Contents

BRST CHARGES FOR NONLINEAR ASSOCIATIVE ALGEBRAS

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It is known that the quantum theory of gauge fields (constrained Hamiltonian systems) has an elegant formulation in the framework of the BRST theory. The main ingredient in that formulation is the BRST charge Q. Its construction for linear (Lie) algebras of constraints is well known. In the case of nonlinear algebras, despite the existence of quite general results concerning the structure of the BRST charges, the general construction is far from being fully understood. The main reason is the appearance of nonstandard terms (forth and higher order in the ghost fields) in Q. Due to the presence of these additional terms the full structure of the BRST charges cannot be written immediately. Thus, the explicit construction of the BRST charges for nonlinear algebras remains a challenge.

Among the quadratically nonlinear algebras there is a special class of so-called quantum Lie algebras (QLA). Additional QLA restrictions help to construct [1] the BRST charges explicitly, despite the nonlinear character of the basic relations. The main ingredient of this construction is the modified ghost-anti-ghost algebra which is also quadratically nonlinear. Moreover, in general, the ghost-anti-ghosts do not commute with the generators of the algebra. Unfortunately, the class of QLA's is not wide enough to include many interesting algebras. Nevertheless, the idea (see [1]) to deform the ghost-anti-ghost algebra in accordance with the structure of the algebra of constraints seems to be valid not only in the case of QLA. In this report, we present some preliminary results how to extend at least some elements of the construction of the BRST charge for QLA to broader classes of quadratic algebras.

As the first example we considered in [2] a one-parametric family of quadratic algebras. The construction of the BRST charge in this case goes straightforwardly, but two nontrivial features arise. First, the BRST charge Q takes a conventional form after a redefinition of the canonical ghost-anti-ghost system. The algebra of modified ghosts is quadratic as for QLA's. Second, the family admits a nonlinear involution; it follows that any algebra of the family has two different bases with quadratic defining relations (two "quadratic faces") and, therefore, two different BRST charges. It turns out [2] that these BRST charges anticommute and, thus, form a double BRST complex.

Thus, the idea to use the noncanonical ghost-anti-ghost fields works perfectly in this example. Next, in [3] we considered famous W_3 and $W_3^{(2)}$ algebras. For these algebras we also introduce the noncanonical ghosts and anti-ghosts which form a quadratic algebra of ghosts. In terms of these ghosts the BRST charge acquires the conventional cubic form (see [3]).

We note that in the BRST construction for nonlinear algebras of constraints (in particular for quantum Lie algebras [1]) the algebra of ghosts forms a special nonlinear associative algebra (called the Nichols - Woronowicz algebra) which was investigated by many authors for the last few years. For these algebras the definition of the multiplications uses special elements (shuffle elements) in the braid group ring. The associativity of the multiplication follows from special features of the shuffle elements. In [4], the multiplicative analogues of the shuffle elements in the braid group rings are obtained. In the R-matrix representations they give rise to new graded associative algebras (b-shuffle algebras). In [4], we consider the case of the Hecke and BMW algebras in detail. The (anti)-symmetrizers for these algebras can be expressed in terms of the highest multiplicative 1-shuffles and in terms of the highest additive 1-shuffles (for the Hecke algebras only). Finally, we examined [4] the spectra and multiplicities of eigenvalues of the multiplicative and additive 1-shuffles. It turns out [4] that these spectra possess a beautiful combinatorial structure.

Список литературы

[1] V.G. Gorbounov, A.P. Isaev, O.V. Ogievetsky, BRST Operator for Quantum Lie Algebras: Relation to Bar Complex, Theor. Math. Phys. 139 No. 1 (2004) 473; arXiv:0711.4133[math.QA].

[2] A.P.Isaev, S.O.Krivonos, O.V.Ogievetsky, BRST charges for finite nonlinear algebras, submitted to Phys. Lett. **A**; arXiv:0807.1820[math-ph].

[3] A.P.Isaev, S.O.Krivonos, O.V.Ogievetsky, BRST operators for W algebras, J.Math.Phys. **49** (2008) 073512; arXiv:0802.3781[math-ph].

[4] A.P. Isaev, O.V. Ogievetsky, Braids, Shuffles and Symmetrizers, submitted to J. of Phys. **A**; arXiv:0812.3974[math.QA].

LANDAU PROBLEM ON SUPERMANIFOLDS

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The famous Landau problem [1] treats a charged quantum particle moving on a plane through which a constant uniform magnetic flux passes. Its spherical generalization is the Haldane model [2] describing a charged particle on a 2-sphere $S^2 \sim SU(2)/U(1)$ in the background of the Dirac monopole. These models constitute a theoretical basis of the Quantum Hall Effect (QHE) [3]. The corresponding $d = 1$ Lagrangians are

$$L_{plan} = |\dot{z}|^2 - i\kappa\,(\dot{z}\bar{z} - \dot{\bar{z}}z) = |\dot{z}|^2 + (A_z\dot{z} + A_{\bar{z}}\dot{\bar{z}})\ ,\ A_z = -i\kappa\bar{z},\ A_{\bar{z}} = i\kappa z, \tag{1}$$

$$L_{sphere} = \frac{1}{(1+|z|^2)^2}|\dot{z}|^2 - is\frac{1}{1+|z|^2}\,(\dot{z}\bar{z} - \dot{\bar{z}}z)\,. \tag{2}$$

The second terms in (1) and (2) are Wess-Zumino (WZ) terms: in the S^2 case it is the standard WZ term on $U(1) \subset SU(2)$, while in the planar case it is a WZ term associated with the "central charge" 2κ appearing in the "magnetic translation" group with the algebra $[p_z, p_{\bar{z}}] = 2\kappa$ which defines the symmetry of the planar model. The quantum energy spectrum of the models (1) and (2) is given by

$$(1): \quad E_\ell = \kappa(2\ell+1); \qquad (2): \quad E_\ell = \ell(\ell+1) + 2s\ell, \quad s \in \frac{1}{2}\mathbb{N}\,, \tag{3}$$

where $\ell{=}0,1,2,\ldots$ labels the Landau levels (LL). The common salient feature of the Landau models is that the gap between the $\ell{=}0$ level (Lowest Landau Level, LLL) and the higher levels is proportional to the magnetic fields κ or s and, therefore, when the latter becomes sufficiently strong, it is a good approximation to confine the consideration to LLL only. The LLL limit corresponds to sending $\kappa, s \Rightarrow \infty$ in (1), (2) and so retaining only WZ terms. The quantization of WZ terms gives rise to noncommutative coordinates, so there arises a one-to-one correspondence between LLL and a noncommutative 2-plane or fuzzy sphere [4] (in the S^2 case). Thus, the Landau model and its generalizations (including its superextensions) are worth studying not only from the physical point of view as sound quantum-mechanical problems, but also from the mathematical point of view due to their deep relation to the noncommutative (super)geometry.

Recently, there was activity in constructing and studying some minimal superextensions of the S^2 Landau model, such that their planar limits yield the appropriate superextensions of the original Landau problem [5]- [9] (see also [11, 12]). The superextended S^2 Landau models constructed in [6, 10] are based on the supergroup $SU(2|1)$ which extends $SU(2)$ and is defined by the anticommutation relations $(i, k = 1, 2)$

$$\{Q_i, \bar{Q}_k\} = \epsilon_{ik}F + J_{ik}\,, \quad \{Q_i, Q_k\} = \{\bar{Q}_i, \bar{Q}_k\} = 0\,. \tag{4}$$

Here $(F, J_{(ik)})$ generate the bosonic subgroup $U(2) \subset SU(2|1)$. The $SU(2|1)$ Landau models exist in the two variants: (i) the superspherical (SS) Landau model, the model describing a particle on the supercoset $SU(2|1)/U(1|1)$ which is just the supersphere $S^{(2|2)} \sim \mathbb{CP}^{(1,1)}$ and where $U(1|1) \sim (J_3, F, Q_2, \bar{Q}^2)$; (ii) the superflag (SF) Landau model which describes a particle on the superflag manifold $SU(2|1)/[U(1) \times U(1)]$. The corresponding $d = 1$ Lagrangians are extensions of (2) by some fermionic terms: the SS model deals with the (2|2) set of the target space world-line fields $(z, \bar{z}, \zeta, \bar{\zeta})$ while in the SF model one encounters an extended set (2|4) of such fields, $(z, \bar{z}, \xi_i, \bar{\xi}^i, i = 1, 2)$.

The quantization of the SS and SF models revealed interesting peculiarities. Their spectrum is given, respectively, by

$$\mathrm{SS}: \quad E_\ell = \ell(\ell + 2N)\,, \qquad \mathrm{SF}: \quad E_\ell = \ell(\ell + 1) + 2N'\ell\,, \quad N, N' \in \frac{1}{2}\mathbb{Z}\,, \tag{5}$$

i.e., the SF model has the same spectrum as its bosonic S^2 prototype. Though the spectrum is real and positive, the full space of quantum states contains states with negative norms, which is a signal of possible breaking of unitarity in these models. The same phenomenon was found [7] in the planar limits of both the models, which correspond to proper fermionic extensions of the Lagrangian (1). It was shown, however, that this difficulty could be evaded by introducing a nontrivial "metric" operator on the space of states, which amounts to modification of the inner product on the relevant supermanifolds [8]. With respect to the modified inner product all norms become positive-definite (modulo a subspace of unphysical zero-norm states). An interesting new phenomenon which is manifested by passing to the new norms is the presence of hidden (super)symmetries in the SS and SF models and their planar limits. In the latter case, it is the hidden world-line $\mathcal{N}$=2 supersymmetry [8, 9], while in the SS and SF cases it is the dynamical $SU(2|2)$ symmetry [10]. It was also found that the SS model at N is quantum-equivalent to the SF model at $N'{=}N - \frac{1}{2}$. Indeed, the spectra in (5) are related just by this substitution.

Further analysis of the superextended $SU(2|1)$ Landau models, as well as their generalizations to the higher rank supergroups, is now under way. It is intended to clarify their role in describing QEH and a spin generalization of the latter, as well as possible relationships of these supersymmetric quantum-mechanical problems to the integrable structures in the $\mathcal{N}$=4 super Yang-Mills theory and string theory in the framework of general Gauge/Gravity correspondence.

[1] L.D. Landau, Z. Phys. **64** (1930) 629.
[2] F.D.M. Haldane, Phys. Rev. Lett. **51** (1983) 605.
[3] *"Quantum Hall Effects: Field Theoretical Approach and Related Topics"*, World Scientific, Singapour, 2000.
[4] J. Madore, Class. Quant. Grav. 9 (1992) 69.
[5] E. Ivanov, L. Mezincescu and P. K. Townsend, [arXiv:hep-th/0311159].
[6] E. Ivanov, L. Mezincescu and P. K. Townsend, [arXiv:hep-th/0404108].
[7] E. Ivanov, L. Mezincescu and P. K. Townsend, JHEP **0601** (2006) 143 [arXiv:hep-th/0510019].
[8] T. Curtright, E. Ivanov, L. Mezincescu and P. K. Townsend, JHEP **0704** (2007) 020 [arXiv:hep-th/0612300].
[9] E. Ivanov, Theor. Math. Phys. **154** (2008) 349 [arXiv:0705.2249 [hep-th]].
[10] A. Beylin, T. Curtright, E. Ivanov, L. Mezincescu and P. K. Townsend, JHEP **0810** (2008) 069 [arXiv:0806.4716 [hep-th]].
[11] K. Hasebe and Y. Kimura, Nucl. Phys. B **709** (2005) 94 [arXiv:hep-th/0409230]; K. Hasebe, Phys. Rev. Lett. **94** (2005) 206802 [arXiv:hep-th/0411137].
[12] K. Hasebe, Phys. Rev. **D 72** (2005) 105017 [arXiv:hep-th/0503162].

M2 BRANES AND CHERN-SIMONS-MATTER SYSTEMS

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During the last year there was impressive progress in constructing the actions of multiple M2 branes and studying their properties. In the low-energy limit, multiple M2 branes can be effectively described by three-dimensional superconformal field theories, which have the structure of the Chern-Simons-matter theory with $\mathcal{N}$=8 supersymmetry (Bagger-Lambert-Gustavson model [1]) or $\mathcal{N}$=6 supersymmetry (Aharony-Bergman-Jafferis-Maldasena (ABJM) model [2]). The ABJM model plays the role of a "master" model since many three-dimensional superconformal theories follow from it under particular choices of the gauge group. The matter fields in the ABJM model belong to the bi-fundamental representation of the $U(N) \times U(N)$ gauge group while the gauge fields are governed by Chern-Simons (CS) actions of levels k and $-k$, respectively. Like in other cases, it is important and useful to have a superfield description of the ABJM models with the maximal number of manifest and off-shell supersymmetries. Until recently, only $\mathcal{N}$=1 and $\mathcal{N}$=2 off-shell superfield formulations for these models were known.

In [3], we took the decisive step toward the above goal by constructing the classical action of the ABJM model in the $\mathcal{N}$=3, d=3 harmonic superspace. This type of harmonic superspace [4] was worked out twenty years ago in [5] just for finding out the $\mathcal{N} = 3$ superextension of the CS term with and without matter as one of the basic motivations. The free CS gauge action constructed in [5], after passing to the component fields of the vector $\mathcal{N}$=3, d=3 supermultiplet, reads

$$S_{CS} = \frac{k}{4\pi}\int d^3x\Big(\varepsilon^{mnp}A_m\partial_n A_p + \phi^{kl}X_{kl} + \frac{i}{2}\lambda^\alpha\lambda_\alpha - \frac{i}{4}\chi^\alpha_{kl}\chi^{kl}_\alpha\Big). \qquad (1)$$

Note that scalar and spinor fields are auxiliary degrees of freedom in this $\mathcal{N} = 3$ supersymmetric CS action (as well as in its non-Abelian variant).

The basic novelty of the ABJM model, while formulated in the $\mathcal{N}$=3 harmonic superspace, is the presence of two hypermultiplet actions besides the $\mathcal{N}$=3 CS action. Each analytic $\mathcal{N}$=3 hypermultiplet superfield q^+_a (a is the isospinor index) contains 4 scalar and 8 spinor physical component fields (total of 8 and 16 for two hypermultiplets) combined with an infinite tower of the auxiliary off-shell fields. Both q^+ superfields are in the bi-fundamental representation of the gauge group $U_L(N) \times U_R(N)$ and are minimally coupled to the analytic gauge superfields V^{++}_L and V^{++}_R entering into the CS action. The latter is a difference of the separate superfield CS terms for the left and right gauge groups, which ensures the full action to be even under the properly implemented P-parity. Such a peculiar structure of the $\mathcal{N}$=3 superfield CS-matter action plays a key role in the existence of the hidden $\mathcal{N}$=6 and $\mathcal{N}$=8 (in the special case of the gauge group $SU(2) \times SU(2)$) supersymmetries in it, as well as the extended R-symmetry groups $SO(6)$ or $SO(8)$. In the harmonic $\mathcal{N}$=3 superfield formulation three out of six (or eight) supersymmetries are always realized off shell and so are manifest, while the remaining ones close only on shell.

As distinct from the standard $\mathcal{N}$=2, d=4 harmonic superspace or its straightforward $\mathcal{N}$=4, d=3 reduction, the $\mathcal{N}$=3 harmonic superspace admits the neutral spinor derivative D^0_α preserving the Grassmann harmonic analyticity. This is the basic technical reason why one can define additional extended supersymmetry transformations in the $\mathcal{N}$=3 CS-matter systems. On the free hypermultiplet three extra supersymmetries act as

$$\delta_\epsilon q^{+a} = i\epsilon^{\alpha\,(ab)} D^0_\alpha q^+_b\,, \tag{2}$$

where $\epsilon^{\alpha\,(ab)}$ is a triplet of the relevant d=3 spinor parameters. The full interaction theory is invariant under the gauge-covariantized generalization of this transformation combined with the proper nonlinear transformations of the gauge superfields (they are bilinear in the hypermultiplet superfields q^{+a}).

The conformal invariance plays the crucial role in the M2 brane interpretation of the BLG and ABJM models within the AdS_4/CFT_3 correspondence. The $\mathcal{N}$=3 superconformal invariance of the $\mathcal{N}$=3 superfield ABJM action allows only for a minimal gauge interaction of the hypermultiplets, i.e., it forbids any built-in superfield potential. This is one of the most sound new features of the $\mathcal{N}$=3 superfield formulation as compared to the $\mathcal{N}$=1 and $\mathcal{N}$=2 ones. Amazingly, the correct component sextic scalar potential of ABJM emerges on shell after the simultaneous elimination of auxiliary fields of the gauge multiplets and hypermultiplets. Another nice feature of the $\mathcal{N}$=3 harmonic description is that the corresponding superfield equations of motion are formulated solely in the analytic subspace of the $\mathcal{N}$=3 harmonic superspace and have a surprisingly simple form. We hope that these merits of the $\mathcal{N}$=3 harmonic formulation will manifest themselves in quantum computations, e.g., of the relevant superfield effective action. One more direction in which our superfield formulation could be developed is related to gaining further insights into the intrinsic relationship between the M2 actions and the actions of multiple D2 branes via a kind of Higgs phenomenon.

Besides the original $U(N) \times U(N)$ ABJM model, in [3] we also constructed $\mathcal{N}$=3 superfield formulations of some of its generalizations. In the $SU(2) \times SU(2)$ case we gave a simple superfield proof of its enhanced $\mathcal{N}$=8 supersymmetry and $SO(8)$ R-symmetry.

An off-shell $\mathcal{N}$=6 CS action without matter was also analyzed in the framework of more involved $\mathcal{N}$=5 harmonic superspaces which make use of different types of harmonics on the $SO(5)$ group [6]. A possible relation of these extensions of the CS action to the BLG or ABJM models is obscure for the time being.

[1] J. Bagger, N. Lambert, Phys. Rev. D **77** (2008) 065008, arXiv 0711.0955 [hep-th]; A. Gustavsson, Algebraic structures on parallel M2-branes, arXiv 0709.1260 [hep-th].

[2] O. Aharony, O. Bergman, D.L. Jafferis, J. Maldacena, JHEP **0810** (2008) 091, arXiv 0806.1218 [hep-th].

[3] I.L. Buchbinder, E.A. Ivanov, O. Lechtenfeld, N.G. Pletnev, I.B. Samsonov, B.M. Zupnik, ABJM models in N=3 harmonic superspace, Preprint ITP-UH-22/08, JINR-E2-2008-175, arXiv 0811.4774 [hep-th].

[4] A. Galperin, E. Ivanov, S. Kalitzin, V. Ogievetsky, E. Sokatchev, Class. Quant. Grav. **1** (1984) 469; A.S. Galperin, E.A. Ivanov, V.I. Ogievetsky, E.S. Sokatchev, “Harmonic Superspace”, CUP 2001, 306 p.

[5] B.M. Zupnik, D.V. Khetselius, Yad. Fiz. **47** (1988) 1147.

[6] B.M. Zupnik, Phys. Lett. B **660** (2008) 254, arXiv 0711.4680 [hep-th]; Teor. Mat. Fiz. **157** (2008) 217, arXiv 0802.0801 [hep-th].

FULL INTEGRABILITY OF SUPERGRAVITY BILLIARDS: THE ARROW OF TIME, ASYMPTOTIC STATES AND TRAPPED SURFACES IN THE COSMIC EVOLUTION

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Cosmological implications of superstring theory have been under attentive considerations in the last decade from various viewpoints. In any case, the mathematical basis of any application of superstring and p-brane physics to cosmology necessarily consists of the classification and of the study of possible time-evolving string backgrounds. This amounts to the construction, the classification and the analysis of supergravity solutions depending only on time, or more generally, on a low number of coordinates including time. In this context, a quite challenging phenomenon, potentially highly relevant to the overall interpretation of extra-dimensions and string dynamics, was proposed, at the beginning of this millenium, by a number of authors under the name of cosmic billiards. This proposal was a development of the pioneering ideas of Belinskij, Lifshits and Khalatnikov, based on the Kasner solution of Einstein's equations. The Kasner solution corresponds to a regime, where the scale factors $a_i(t)$ $(i = i \dots D-1)$ associated with the various dimensions (including time) of a D-dimensional universe have an exponential behaviour $\log[a_i(t)] \equiv h_i(t) = p_i t$. Einstein equations are simply solved by imposing quadratic algebraic constraints on the coefficients p_i. An inspiring mechanical analogy is at the root of the name billiards. Considering $h_i(t)$ as the coordinates of a fictitious ball, in a Kasner solution the ball is rolling on a straight line and p_i are the components of its velocity. The billiard proposal corresponded to the idea that $h_i(t)$ could be identified with fields in the Cartan subalgebra of a Lie algebra G and one could introduce walls on which the cosmic ball could bounce. These latter are obviously the hyperplanes orthogonal to the simple roots and the billiard table becomes the Weyl chamber of G. Thus, the entire cosmic evolution might be represented by a series of Kasner eras separated by bouncing of the cosmic ball on the billiard walls that produce a reflection of the velocity vector p_i. In the original proposal of the cosmic billiards it was advocated that the relevant Lie algebra G could be identified with the Lie algebra of U, namely, the Lie group of unified duality transformations relevant to the considered string model and to its low-energy effective lagrangian. Notwithstanding the great appeal of this general picture no exact solution of supergravity field equations was constructed before the years 2002-2003, which displayed the features of a cosmic billiard, neither there was, to our knowledge, a general strategy to find them. In the course of the five years 2003-2008, in a series of papers which partly involved other collaborators we pursued a programme of investigations which clarified the mathematical structure underlying supergravity bllliards, established a general method of solution of the field equations, allowed their general classification and last but not least revealed new exciting properties of their moduli space topology and of their asymptotic behaviour.

In particular, in the two years 2007-2008 we consolidated the following specific results:

1. The billiard phenomenon is not a peculiarity, rather it is the generic feature of all exact solutions of supergravity restricted to time dependence.

2. We were able to construct not only some exact solutions but all of them for all supergravities restricted to time dependence with the condition that two of the scale factors are equal. Indeed, under such a condition, by reducing supergravity to D=3 dimensions and then restricting all the fields to pure time dependence, we could map its field equations into those of a one-dimensional sigma model defined over the coset U/H, where H is the maximal compact subgroup of the D=3, non compact U-duality group. For these sigma models we proved complete integrability.

3. Not only we proved integrability, but we established an explicit integration algorithm which provides the general integral in terms of arbitrary integration constants.

4. We established the general dynamic mechanism governing the affine extension of the U-duality algebra which occurs when we further reduce supergravity from D=3 to D=2 dimensions. This mechanism is of crucial relevance in order to enlarge the space of exact solutions by removing the constraint that two scale factors should be equal. The extension of our integration algorithm to the case where the U-algebra is replaced by its affine or hyperbolic Kac Moody extension is the frontier of our present research plans.

5. The essential role of the Tits Satake projection of non-compact Lie algebras was clarified. The billiard table is not the Weyl chamber of the Lie algebra U, rather it is the Weyl chamber of its Tits Satake subalgebra, namely $\mathrm{U_{TS}}$. Correspondingly, the bouncing of the cosmic ball corresponds to a smooth realization of reflections pertaining to the Weyl group of $\mathrm{U_{TS}}$ named $\mathrm{W_{TS}}$. Since several supergravity theories have the same Tits Satake projection, it follows that, from the point of view of cosmological evolution, supergravity theories fall into a restricted number of universality classes. Within each universality class various elements are distinguished by a different compact group which we named the paint group $\mathrm{G_{paint}}$. It is responsible for rotation among themselves off various painted copies of the billiard walls located at the same place.

6. We explored the general properties of the established general integral and we discovered quite new and intriguiguing properties of its moduli space. This latter is given by a suitable compact coset manifold $\mathrm{H/G_{paint}}$, further modded by the action of the relevant Weyl group $\mathrm{W_{TS}}$.

7. We proved that in this moduli space there exist both trapped and (super)critical surfaces. The available asymptotic states of the universe were by us shown to be in one-to-one correspondence with the elements of the Weyl group $\mathrm{W_{TS}}$.

8. Furthermore, a quite intriguing general property of the time flows was discovered. The time flow is always in the direction of increasing the disorder, this latter being measured by the number of elementary transpositions that characterize each Weyl group element. This property opens glimpses of a new cosmological entropy to be possibly interpreted in terms of superstring microstates, as it happens for the Bekenstein-Hawking entropy of black holes.

[1] Pietro Fré, Jan Rosseel, *On full-fledged supergravity cosmologies and their Weyl group asymptotics,* arXiv:0805.4339. to appear on Class. and Quant. Grav.

[2] Pietro Fré, Alexander Sorin, *The arrow of time and the Weyl group: all supergravity billiards are integrable,* arXiv:0710.1059. to appear on Nucl. Phys.

[3] Pietro Fré, Floriana Gargiulo, Jan Rosseel, Ksenya Rulik, Mario Trigiante, Antoine Van Proeyen, *Tits-Satake projections of homogeneous special geometries,* Class.Quant.Grav. 24 (2007) 27-78, arXiv:hep-th/0606173.

[4] Pietro Fré, Alexander Sorin, *Integrability of Supergravity Billiards and the generalized Toda lattice equation* Nucl.Phys. B733 (2006) 334-355, arXiv:hep-th/0510156

GEOMETRIC QUANTIZATION AND ALGEBRAIC LAGRANGIAN GEOMETRY

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The paper [1] is a survey devoted to a new method of quantization.

Quantization itself is the main problem of theoretical physics. The need to introduce and develop was dictated by the creators of the quantum theory. According to the Copenhagen philosophy, the physical predictions of a quantum theory must be formulated in terms of classical concepts. So in addition to the usual structures (Hilbert space, unitary transformations, self adjoint operators...,) any reasonable quantum theory has to admit an appropriate passage to a classical limit such that the quantum observables are transfered to the classical ones. However, as it was pointed out by Dirac at the beginning of the quantum age, the correspondence between quantum theory and classical theory has to be based not only on numerical coincidences taking place in the limit $h \to \infty$ but on an analogy between their mathematical structures. Classical theory does approximate the quantum theory but it does do even more — it supplies a frame to some interpretation of the quantum theory. Using this idea we can understand a quantization procedure in general as a correspondence between classical theories and quantum theories. In this sense quantization of the classical mechanical systems is the moving in one direction while taking a quasi-classical limit we go in the opposite direction of this correspondence. More abstractly: the moduli space of the quantum theories is an n - covering of the moduli space of the classical ones (one supposes that n equals 2), and quantization is the structure of this covering.

Quantization itself is a very popular subject. There is a number of different approaches to this problem. However, one of them is honoured as the first one in theoretical physics and is named canonical quantization. In simple cases the correspondence comes with some choice of fixed coordinates. If a classical observable is represented by a function $f(p_a, q^b)$ in these coordinates then the corresponding quantum observable equals the operator

$$f(-\imath h \frac{\partial}{\partial q^a}, q^a).$$

The canonical quantization of the harmonic oscillator is a standard computation in theoretical physics: any alternative approach should be compared with it and if the answer is sufficiently different from the classical one, then this approach is rejected. However, this formal substitution (when one puts some differential operators instead of coordinates p_a) introduces a lot of problems. Indeed, beyond the simple cases during this process the result of the quantization depends on the order of p and q in the expression for the classical observable f and, moreover, the result strongly depends on the coordinate choice and it is not invariant under generic canonical transformations. Nevertheless, this canonical quantization supplied by some physical intuition together with its various generalizations takes the central part of modern theoretical physics.

One way to develop the canonical method and avoid the difficulty is provided by geometric quantization. Geometric quantization has two slightly different meanings as a term. One could understand it either as a specific construction well known as the Souriau - Kostant quantization or as a general approach to the problem based on the underlying geometry. Nowadays the problem of quantization is treated by quite different methods: algebraic approach includes deformation quantization, formal geometry, noncommutative geometry, quantum groups; analytical approach consists of the theory of integral Fourier operators, Toeplitz structures and other ones. All the methods mentioned above have one mutual marking point — coming in these ways one almost completely forgets about the structure of the given system (and the Dirac suggestion mentioned above), and the "homecoming"turns to be absolutely impossible. At the same time, going in the geometric quantization direction one at least tries to keep (at least in mind) the original system. The corresponding symplectic manifold remains to be basic for all the constructions and takes the real part in the definition of all auxiliary geometrical objects which give us the result of the quantization. At the same time geometric quantization does not need any choice of coordinates and this basic feature gives a possibility to deal with complicated systems which do not admit any global coordinates at all. But starting with a given classical phase space geometric quantization should give us a result which has to be comparable with the canonical one for simple systems. Thus, in any case geometric quantization is a generalization of the canonical quantization. To keep the relationship, one usually pays a cost loosing generality of the construction: from the whole space of classical observables one takes only a subclass of "quantizable"functions, and this subclass is sufficiently small. To separate such quantizable objects, one should choose a polarization of given symplectic manifold (= classical phase space), then these objects are distinguished by the condition that their Hamiltonian vector fields preserve the polarization.

The known schemes of geometric quantization are unified by the fact that usually they take the space of regular sections of a prequantization bundle as the Hilbert space (and again one imposes some additional conditions on these sections to be regular in our sense). In the original Souriau - Kostant construction one takes all smooth sections with bounded L^2 - norm (with respect to a given hermitian structure on the fibers of the prequantization bundle weighted by the Liouville form). Further specializations come in different ways: Rawnsley - Berezin method uses only the sections which are holomorphic with respect to a complex polarization (= fixed complex structure on M) as well as in the Toeplitz - Berezin approach, while in the real polarization case one collects only such sections (weighted by half weights) which are invariant with respect to infinitesimal transformations tangent to the fibers of a real polarization (= lagrangian fibration).

One should say that the introduction of an additional structure — complex polarization — turns the subject of geometric quantization to the most developed region of modern mathematics, namely, to algebraic geometry. As it was mentioned above, a number of methods uses complex polarization. It imposes an additional condition that our symplectic manifold (M, ω) admits a Kahler structure: there exists some complex structure J compatible with ω which is integrable. Together these two structures ω, J give us the corresponding riemannian metric g such that complex manifold M, J is endowed with a hermitian metric, and since ω is closed by the definition, it gives us a Kahler structure on M. Moreover, one has a usual for any quantization method requirement for ω to have integer cohomology class:

$$[\omega] \in H^2(M, \mathbb{Z}) \subset H^2(M, \mathbb{R})$$

(the charge integrality condition). This implies that the Kahler metric described above is of the Hodge type and, therefore, the Kahler manifold is an algebraic variety. So one can quantize a symplectic manifold if it admits an algebro - geometric structure! It is not so surprising if we take in mind the so-called geometric formulation of quantum mechanics.

The basic idea is to replace the algebraic methods of quantum mechanics by algebro - geometric methods. The author found all these ideas in a paper of Ashtekar and Schilling but of course the original sources have existed, as one thinks, since the birth of quantum theory itself. Roughly speaking, the starting point is that usually in quantum mechanics one deals with a Hilbert space but the quantum states are represented by rays in the space since two vectors ψ_1, ψ_2 represent the same state if they are proportional. Thus, it is natural to consider the projectivization $\mathbb{P}(\mathcal{H})$ instead of $\mathcal{H}$ as the space of quantum states. This finite - or infinite - dimensional complex manifold is automatically endowed with a hermitian metric (Fubini - Study), so one can regard it as a real manifold with the Kahler structure. This real manifold (finite or infinite dimensional) is endowed automatically with the symplectic structure and riemannian metric. Quantum states are represented just by points of this manifold. Quantum observables are represented by smooth real functions of special type which one calls Berezin symbols. With respect to these ideas one can generalize quantization problem in a non-linear manner, namely, instead of a Hilbert space one could try to find (or to construct) some finite or infinite dimensional Kahler manifold $\mathcal{K}$ together with a correspondence between smooth functions on a given symplectic manifold (= classical observables on a given phase space) and Berezin symbols on this Kahler manifold. This nonlinear generalization was called algebro - geometric quantization. Following Ashtekar and Schilling we require for the construction of this Kahler manifold to avoid, as an intermideate step, the introduction of Hilbert spaces known from usual methods of geometric quantization.

The main aim of the paper is to present an example of successful algebro - geometric quantization for compact simply connected symplectic manifolds. We call this method the ALG(a) - quantization. Of course, it is an abbreviation. To decode it, we need to recall some basic facts belonging to a new subject which was created just on the border between algebraic and symplectic geometries (if such a border does exist).

One can say that different subjects are mixed in modern mathematics. For example, in connection with the mirror symmetry conjecture one accepts the idea that algebraic geometry of a manifold X corresponds to symplectic geometry of its mirror partner X'. The ingredients of algberiac geometry over X (bundles, sheaves, divisors ...) are compared with some derivations of symplectic geometry (Lagrangian submanifolds of special types). For example, in the so-called homological mirror symmetry one compares two categories that came from algebraic geometry and symplectic geometry, respectively, and in some particular cases (elliptic curve) this approach gives the desired result. On the other hand, one has a number of moduli spaces generated in the framework of algebraic geometry over X and another way is to find a number of moduli spaces in the framework of symplectic geometry. The development of this idea comes in different ways and even now one could report a number of promised results and ideas clarifying the original one. However, these results are sufficiently far to be complete and to cover all the problems. However, the main idea, which proclaims the creation of some new synthetic (or at least synergetic) geometry unifying algebraic and symplectic ones, remains to be very attractive and seems to be true.

One step in this way was done in 1999 when the moduli space of half weighted Bohr - Sommerfeld Lagrangian cycles of fixed volume and topological type was proposed by A.N. Tyurin and A.L. Gorodentsev. Starting with a simply connected compact symplectic manifold with integer symplectic form (read "classical mechanical system with compact simply connected phase space which satisfies the Dirac condition") the authors constructed a set of infinite dimensional moduli spaces which were infinite dimensional algebraic manifolds depending on the choice of some topological fixing and a real number — the volume of the half weighted cycles. Lagrangian geometry is mixed in the construction with algebraic geometry and this construction itself belongs to some new synthetic geometry. The authors called it ALAG — Abelian Lagrangian algebraic geometry (so it is wrong to think that they took their initials and made a mistake). It was created as a step in some new approach to mirror symmetry conjecture generalizing some notions from standard geometric quantization (prequantization data, Bohr - Sommerfeld condition, etc.), so it is not quite surprising that this construction plays an important role in geometric quantization. I proved that these moduli spaces of half weighted Bohr - Sommerfeld Lagrangian subcycles of fixed volume solve the problem of algebro - geometric quantization stated above for simply connected compact symplectic manifolds. This method, proposed there, was called the ALG(a) - quantization. This new method gives new results which are nevertheless quite consistent with the old ones if an appropriate polarization on (M, ω) is chosen. After papers [2], [3] were published, it was understood that ALG(a) - quantization is the broadest generalization of the so - called Maslov correspondence which comes from the semi classical quantization proposed by V.P. Maslov for the cotangent bundle of an affine space and extended by M. V. Karasev to the case of the cotangent bundle of any smooth manifold. The ALG(a) - quantization goes further — one takes any integral symplectic manifold. Thus, the quantization problem can be reduced to a problem of lagrangian geometry. And it is the starting point of an another long story, see [4]...

[1] N.A. Tyurin, Geometric quantization and algebraic lagrangian geometry, Surveys in Geometry and Number theory, London Math. Soc., Lecture notes series, Vol 338 (2007) 279

[2] N.A. Tyurin, The correspondence principle in Abelian lagrangian geometry, Izvetsiya RAN, ser. mat., 65: 4 (2001) 823.

[3] N.A. Tyurin, Dynamical correspondence in algebraic lagrangian geometry, Izvestiya RAN, ser. mat., 66: 3 (2002) 611.

[4] N.A. Tyurin, Lagrangian tori in the projective plane, Theoretical and Mathematical Physics 158 (1) (2009) 1.

VACUUM SOLUTIONS IN $4+1$ AND $5+1$ LOVELOCK GRAVITY

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Modified theories of gravity are under active consideration at present in cosmology. Efforts are being made to mimic late time acceleration from large scale modification of gravity without resorting to exotic forms of matter dubbed dark energy. The extra dimensional effects can give rise to modification of gravity; similar effects can be induced by adding a generic function of Ricci scalar to Einstein-Hilbert action giving rise to $f(R)$ gravity. The quantum effects can also lead to higher order curvature corrections to Einstein-Hilbert action. These corrections can be systematically computed in perturbative regime of string theory.

The goal of the present paper is to study power-law solutions in vacuum Gauss-Bonnet gravity, which replace Kasner solution near initial singularity in $5+1$ dimensions, and to investigate re-collapse possibility in $4+1$ dimensional Gauss-Bonnet gravity. We chose the corrections to Einstein-Hilbert action in the form of Gauss-Bonnet term for two reasons. First, Gauss-Bonnet contribution appears in the string gravity corrections. Second, this term is the next to Einstein term in Lovelock gravity. In the latter theory the equations of motion are the second order derivative equations for the metrics coefficients in all levels, and the Lovelock gravity entered recently in a new stage of intense investigations, mainly in the area of black hole solutions and related thermodynamical properties. It should be noted that in $4+1$ and $5+1$ worlds, the action consisting of Einstein and Gauss-Bonnet term is the exact action of Lovelock gravity.

We consider a multidimensional theory with the action

$$S = \int \sqrt{-\mathrm{g}}\,(R + \alpha GB)\, d^N x, \tag{1}$$

where GB is the Gauss-Bonnet term

$$GB = R^{iklm}R_{iklm} - 4R^{ik}R_{ik} + R^2 \tag{2}$$

on the flat anisotropic (Bianchi I) background

$$g_{ik} = \mathrm{diag}\,(-1, a_1^2(t), a_2^2(t), \ldots, a_{N-1}^2(t)). \tag{3}$$

The corresponding dynamical equations is bulky and we sent you to the original papers [1,2], but there is one essential difference between $4+1$ and $5+1$ cases. In the Friedman constraint there is only one additional term appearing due to GB in the $4+1$ case whereas in $5+1$ case there are five one. Actually it mean that in $4+1$ dimensions there is some correction to Kasner vacuum solution significant at high curvature, but this correction can change dynamic dramatically. Unfortunately the analytical investigation of this question is impossible and it was studied numerically. The numerical investigation of this problem demonstrate that overwhelming majority of trajectories beginning from the initial singularity (points with high curvature) lead to re-collapse or nonstandard singularity (points with finite Hubble parameters and infinite its time derivatives) in future. Actually only insignificant minority trajectories with very special initial condition lead to low energy Kasner regime and hence to probable normal cosmology [1]. The analogous numerical investigation in 5+1 dimensions show that more then half trajectories lead to low energy Kasner regime [3].

Another interesting thing concerning $5+1$ dimensional case is existence of absolutely new vacuum solution at high curvature. This new solution exist due to five additional terms arising from GB correction. This new solution was found analytically and for the metric $ds^2 = -dt^2 + \sum t^{2p_i} dx_i^2$ looks like [2]

$$\sum_{i<j<k<l}^{5} p_i p_j p_k p_l = 0, \quad \sum_{i}^{5} p_i(p_i - 1) \sum_{i \neq j,k; j<k}^{5} p_j p_k = 0. \tag{4}$$

As it was already noted this solution usually (depending on initial conditions) relax to generalized Kasner solution [3]

$$\sum_{i=1}^{5} p_i = 1, \quad \sum_{i=1}^{5} p_i^2 = 1. \tag{5}$$

[1] R. Chingangbam, M. Sami, P. V. Tretyakov, A.V. Toporensky, Phys. Lett. B **661**, 162–166 (2008); arXiv:0711.2122[hep-th].

[2] A. Toporensky, P. Tretyakov, Grav. Cosmol. **13**, 207–210 (2007); arXiv:0705.1346[gr-qc].

[3] S. A. Pavluchenko, A. V. Toporensky, e-print arXiv:0811.0558[gr-qc].

HIDDEN SYMMETRIES OF $\mathcal{N}$=4 SUPER YANG-MILLS THEORY

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It was shown by Witten that B-type open topological string theory with the (5|6)-dimensional quadric hypersurface $Q^{5|6}$ in $\mathbf{C}P^{3|3}\times\mathbf{C}P^{3|3}$ as a target space is equivalent to holomorphic Chern-Simons (hCS) theory on $Q^{5|6}$ [1]. Furthermore, he assumed that hCS theory on $Q^{5|6}$ was equivalent to $\mathcal{N}$=4 super Yang-Mills (SYM) theory on Minkowski space and this was proven in [2]. There, it was shown that one could bring Witten's form of the hCS field equations to the well-known constraint equations on the supercurvature field strength corresponding to full $\mathcal{N}$=3 SYM theory on the superspace $\mathbf{C}^{4|12}$ or one of its real subspaces. This theory is known to be equivalent to $\mathcal{N}$=4 SYM theory, when formulated on Minkowski space.

The above (twistor) correspondence between $\mathcal{N}$=4 SYM theory and hCS theory on the supermanifold $Q^{5|6}$ was used for studying integrability properties of SYM theory in [3], where an infinite set of graded symmetries (double-loop type algebra) recursively generated from supertranslations was constructed. Presumably, the existence of such nonlocal symmetries underlies the observed integrable structures in quantum $\mathcal{N}$=4 SYM theory.

[1] E. Witten, Commun. Math. Phys. **252** (2004) 189.
[2] A.D. Popov, C. Sämann, Adv. Theor. Math. Phys. **9** (2005) 931.
[3] A.D. Popov, M. Wolf, Commun. Math. Phys. **275** (2007) 685.

INTEGRABILITY OF VORTEX EQUATIONS

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Coset space dimensional reduction [1, 2] was used for obtaining effective field theories from compactification of string theory on 6-dimensional coset spaces G/H, where H is a closed subgroup of the Lie group G (see e.g. [3]). The standard reduction scheme was generalized [4, 5] to a G-equivariant dimensional reduction of Yang-Mills theory on manifolds of the form $M \times G/H$, where M is a smooth manifold of dimension q and G/H is a reductive coset space with topologically nontrivial internal fluxes. The general formalism was developed in [4, 5] and was used to describe vortices as generalized instantons of higher-dimensional Yang-Mills theory [5, 6, 7], as well as to construct explicit SU(2)-equivariant monopole and dyon solutions of pure Yang-Mills theory in four dimensions [8]. In particular, it was shown that for $G/H = \mathbf{C}P^1$ and dim$M$=2 the instanton Yang-Mills equations reduced to M coincide with the ordinary (Abelian or non-Abelian) vortex equations. The vortex equations were shown to be integrable when M was a compact Riemann surface of genus g>1 [7]. Therefore, for g>1 the standard methods of integrable systems can be applied for constructing their solutions. Topological obstructions (inequalities for Chern numbers of gauge fields) to the existence of solutions to the vortex equations were derived as well [7].

[1] P. Forgács, N.S. Manton, Commun. Math. Phys. **72** (1980) 15; C.H. Taubes, Commun. Math. Phys. **75** (1980) 207.

[2] D. Kapetanakis, G. Zoupanos, Phys. Rept. **219** (1992) 1.

[3] R. Blumenhagen, B. Körs, D. Lüst, S. Stieberger, Phys. Rept. **445** (2007) 1.

[4] L. Álvarez-Cónsul, O. García-Prada, J. Reine Angew. Math. **556** (2003) 1; Commun. Math. Phys. **238** (2003) 1.

[5] A.D. Popov, R.J. Szabo, J. Math. Phys. **47** (2006) 012306; O. Lechtenfeld, A.D. Popov, R.J. Szabo, Progr. Theor. Phys. Suppl. **171** (2007) 258.

[6] O. Lechtenfeld, A.D. Popov, R.J. Szabo, JHEP **08** (2008) 093.

[7] A.D. Popov, arXiv: 0712.1756 [hep-th]; Lett. Math. Phys. **84** (2008) 139.

[8] A.D. Popov, Phys. Rev. D **77** (2008) 125026; Mod. Phys. Lett., in print, arXiv: 0804.3845 [hep-th].

REVERSING THE SIGN OF THE CASIMIR FORCE WITHIN LIFSHITZ THEORY

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The development of micro(nano) electromechanical machines and the precision measurements of attractive Casimir force [1] have prompted a new interest in the Casimir repulsion. Theoretically, flat mobile parts of any micro-electrical machine drawn apart at 10 nm should experience an inward Casimir pressure of about 1 Atm. It may leave to undesired stiction. Special choice of the materials may reduce the attraction or even change the sign of the Casimir force. Furthermore, there are ideas of putting Casimir repulsion into use [2].

$>$From Lifshtz theory [3] it follows that the force may become repulsive if one of the parallel plates has nontrivial magnetic permeability, $\mu \neq 1$. This possibility was not seriously regarded since for "natural"materials, where the magnetization of the system is due to the movement of the electrons in the atoms, $\mu(\omega) = 1$ at visible range. However in composite materials if the inclusions are smaller than the wavelength, but larger than the atomic size the effective dielectric and magnetic functions can be introduced as a result of local field averaging. That is why the artificial materials [4] with magnetic response arising from micro (nano) inclusions have recently become good candidates for observing the Casimir repulsion. Starting from the Lifshitz formula one can establish the limits for the Casimir force between plates with dispersion: $-7/8\,F_C(L) \leq F(L) \leq F_C(L)$, where F_C is the force between perfect conductors [5].

We consider [5,6] the Casimir force between a metal and a metamaterial. For describing the meta-materials we use the effective media approach, considering anisotropic compound material as a homogeneous media having effective dielectric and magnetic functions. For the dielectric permittivity and magnetic permeability the frequency dependence is well fitted by N-oscillator model $\sum_i^N C_i\omega_{p,i}^2/(\omega^2 - \omega_{0,i}^2 + i\gamma_i\omega)$. This approach is valid for wavelengths longer than the пїSlattice constantпїS of the meta-material. In other words, the theoretical estimations for the force are trustable for plate separations large in comparison with the пїSlattice constantпїS of the meta-material. For more accurate results optical data [7] in a wide frequency range and for different incidence angles are needed.

We show [6] that if one of the mirrors has a non-unity magnetic permeability the force is positive at short distances provided the dielectric permittivity is non-unity as well. At long and medium distances, $L \geq 2\pi c/\omega_0$ this set-up yields repulsion if this mirror is more magnetic than dielectric, $\varepsilon(i\omega) < \mu(i\omega)$. In the simplified case when its dielectric permittivity and magnetic permeability are described by a plasma model we find the minimal ratio between magnetic and dielectric plasma frequencies required to get repulsion, $\omega_{p,m}/\omega_{p,e} \approx 1.0255$.

The Casimir force being weak and decreasing rapidly with distance, we conclude that to get measurable repulsion the matamaterial should obey the inequality $\varepsilon(i\omega) < \mu(i\omega)$ in a wide range of optical frequencies.

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[1] S. K. Lamoreaux, Phys. Rev. Lett. **78**, 5 (1997); A. Roy et al, Phys. Rev. D **60**, 111101 (1999); G. Bressi et al, Phys. Rev. Lett. **88**, 041804 (2002); R. S. Decca et al, Phys. Rev. Lett. **91**, 050402 (2003); H. B. Chan et al, Science **291**, 1941 (2001)

[2] F. Capasso et al, IEEE J. Sel. Top. Quantum Electron. **13**, 400 (2007).

[3] E. M. Lifshitz, Sov. Phys. JETP, vol. 2, 73-83 (1956).

[4] J. B. Pendry et al, IEEE Trans. Micr. Theory. Tech. 47, 2075 (1999); V.G. Veselago et al, J. Comput. Theor. Nanosci.**3**, N 2, p. 1, 2006.

[5] A. Lambrecht and I. G. Pirozhenko, Phys. Rev. A **78** 062102 (2008).

[6] I. G. Pirozhenko and A. Lambrecht, J. Phys. A: Math. Theor. **41**, 164015 (2008).

[7] I. G. Pirozhenko, A. Lambrecht and V. Svetovoy, New J. Phys. **8**, 238 (2006).

LIST OF PUBLICATIONS

MONOGRAPHS

1. A.S. Galperin, E.A. Ivanov, V.I. Ogievetsky, E.S. Sokatchev, “Harmonic Superspace”, *2-nd (paper-back) edition, Cambridge University Press, 2007, 306 p.*

JOURNAL PUBLICATIONS

1. A. Arnaeva, S. Krivonos, “BRST charge for the classical N=2 W_3 superalgebra”, *Probl. Mod. Theor. Phys., Volume in honour of Prof. I.L. Buchbinder in the occasion of his 60th birhday, Tomsk, 39 - 45 (2008).*
2. B.M. Barbashov, V.N. Pervushin, “Nikolay A. Chernikov (1928-2007)”, *The old and new Concepts of Physics. An open-dialog journal, ISSN:1733-8026 Lodz University Press (2008).*
3. B.M. Barbashov, Comment on the article “Hamilton Unification of General Relativity and Standard Mode”, *The old and new Concepts of Physics. An open-dialog journal, ISSN:1733-8026, Lodz University Press (2008).*
4. S. Bellucci, S. Krivonos, A. Shcherbakov, A. Sutulin, “N=4 Superconformal Mechanics and Black Holes”, *Phys. Rev. D* **78**, *125001 (2008); [arXiv:hep-th/0807.1785].*
5. S. Bellucci, S. Krivonos, A. Sutulin, “N=4 supersymmetric 3-particles Calogero model”, *Nucl. Phys. B* **805**, *24-39 (2008); [arXiv:hep-th/0805.3480].*
6. S. Bellucci, S. Krivonos, A. Shcherbakov, “Generic N=4 supersymmetric hyper-Kahler sigma models in D=1”, *Phys. Lett. B* **645**, *299-302 (2007); [arXiv:hep-th/0611248].*
7. S. Bellucci, S. Krivonos, V. Ohanyan, “N=4 supersymmetric MICZ-Kepler systems on S3”, *Phys. Rev. D* **76**, *105023 (2007); [arXiv:hep-th/0706.1469].*
8. S. Bellucci, S. Krivonos, A. Sutulin, “N=8 supersymmetric mechanics on the sphere S3”, *Phys. Rev. D* **76**, *065017 (2007); [arXiv:hep-th/0706.3466].*
9. S. Bellucci, S. Krivonos, O. Lechtenfeld, A. Shcherbakov, “Superfield Formulation of Nonlinear N=4 Supermultiplets”, *Phys. Rev. D* **77**, *045026 (2008); [arXiv:hep-th/0710.3832].*
10. A. Beylin, T.L. Curtright, E. Ivanov, L. Mezincescu, P.K. Townsend, “Unitary Spherical Super-Landau Models”, *JHEP* **0810**, *069 (2008); [arXiv:hep-th/0806.4716].*
11. V.G.Bornyakov, V.K.Mitrjushkin and M.Mueller-Preussker, ”Infrared behavior and Gribov ambiguity in SU(2) lattice gauge theory”, *Phys. Rev. D* **79**, *074504 (2009).*
12. I.L. Buchbinder, E.A. Ivanov, O. Lechtenfeld, I.B. Samsonov, B.M. Zupnik, “Gauge theory in deformed N = (1,1) superspace”, *Phys. Part. Nucl.* **39**, *759-797 (2008); [arXiv:hep-th/0709.3770].*

13. R. Chingangbam, M. Sami, P. V. Tretyakov, A.V. Toporensky, "A Note on the Viability of Gauss-Bonnet Cosmology", *Phys. Lett. B* **661**, *162-166 (2008).*

14. D. Cirilo-Lombardo, "On the mathematical structure and hidden symmetries of the Born-Infeld field equations", *J. Math. Phys.* **48**, *032301 (2007); [arXiv:hep-th/0612282].*

15. D.J. Cirilo-Lombardo, "On the Lorentz Group SO(3, 1), Geometrical Supersymmetric Action for Particles and Square-Root Operators II. Squeezed States and Relativistic Wave Equations", *Phys. Part. Nucl. Lett.* **4**, *244 (2007).*

16. D.J. Cirilo-Lombardo, "Non-compact groups, Coherent States, Relativistic Wave equations and the Harmonic Oscillator", *Found. Phys.* **37**, *919-950, 1149-1180 (2007); [arXiv:hep-th/0701195].*

17. D.J. Cirilo-Lombardo, "Quantum field propagator for extended-objects in the microcanonical ensemble and the S-matrix formulation", *Phys. Lett. B* **637**, *133-138 (2006); [arXiv:hep-th/0705.4533].*

18. D.J. Cirilo-Lombardo, N.G. Sanchez, "Microcanonical model for a gaz of evaporating black holes and strings, scattering amplitudes and mass spectrum", *Int. J. Mod. Phys. A* **23**, *975-1000 (2008); [arXiv:hep-th/0708.0393].*

19. D.J. Cirilo-Lombardo, "Riemannian superspaces, exact solutions and the geometrical meaning of the field localization", *Int. J. Theor. Phys.* **47**, *3015-3028 (2008).*

20. D.J. Cirilo-Lombardo, "The Geometrical properties of Riemannian superspaces, exact solutions and the mechanism of localization", *Phys. Lett. B* **661**, *186-191 (2008).*

21. D.J. Cirilo-Lombardo, "The Geometrical Properties and Physical Meaning of Some Particular Riemannian Superspaces", *Phys. Part. Nucl. Lett.* **5**, *494-500 (2008).*

22. T. Curtright, E. Ivanov, L. Mezincescu, P.K. Townsend, "Planar Super-Landau Models Revisited", *JHEP* **0704**, *020 (2007); [arXiv:hep-th/0612300].*

23. J.Daboul, G.S.Pogosyan and K.B.Wolf, "Noncommuting limits of oscillator wavefunctions", *Phys. Atom. Nucl.* **70**, *513-519, (2007).*

24. F. Delduc, E. Ivanov, "Gauging N=4 supersymmetric mechanics II: (1,4,3) models from the (4,4,0) ones", *Nucl. Phys. B* **770**, *179-205 (2007); [arXiv:hep-th/0611247].*

25. F. Delduc, E. Ivanov, "The common origin of linear and nonlinear chiral multiplets in N=4 mechanics", *Nucl.Phys. B* **787**, *176-197 (2007); [arXiv:hep-th/0706.0706].*

26. F. Delduc, E. Ivanov, "New Model of N=8 Superconformal Mechanics", *Phys. Lett. B* **654**, *200-205 (2007); [arXiv:hep-th/0706.2472].*

27. F. Delduc, O. Lechtenfeld and A.S. Sorin, "$N = 2$ Supersymmetric Unconstrained Matrix GNLS Hierarchies are Consistent", *Lett. Math. Phys.* **84**, *No. 2-3, 109–122 (2008).*

28. B. Enriquez, S. Pakuliak, V. Rubtsov, “Basic representations of quantum current algebras in higher genus“, *Contemporary Mathematics* **433**, *177–190 (2007).*

29. B. Enriquez, S. Khoroshkin, S. Pakuliak, “Weight functions and Drinfeld currents“, *Comm. Math. Phys.* **276**, *691–725 (2007).*

30. S. Fedoruk, J. Lukierski, “Twistorial versus space-time formulations: Unification of various string models”, *Phys. Rev. D* **75**, *026004 (2007); [arXiv:hep-th/0606245].*

31. S. Fedoruk, J. Lukierski, “Two-twistor description of membrane”, *Phys. Rev. D* **76**, *066005 (2007); [arXiv:hep-th/0706.2129].*

32. S. Fedoruk, E. Ivanov, “New model of higher-spin particle”, *Phys. Atom. Nucl.* **71**, *868-875 (2008); [arXiv:hep-th/0701177].*

33. G. von Gehlen, N. Iorgov, S. Pakuliak, V. Shadura, Yu. Tykhyy, “Form-factors in the Baxter-Bazhanov-Stroganov model I: Norms and matrix elements“, *J. Phys. A: Math. Theor.* **40**, *14117–14138 (2007).*

34. G. von Gehlen, N. Iorgov, S. Pakuliak, V. Shadura, Yu. Tykhyy, ”Form-factors in the Baxter-Bazhanov-Stroganov model II: Ising model on the finite lattice”, *J. Phys. A: Math. Theor.* **41**, *9, 095003 (2008).*

35. C.Grosche, G.S.Pogosyan and A.N.Sissakian, ”Path Integral Approach for Superintegrable Potentials on Spaces of Non-Constant Curvature: II. Darboux Spaces D_{III} and D_{IV}”, *Phys. Part. Nucl.* **38**, *299-325, (2007).*

36. C.Grosche, G.S.Pogosyan and A.N.Sissakian, ”Path Integral Approach for Superintegrable Potentials on Spaces of Non-Constant Curvature: I. Darboux Spaces D_I and D_{II}”. *Phys. Part. Nucl.* **38**, *299-325, (2007).*

37. C. Gutschwager, T.A. Ivanova and O.Lechtenfeld, “Scattering of noncommutative waves and solitons in a supersymmetric chiral model in 2+1 dimensions”, *J. High Energy Phys.* **11**, *052 (2007).*

38. A.P. Isaev and O.V. Ogievetsky, ”On Baxterized Solutions of Reflection Equation and Integrable Chain Models”, *Nucl. Phys. B* **760**, *167-183 (2007).*

39. A.P. Isaev, ”Functional equations for transfer-matrix operators in open Hecke chain models”, *Theor. Math. Phys.* **150**, *No.2, 187-202 (2007).*

40. A.P. Isaev, S.O. Krivonos, O.V. Ogievetsky, “BRST operators for W algebras”, *J. Math. Phys.* **49**, *073512 (2008); [arXiv:math-ph/0802.3781].*

41. A.P.Isaev, A.I.Molev, A.F.Oskin, ”On the idempotents of Hecke algebras”, *Lett. Math. Phys.* **85**, *79-90 (2008).*

42. A.P.Isaev, S.O.Krivonos, O.V.Ogievetsky, ”BRST operators for W algebras”, *J. Math. Phys.* **49**, *073512 (2008).*

43. A.P. Isaev, O.V. Ogievetsky, *Braids, Shuffles and Symmetrizers*, J.Phys. A 42 (2009) 304017.

44. A.P. Isaev, P.N. Pyatov, "Spectral extension of the quantum group cotangent bundle", *Commun.Math.Phys.* **288**, *1137-1179 (2009).*

45. E.A. Ivanov, A.V. Smilga, "Cryptoreality of nonanticommutative Hamiltonians", *JHEP* **0707**, *036 (2007); [arXiv:hep-th/0703038].*

46. E. Ivanov, O. Lechtenfeld, A. Sutulin, "Hierarchy of N=8 Mechanics Models", *Nucl. Phys. B* **790**, *493-523 (2008); [arXiv:hep-th/0705.3064].*

47. E. Ivanov, "Supersymmetrizing Landau models", *Theor. Math. Phys.* **154**, *349-361 (2008); [arXiv:hep-th/0705.2249].*

48. V. Kazakov, A. Sorin, A. Zabrodin, "Supersymmetric Bethe Ansatz and Baxter Equations from Discrete Hirota Dynamics", *Nucl. Phys. B* **790**, *345-413 (2008); [arXiv:hep-th/0703147].*

49. S. Khoroshkin, S. Pakuliak, "Generating series for nested Bethe vectors", *SIGMA* **4**, *081 (2008); [arXiv:0810.3131].*

50. S. Khoroshkin, S. Pakuliak, "A computation of an universal weight function for the quantum affine algebra $U_q(\widehat{gl}_N)$", *J. Math. of Kyoto University* **48**, *277–321 (2008).*

51. S. Khoroshkin, S. Pakuliak, V. Tarasov, "Off-shell Bethe vectors and Drinfeld currents", *J. Geom. and Phys.* **57**, *1713–1732 (2007).*

52. S. Khoroshkin, S. Pakuliak, "Method of projections of Drinfeld currents", *Amer. Math. Soc. Translations* **221***(2), 157–172 (2007).*

53. S. Khoroshkin, S. Pakuliak, "Method of projections and universal weight function for the quantum affine algebra $U_q(\widehat{sl}_{N+1})$". *Theor. and Math. Phys.* **150***(2), 179–192 (2007).*

54. S. Krivonos, A. Nersessian, V. Ohanyan, "Multi-center MICZ-Kepler system, supersymmetry and integrability", *Phys. Rev. D* **75**, *085002 (2007); [arXiv:hep-th/0611268].*

55. S.O. Krivonos, A. Shcherbakov, "Hyper-Kahler manifolds and nonlinear supermultiplets", *Phys. Part. Nucl. Lett.* **4**, *55-59 (2007) [Pisma Fiz. Elem. Chast. Atom. Yadra 2007N1, 91-98 (2007)].*

56. A. Lambrecht, I. Pirozhenko, L. Duraffourg and Ph. Andreucci, "The Casimir effect for silicon and gold slabs", *Europhys. Lett.* **77**, *44006 (2007).*

57. A. Lambrecht, I. Pirozhenko, "The Casimir force between dissimilar mirrors and the role of the surface plasmons", *Phys. Rev. A* **77**, *013811 (2008).*

58. O. Lechtenfeld and A.D. Popov, "Noncommutative solitons in a supersymmetric chiral model in 2+1 dimensions", *J. High Energy Phys.* **06**, *065 (2007).*

59. O. Lechtenfeld, A.D. Popov and R.J. Szabo, "$SU(3)$-equivariant quiver gauge theories and nonabelian vortices", *J. High Energy Phys.* **08**, *093 (2008).*

60. W. Miller Jr., E.G.Kalnins and G.S.Pogosyan, "Exact and quasi-exact solvability of second order superintegrable quantum systems. II. Relations to separation of variables", *J. Math. Phys.* **48**, *023503 (2007).*

61. V.V. Nesterenko, "Instability of classical dynamics in theories with higher derivatives", *Phys. Rev. D* **75**, *No. 8, 087703 (2007).*

62. V.V. Nesterenko, A. Feoli, G. Lambiase and G. Scarpetta, "Electromagnetic shape resonances of a dielectric sphere and radiation of portable telephones", *Mod. Phys. Lett.* **B**, *22, No. 10, 735–742 (2008).*

63. V.V. Nesterenko, "Surface modes and photonic modes in Casimir calculations for a compact cylinder", *J. Phys. A: Math. & Theor.* **41**, *No. 16, 164005 (2008).*

64. Sh. Nojiri, S.D. Odintsov, P.V. Tretyakov, "From inflation to dark energy in the non-minimal modified gravity", *Prog. Theor. Phys. Suppl.* **172**, *81–89 (2008).*

65. S. Pakuliak, V. Rubtsov, A. Silantyev, "SOS model partition function and the elliptic projections", *J. Phys. A: Math. Theor.* **41**, *295204 (2008).*

66. S. Pakuliak, V. Rubtsov, A. Silantyev, "Classical elliptic current algebras. I", *J. Generalized Lie Theory and Applications* **2**, *No. 2, 65–78 (2008).*

67. S. Pakuliak, V. Rubtsov, A. Silantyev, "Classical elliptic current algebras. II", *J. Generalized Lie Theory and Applications* **2**, *No. 2, 79–93 (2008).*

68. M. Piatek, V.N. Pervushin, A.B. Arbuzov, "Generating Functional for Bound States in QED", *Fizika B* **17**, *189-196 (2008); [arXiv:hep-th/0810.5199].*

69. I. Pirozhenko, A. Lambrecht, "Influence of slab thickness on the Casimir force", *Phys. Rev. A* **77**, *013811 (2008).*

70. I. Pirozhenko, A. Lambrecht, "Casimir repulsion and metamaterials", *J. Phys. A: Math. Theor.* **41**, *No. 16, 164015 (2008).*

71. A.D. Popov and M. Wolf, "Hidden symmetries and integrable hierarchy of the N=4 supersymmetric Yang-Mills equations", *Commun. Math. Phys.* **275**, *685 (2007).*

72. A.D.Popov, "Sigma models with N=8 supersymmetries in 2+1 and 1+1 dimensions", *Phys. Lett. B* **647**, *509 (2007).*

73. A.D. Popov, "Explicit nonabelian monopoles and instantons in SU(N) pure Yang-Mills theory", *Phys. Rev. D* **77**, *125026 (2008).*

74. A.D. Popov, "Nonabelian vortices on Riemann surfaces: an integrable case", *Lett. Math. Phys.* **84**, *139 (2008).*

75. N.A. Tyurin, "Geometric quantization and algebraic lagrangian geometry", *London Math. Soc. Lecture Notes* **338**, *279 - 318 (2007).*

76. Н.А. Тюрин, "Универсальный класс Маслова бор - зоммерфельдова лагранжева вложения в псевдоэйнштейново многообразие", *Теор.Мат Физ.* **150**, *No. 2, 325 - 337 (2007).*

77. Тюрин Н.А., ”Бирациональные отображения и специальные лагранжевы слоения”, *Труды Математического института им. В. А. Стеклова РАН* **264** *(2009).*

78. Тюрин Н.А., ”О лагранжевых торах в проективной плоскости”, *Теоретическая и Математическая физика* **158**, *3-22 (2009).*

79. B.M. Zupnik, “Reality in noncommutative gravity”, *Class. Quant. Grav.* **24**, *15-26 (2007); [arXiv:hep-th/0512231].*

80. B.M. Zupnik, “Chern-Simons theory in SO(5)/U(2) harmonic superspace”, *Theor. Math. Phys.* **157**, *1550-1564 (2008); [arXiv:hep-th/0802.0801].*

81. B.M. Zupnik, “Chern-Simons D=3, N=6 superfield theory”, *Phys. Lett. B* **660**, *254-259 (2008); [arXiv:hep-th/0711.4680].*

ARTICLES ACCEPTED FOR PUBLICATIONS

1. С.А. Белев, Н.А. Тюрин, ”Неторические лагранжевы слоения торических многообразий Фано”, *Математические заметки, accepted.*

2. I.L. Bogolubsky, V.G. Bornyakov, G. Burgio, E.-M. Ilgenfritz, V.K. Mitrjushkin, and M. Müller-Preussker, ”Improved Landau gauge fixing and suppression of finite-volume effects of the lattice gluon propagator”, *Phys. Rev. D, to be published; [arXiv:hep-lat/0707.3611].*

3. I.L. Bogolubsky, V.G. Bornyakov, G. Burgio, E.-M. Ilgenfritz, V.K. Mitrjushkin, M. Müller-Preussker, and P. Schemel, ”The Landau gauge gluon propagator: Gribov problem and finite-size effects”, *PoS (Lattice 2007)* **318**, *to be published; [arXiv:hep-lat/0710.3234].*

4. A. Borowiec, J. Lukierski and V.N. Tolstoy, ”Once again about quantum deformations of D=4 Lorentz algebra: twistings of q-deformation”, *Eur. Phys. J. C, published online DOI 10.1140/epjc/s10052-008-0694-3; [arXiv:hep-th/0804.3305].*

5. J.Broedel, T.A. Ivanova and O. Lechtenfeld, “Construction of noncommutative instantons in 4k dimensions”, *to appear in Mod. Phys. Lett. A.*

6. I.L. Buchbinder, E.A. Ivanov, O. Lechtenfeld, I.B. Samsonov, B.M. Zupnik, “Gauge theory in deformed N = (1,1) superspace”, accepted for publishing in EChAYa *[arXiv:hep-th/0709.3770].*

7. I.L. Buchbinder, E.A. Ivanov, O. Lechtenfeld, N.G. Pletnev, I.B. Samsonov, B.M. Zupnik, “ABJM models in N=3 harmonic superspace”, *[arXiv:hep-th/0811.4774].*

8. F. Delduc, O. Lechtenfeld, A.S. Sorin, ”$N = 2$ supersymmetric unconstrained matrix GNLS hierarchies are consistent”, *to appear in Lett. Math. Phys; [arXiv:0708.1125].*

9. E.G.Kalnins, J.M.Kress, W.Miller Jr., and G.S.Pogosyan, ”Non degenerate superintegrable systems in n dimensional complex Euclidean space”, *Phys. Atom. Nucl., to appear*

10. V.V. Nesterenko, "Surface modes and photonic modes in Casimir calculations for a compact cylinder", *J. Phys. A: Math. & Theor. , accepted.*

11. V.V. Nesterenko, A. Feoli, G. Lambiase, G. Scarpetta, " Electromagnetic shape resonances of a dielectric sphere and radiation of portable telephones", *Mod. Phys. Lett. B, accepted.*

12. I. Pirozhenko, A. Lambrecht, "Influence of slab thickness on the Casimir force", *Phys. Rev. A, accepted.*

13. I. Pirozhenko, A. Lambrecht, "Casimir repulsion and metamaterials", *J. Phys. A, accepted.*

14. A.D. Popov, "Bounces/Dyons in the plane wave matrix model and SU(N) Yang-Mills theory", *Mod. Phys. Lett. A, in print; [arXiv:hep-th/0804.3845].*

PREPRINTS AND DATA BASES

1. A.B. Arbuzov, B.M. Barbashov, A. Borowiec, V.N. Pervushin, S.A. Shuvalov, A.F. Zakharov, "Is it possible to estimate the Higgs Mass from the CMB Power Spectrum?", arXiv:0802.3427.

2. S. Bellucci, S. Krivonos, O. Lechtenfeld, A. Shcherbakov, "Superfield Formulation of Nonlinear N=4 Supermultiplets", *preprint CERN-PH-TH-2007-194, ITP-UH-23-07 (2007); [arXiv:hep-th/0710.3832].*

3. A. Borowiec and A. Pachol, "$\kappa-$Minkowski spacetime as the result of Jordanian twist deformation", arXiv:math-ph/0812.0576.

4. J.Broedel, T.A. Ivanova and O. Lechtenfeld, "Construction of noncommutative instantons in 4k dimensions", arXiv:hep-th/0703009.

5. R. Chingangbam, M. Sami, P. V. Tretyakov, A.V. Toporensky, "A Note on the Viability of Gauss-Bonnet Cosmology", arXiv:0711.2122.

6. D.J. Cirilo-Lombardo, N.G. Sanchez, "Microcanonical model for a gaz of evaporating black holes and strings, scattering amplitudes and mass spectrum", arXiv:0708.0393 [hep-th].

7. B.G. Dimitrov, "Algebraic Geometry Approach in Theories with Extra Dimensions I. Application of Lobachevsky Geometry", arXiv:0810.1501 [hep-th].

8. B.G. Dimitrov, "Algebraic Geometry Approach in Theories with Extra Dimensions II. Tensor Length Scale, Compactification and Rescaling in Low-Energy Type I String Theory", arXiv:0810.1503 [hep-th].

9. B.G. Dimitrov, "Block-Structure Method for the Solution of the Matrix System of Equations $g^{ij}g_{jk} = \delta^i_k$ in the N-dimensional Case", arXiv:0810.5312 [hep-th].

10. S. Fedoruk, E. Ivanov, O. Lechtenfeld, "Supersymmetric Calogero models by gauging", arXiv:0812.4276 [hep-th].

11. S. Fedoruk, J. Lukierski, “Purely twistorial string with canonical twistor field quantization”, arXiv:0811.3353 [hep-th].

12. A. T. Filippov, ”A New Integrable Model of (1+1)-Dimensional Dilaton Gravity Coupled to Toda Matter”, arXiv:0801.1312v1 [hep-th].

13. L. Frappat, S. Khoroshkin, S. Pakuliak, E. Ragoucy. ”Bethe Ansatz for the Universal Weight Function”, arXiv:0810.3135 [math.QA].

14. P. Fre, A.S. Sorin, ”The arrow of time and the Weyl group: all supergravity billiards are integrable”, arXiv:0710.1059 [hep-th].

15. Fursaev, D.V. “Entanglement Entropy in Quantum Gravity and the Plateau Problem”, arXiv:0711.1221 [hep-th].

16. G. von Gehlen, N. Iorgov, S. Pakuliak, V. Shadura, Yu. Tykhyy, “Form-factors in the Baxter-Bazhanov-Stroganov model II: Ising model on the finite lattice“, arXiv:0711.0457 [nlin.SI].

17. C. Gutschwager, T.A. Ivanova and O.Lechtenfeld, “Scattering of noncommutative waves and solitons in a supersymmetric chiral model in 2+1 dimensions”, arXiv:0710.0079 [hep-th].

18. A. P. Isaev, “Operator approach to analytical evaluation of Feynman diagrams”, arXiv:0709.0419 [hep-th].

19. A.P.Isaev, O.V.Ogievetsky, A.F. Os’kin, ”Chain models on Hecke algebra for corner type representations”, arXiv:0710.0261 [math.QA].

20. A.P. Isaev, S.O. Krivonos, O.V. Ogievetsky, “BRST charges for finite nonlinear algebras”, arXiv:0807.1820 [math-ph].

21. A. P. Isaev, A. I. Molev, ”Fusion procedure for the Brauer algebra”, arXiv:0812.4113 [math.QA].

22. E.A. Ivanov, “Supersymmetric variants of the Landau model”, *submitted to the Collection of Papers devoted to 100-th Anniversary of the Birthday of Academician L.D. Landau, to be published by the Edotorial Board of the Kharkiv State University, Kharkiv, Ukraine.*

23. E. Ivanov, “Gauged supersymmetric mechanics”, *Probl. Mod. Theor. Phys., Volume in honour of Prof. I.L. Buchbinder in the occasion of his 60th birhday, Tomsk, 197 - 207 (2008).*

24. S. Khoroshkin, S. Pakuliak, “A computation of an universal weight function for the quantum affine algebra $U_q(\widehat{gl}_N)$“, arXiv:0711.2819 [math.QA].

25. O. Lechtenfeld, A.D. Popov and R.J. Szabo, “Quiver gauge theory and noncommutative vortices”, arXiv:0706.0979 [hep-th].

26. A. Oskin, S. Pakuliak, A. Silantyev. “On the universal weight function for the quantum affine algebra $U_q(\widehat{gl}_N)$“, arXiv:0711.2821 [math.QA].

27. S. Pakuliak, V. Rubtsov, A. Silantyev, "Classical elliptic current algebras", *J. Generalized Lie Theory and Applications, submitted*; arXiv:0709.3592 [math.QA].

28. I.B. Pestov, "Self-Organization of Physical Fields and Spin", *Preprint JINR, E2–2008–93, Dubna, 2008.*

29. N.A. Tyurin, "On families of BS_{can} lagrangian tori in the projective spaces", arXiv:0708.1605.

30. N.A. Tyurin, "Three conjectures on lagrangian tori in the projective plane", arXiv:0712.1495.

31. N.A.Tyurin, "Pseudo toric Lagrangian fibrations of toric and non toric Fano varieties", *Max Plank Institute preprint, MPI 09-29 (2009).*

32. B.M. Zupnik, "Chern-Simons D=3, N=6 superfield theory", arXiv:0711.4680 [hep-th].

33. B.M. Zupnik, "Supersymmetric Chern-Simons models in harmonic superspaces", *Probl. Mod. Theor. Phys., Volume in honour of Prof. I.L. Buchbinder in the occasion of his 60th birhday, Tomsk, 349 - 356 (2008).*

CONFERENCE CONTRIBUTIONS

1. V.de Alfaro, A.T.Filippov, "Two-Dimensional Dilaton Gravity and Toda - Liouville Integrable Models", *To be published in Proceedings of 'QUARKS-2008', Sergiev Posad, 23-29 May, 2008; [arXiv:hep-th/0811.4501].*

2. A. Borowiec, J. Lukierski and V.N. Tolstoy, "New twisted quantum deformations of $D = 4$ super-Poincare algebr", arXiv:0803.4167v2 [hep-th], to appear in Quantum Symmetries" (SQS'07) (Dubna,30.07 - 4.08, 2007), eds S. Fedoruk, E. Ivanov.

3. F. Delduc, E. Ivanov, "Gauging isometries in N=4 supersymmetric mechanics", *Proceedings of the International Workshop "Supersymmetries and Quantum Symmetries" (SQS'07), Dubna, Russia, 30 Jul - 4 Aug 2007; preprint JINR E2-2008-83, 324-333 (2008); [arXiv:hep-th/0801.4521].*

4. S. Fedoruk, E. Ivanov, "New model of higher-spin particle", *Proceedings of 12th International Conference on Symmetry Methods in Physics (SYMPHYS-12), Yerevan, Armenia; [arXiv:hep-th/0701177].*

5. S. Fedoruk, J. Lukierski, "Twistorial and space-time descriptions of D=4 string models", *Proceedings of 22nd Max Born Symposium on Quantum, Super and Twistors, Wroclaw, Poland; [arXiv:hep-th/0701182].*

6. S. Fedoruk, A. Frydryszak, J. Lukierski, C. Miquel-Espanya, "Massive Particle Model with Spin from a Hybrid (spacetime-twistorial) Phase Space Geometry and Its Quantization", *Proceedings of 22nd Max Born Symposium on Quantum, Super and Twistors, Wroclaw, Poland; [arXiv:hep-th/0702050].*

7. E. Ivanov, "Nonlinear Realizations in Tensorial Superspaces and Higher Spins", *Proceedings of 22nd Max Born Symposium on Quantum, Super and Twistors, Wroclaw, Poland; [arXiv:hep-th/0703056].*

8. E. Ivanov, "Supersymmetrizing Landau models", *Proceedings of International Workshop on Classical and Quantum Integrable Systems (CQIS 2007), Dubna, Russia, 2007; [arXiv:hep-th/0705.2249].*

9. E.G.Kalnins, W.Miller Jr. and G.S.Pogosyan, "Exact and quasi-exact solvability of second order superintegrable quantum systems", *The IMA Volumes in Mathematica and its Applications, Volume 144, Editors: M.Eastwood and W.Miller, Jr. "Symmetries and Overdetermined Systems of Partial Differential Equation", Springer, pages 431-444, 2008. (Institute for Mathematics and its Applications 2006 Summer Program). Minneapolis, USA, July 17 - August 04, 2006.*

10. O. Lechtenfeld, A.D. Popov and R.J. Szabo, "Quiver gauge theory and noncommutative vortices", *Talk given at 21st Nishinomiya-Yukawa Memorial Symposium on Theoretical Physics: Noncommutative Geometry and Quantum Space-Time in Physics, Nishinomiya and Kyoto, Japan, 11-15 Nov 2006.*

11. V.V. Nesterenko, "Surface modes and photonic modes in Casimir calculations for a compact cylinder", *the 8-th Workshop on Quantum field theory under the influence of external conditions, September 16-21, 2007, Leipzig, Germany.*

12. V.V. Nesterenko (invited talk), *Международной конференции "Интегралы по путям - Новые тенденции и перспективы" (23 - 28 сентября 2007 г, Дрезден, Германия).*

13. I.B. Pestov, "Spin and Geometry", *In: "Relativistic Nuclear Physics and Quantum Chromodynamics", Eds. A.N.Sissakian, V.V.Burov, A.I.Malakhov, Vol. II, 289-299 (2008); Proceedings of the XVIII International Baldin Seminar on High Ehergy Physics Problems, Dubna September 25-30, 2006.*

14. I.B. Pestov, "Spin Physics and Self-Organization of Physical Fields", *In: "Relativistic Nuclear Physics and Quantum Chromodynamics". Dubna 2008, p.72. Book of Abstracts of the XIX International Baldin Seminar on High Energy Physics Problems, Dubna, Russia, 29 September – 4 October, 2008.*

15. I.B. Pestov, "The essence of time and Cosmology", *In: "13 Russian Gravitational Conference - International conference on Gravitation, Cosmology and Astrophysics. Abstracts", Moscow 2008, p. 102-103.*

16. I. Pirozhenko, A. Lambrecht, "Influence of slab thickness on the Casimir force", *(poster), at 10eme Colloque sur les Lasers et l'Optique Quantique, 2-5 July, 2007, Grenoble, France.*

17. I. Pirozhenko, A. Lambrecht, "Metamaterials and Casimir repulsive force" *(poster), at the International School "Thermal Radiation at the nanoscale: forces, heat transfer, coherence", May 21-25, 2007, Les Houches , France.*

18. I. Pirozhenko, A. Lambrecht, "Casimir repulsion and metamaterials", *(oral presentation), at the 8-th Workshop on Quantum field theory under the influence of external conditions, September 16-21, 2007, Leipzig, Germany.*

19. V.K. Tintschev, "Reduction of equations in the model of interaction between beam and residual gases", *Proc. of the Conference "Nonlinear Phenomena In Complex Systems, XV Annual Seminar", Minsk, Belarus 20–23.05.2008.*

20. B.M. Zupnik, "Gauge model in D=3, N=5 harmonic superspace", *Proceedings of 7th International Workshop on Supersymmetries and Quantum Symmetries (SQS 07), Dubna, Russia, 30 Jul - 4 Aug 2007; [arXiv:hep-th/0708.3951].*