overcoming is greater?” At relatively high temperatures, in accordance with the Arrhenius law, the probabilities of overcoming the barriers are determined by their heights, and at temperatures close to absolute zero, when the ratchet moves according to the tunnel mechanism, the barrier shapes become important. Therefore, for narrow high and low wide barriers, the overcoming mechanism may turn out to be different and, moreover, dependent on temperature. As a result, a temperature-induced change in the direction of the ratchet motion may occur. We present a simple interpolation theory to illustrate this effect. We also formulate simple criteria for the choice of the shape of the potential relief at which one can experimentally observe motion reversal.

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Spin 1 Particle with Anomalous Magnetic Moment and Polarizability in presence of the uniform magnetic field

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Within the general method by Gel'fand – Yaglom, starting with the extended set of representations of the Lorentz group, we have constructed a relativistic generalized system of the first order equations for a spin 1 particle with two additional characteristics, anomalous magnetic moment and polarizability. In tensor form, we have taken into account the presence of external electromagnetic fields. After eliminating the accessory variables of the complete wave function, we derive the minimal 10-component form of equations, the last includes two additional interaction terms which are interpreted as related to anomalous magnetic and moment and polarizability. This approach is extended to space-time models with pseudo-Riemannian structure, within the tetrad method. We specify the basic equation to the cylindrical coordinates and tetrad, and in presence of the external uniform magnetic field. After separating the variables, we derive the system of 10 first order differential equations in polar coordinate. To resolve this system, we apply the method by Fedorov – Gronskiy. Within this approach, the complete 10-component wave function is decomposed in three projective constituents, dependence of each on the polar coordinates is determined by only one function. We find expressions for this basic function $F_i(r)$ in terms of confluent hypergeometric equations; at this there arises a quantization rule for some spectral parameter. Within the method by Fedorov – Gronskiy, additionally arises algebraic homogenous system of 10 equations, which completely determines the structure of 10-component solutions. From vanishing the determinant of the algebraic system, we derive a cubic algebraic equation with respect to energy parameter ϵ^2. Its solutions are found in analytical form, and studied numerically.

Hardronic Decays of Heavy Lepton

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Two-particle decays of the τ -lepton: $\tau \to \pi\nu_\tau, \tau \to K\nu_\tau, \tau \to \rho\nu_\tau, \tau \to K^\star\nu_\tau, \tau \to a_1(1250)\nu_\tau$ have been studied in the framework of the Quark Confined Model . The obtained branching values are in good agreement with the experimental data. The three-particle decay $\tau \to \pi\pi\nu_\tau$ has been studied. The contribution of the direct diagram and the diagram with the intermediate $\rho(770)$ meson have been considered separately. The obtained numerical value $Br(\tau \to \pi\pi\nu_\tau = 0,237$ is in good agreement with the existing experimental situation.

Leptonic and Semileptonic Interactions of Charmed Mesons

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Within the framework of the Covariant Model of Constituent Quarks (CMCQ), leptonic and semileptonic decays of D mesons have been studied. The widths of leptonic decays

$D \to e\nu_e, \mu\nu_\mu, \tau\nu_\tau$ and the branching fractions of semileptonic decays $D^+ \to \pi^0 e^+\nu_e, \pi^0\mu^+\nu_\mu, K^0 e^+\nu_e, K^0\mu^+\nu_\mu$, $D^0 \to \pi^- e^+\nu_e, \pi^-\mu^+\nu_\mu, K^- e^+\nu_e, K^-\mu^+\nu_\mu$, $D_s^+ \to K^0 e^+\nu_e, K^0\mu^+\nu_\mu$. The results of calculations within the accuracy of the model are consistent with experimental data and estimates obtained in other theoretical approaches.

Is it possible matching higher-twist contributions with chiral perturbation theory?

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Using the example of the QCD analysis of the precise low-energy data on the polarized Bjorken sum rule, we show how it is possible to make a transition between two regimes of the QCD expansions down to low Q^2 scales. As it is well known, at low momentum transfer, $Q < 1$~GeV, the description of the perturbative part of the Bjorken integral in the framework of standard perturbation theory encounters serious difficulties due to unphysical features of the usual perturbative running coupling. To avoid this difficulty, we use an analytic running coupling which, without introducing additional parameters, eliminates the unphysical features of the perturbative coupling. Since the theoretical description of the Bjorken sum rule involves not only a series in powers of α_s but also a series in powers of $1/Q^2$ (higher twist contributions summing into an unknown function), we will use the technique of matching the function at large Q^2 and behavior at small Q^2 near zero by involving the Gerasimov--Drell--Hearn sum rule. The essence of the ``matching" method is that the sum rule is applied to the region of large values of Q^2, where it works well, and then continues to the region of small Q^2. This allows us to obtain information about the behavior of structural functions in the region where experimental data are not available. The region near $Q^2 = 0$ is of particular interest because it corresponds to small distances between interacting particles. In this region, the structural functions can experience significant changes associated with the manifestation of the inner degrees of freedom of hadrons. A qualitative description of the region near $Q^2 = 0$ can be obtained by analyzing the behavior of structural functions at small values of Q^2. This approach in different loop level of the perturbative part gives a stable good agreement with the experimental data in the whole region up to zero momentum transfer.

Ghost and Gluon Propagators at Finite Temperatures within a Rainbow Truncation of Dyson-Schwinger Equations

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The truncated Dyson-Schwinger and Bethe-Salpeter equations in Euclidean complex momentum domain are analysed within the ladder rainbow truncation. The approach is generalized to finite temperatures. Some critical phenomena in hot matter, such as behaviour of ghost and gluon propagators at high temperatures, relevant to possible signals of Quark Gluon Plasma, are considered.

Matter transport as fundamental property of solitons. Generalization of the Stokes drift mechanism to strongly nonlinear systems.

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A soliton is defined as a nonlinear solitary wave that propagates in environmen t with constant speed, shape and amplitude due to a balance of nonlinearity and dispersion. Solitary wave was first