we study the relevant system of four radial equations and analyze behavior of eigenvalues of corresponding deviation curvature tensor. We found that the real parts of the eigenvalues are positive near the horizon, but at infinity the eigenvalues tend to $1 - (M / \varepsilon)^2$ / so they are positive for all physically interpreted energy values bigger than the particle mass. The Newman-Unti-Tamburino parameter does not influence on the character of geodesics behavior.

Resonant tunneling in QCD

Roman Shulyakovsky
Institute of Applied Physics NAS of Belarus, Minsk, Belarus

Tunneling processes in QCD described by classical solutions of field equations in Euclidean space (instantons) are considered. It has been shown that the exponential suppression of such transitions is removed due to resonance effects. Thus, energy bands are formed by analogy with the effects in crystals. The results are consistent with phenomenological considerations obtained by E. Shuryak, D. Dyakonov and others and also from the analysis of the Shifman–Weinstein–Zakharov (SWZ) sum rule. There are very strong arguments in favor of the fact that instantons in QCD provide the existence of quark and gluon condensates. Moreover, such non-perturbative fluctuations of gluon fields appear enough often. There are very strong arguments in favor of the fact that instantons in QCD provide the existence of quark and gluon condensates. Moreover, such non-perturbative fluctuations of gluon fields appear often enough (the density of instantons is estimated at 1 per Fm^4 in 4-dimensional Euclidean space). So, instanton tunneling transitions will not be suppressed even for medium energies 1 – 10 GeV, i.e. energies that will be achieved at the SPD facility (NICA, JINR). At the LHC accelerator, the range of kinematic regions is much wider, which significantly expands the variability of the task of searching for instantons.

Testing single micro-particles as individual luminescent upconversion probes

Victor G. Nikiforov, Andrey V. Leontyev, Larisa A. Nurtdinova, Evgeny O. Mityushkin, Artemi G. Shmelev, Dmitry K. Zharkov, Anton P. Chuklanov, Niaz I. Nurgazizov
Zavoisky Physical-Technical Institute, FRC Kazan Scientific Center of RAS, Kazan, Russia

Upconversion nano(micro) crystallites doped with rare earth ions are promising luminescent probes in a wide range of applied and fundamental problems. Particular attention should be paid to the biomedical area: visualization of biological objects, biosensing, therapy and diagnosis of cancer, drug delivery, etc. As a rule, the methods presented in the literature use a large ensemble of upconversion particles. Note that modern confocal optical microscopy makes it possible to detect the luminescent response of single phosphors. Thus, a attractive prospect arises for the development of single particle technology allows one to use an individual probe for monitoring the parameters of the local state of the environment (temperature, viscosity, pH, electric and magnetic fields, etc.). In problems of this kind, the decisive role is played by the features of the photophysical parameters of a single particle chosen as a probe. It should be noted that the parameters of a particle can differ greatly from the values averaged over a large ensemble of similar particles. The report presents studies of the luminescent upconversion response of various single oxide and fluoride submicroparticles, analyzes the multiphoton activation mechanisms of rare earth ions emission and the sourses of luminescence significant polarization. Examples of using single phosphors as temperature and orientation sensors are demonstrated. The prospects for their use in biological objects are discussed.

Vizualization and Probing the Surface of Isolated Nervous System of Grape Snail Using Luminescent Nanoparticles

L.A. Nurtdinova, A.V. Leontiev, A.G. Shmelev, D.K. Zharkov, R.M. Gataullina, E.O. Mityushkin, A.N. Solodov, R.R. Zairov, A.R. Mustafina, V.V. Andrianov, L.N. Muranova, Kh.L. Gainutdinov, A.P. Chuklanov, N.I. Nurgazizov and V.G. Nikiforov
Zavoisky Physical-Technical Institute, FRC Kazan Scientific Center of RAS, Kazan, Russia

Of particular interest is the problem of visualization in biomedicine, when the position of probes introduced into living tissue is registered remotely and noninvasively by optical methods in real