Hamiltonian formulation of low energy QCD in terms of gauge invariant dynamical variables can be achieved.

The exact implementation of the Gauss laws reduces the colored spin-1 gluons and spin-1/2 quarks to unconstrained colorless spin-0, spin-1, spin-2 and spin-3 glueball fields and colorless Rarita-Schwinger fields respectively.

The obtained physical Hamiltonian naturally admits a systematic strong-coupling expansion in powers of $\lambda = g^{-2/3}$, equivalent to an expansion in the number of spatial derivatives.

The leading-order term corresponds to non-interacting hybrid-glueballs, whose low-lying spectrum can be calculated with high accuracy by solving the Schrödinger-equation of the Dirac-Yang-Mills quantum mechanics of spatially constant fields (at the moment only for the 2-color case).

The discrete glueball excitation spectrum shows a universal string-like behaviour with practically all excitation energy going in to the increase of the strengths of merely two fields, the "constant Abelian fields"corresponding to the zero-energy valleys of the chromomagnetic potential. Inclusion of the fermionic degrees of freedom significantly lowers the spectrum and allows for the study of the sigma meson.

Higher-order terms in λ lead to interactions between the hybrid-glueballs and can be taken into account systematically using perturbation theory in λ, allowing for the study of IR-renormalisation and Lorentz invariance.

The existence of the generalized polar decomposition used, the position of the zeros of the corresponding Jacobian (Gribov horizons), and the ranges of the physical variables can be investigated by solving a system of algebraic equations. Its exact solution for the case of one spatial dimension and first numerical solutions for two and three spatial dimensions indicate that there is a finite number of solutions separated by Gribov horizons.