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GEOMETRY AND PHYSICS

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Sponsored by

LIST OF PARTICIPANTS

Spyridon Afentoulidis Almpanis
Anton Alekseev
Teresa Arias-Marco
Russell Avdek
Denis Bashkirov
Aditya Basu
Daniel Bedats
Zdeněk Bill
Samuel Blitz
Konrad Brandts
Andreas Čap
Alessandro Carotenuto
Darek Cidlinský
Gabriella Clemente
Carlo Alberto Cremonini
Martin Čadek
Georgios Dimitroglou Rizell
Martin Doležal
Boris Doubrov
Maciej Dunajski
Zdeněk Dušek
Serhii Dylda
Rui Loja Fernandes
Ana Cristina Ferreira
Joel Fine
Anton Galaev
Alfonso Garmendia
Roman Golovko
Ángel González-Prieto
Jan Gregorovič
Karmen Grizelj
Zhagnwen Guo
Leszek Hadasz
Pavel Hájek
Christoph Harrach
Md Fazlul Hoque
Stanislav Hronek
Ondřej Hulík
Goce Chadzitaskos
Josef Janyška
Branislav Jurčo
Johnson Allen Kessy
Igor Khavkine
Peter Kristel
Boris Kruglikov
Lukáš Krump
Andrey Krutov
Svatopluk Krýsl
Radosław Kycia
Roman Lávička
Matti Lyko
Tibor Macko
Omid Makhmali
Mauro Mantegazza
Antonella Marchesiello
Martin Markl
Michal Marvan
David Duncan McNutt
Peter Michor
Eva Miranda
Pau Mir Garcia
Timothy Moy
Stefan Nemirovski
Jan Novák
Réamonn Ó Buachalla
Felix Physiker
Svilen Popov
Tomáš Procházka
Roland Púček
Ajay Raj
Aashis Rana
Dominik Rist
Paolo Rossi
Tomáš Rusin
Katja Sagerschnig
Martin Schnabl
Eivind Schneider
Maibach Sid
Mária Šimková
Jan Slovák
Libor Šnobl
Vladimír Souček
Wijnand Steneker
Karen Strung
David Sykes
Josef Šilhan
Dennis The
Vít Tuček
Fridrich Valach
Rikard von Unge
Gideon Vos
Jan Vysoký
Henrik Winther
Lenka Zalabová
Martin Zika

ANNOUNCED LECTURES

A. Invited lectures

Anton Alekseev: *Virasoro Hamiltonian spaces and 2D-1D duality*
Rui Loja Fernandes: *Solving Cartan's realization problems*
Joel Fine: *Knots, minimal surfaces and J-holomorphic curves*
Boris Kruglikov: *Supersymmetries of geometric structures*
Eva Miranda: *From fluid computers to escape trajectories: Two sides of a mirror*
Stefan Nemirovski: *Lorentz geometry and contact topology*

B. Other lectures

Spyridon Afentoulidis Almpanis: *Dirac cohomology for the BGG category* $\mathcal{O}$
Teresa Arias-Marco: *4-dimensional Riemannian homogeneous manifolds*
Samuel Blitz: *Toward a Classification of Conformal Hypersurface Invariants*
Andreas Čap: *BGG sequences and generalizations of the Korn inequality*
Alessandro Carotenuto: *TBA*
Gabriella Clemente: *Curvature in almost-complex and complex geometry*
Carlo Alberto Cremonini: *Branes, kappa symmetry and all that*
Georgios Dimitroglou Rizell: *Quantitative perspective on Legendrians and non-Legendrians, and applications to* C^0*-contact topology*
Martin Doležal: *Geometric structure of a variation of the 3-link snake robot model*
Boris Doubrov: *Homogeneous deformations of the adjoint orbit of* $\mathfrak{sl}(3)$
Maciej Dunajski: *Conformal geodesics can not spiral*
Zdeněk Dušek: *Structure of geodesics for Finsler geodesic orbit (*α,β*)-metrics*
Serhii Dylda: *Algebraic Surgery over simplicial complexes and ball complexes*
Ana Cristina Ferreira: *Geometry of spaces of split skew torsion*
Anton Galaev: *Losik classes and Reeb foliations*
Alfonso Garmendia: *Lie Algebroids, Groupoids and Quantization*
Roman Golovko: *On non-geometric augmentations of Legendrian submanifolds*
Ángel González-Prieto: *Topological Quantum Field Theories in representation theory*
Jan Gregorovič: *On integrability of compatible G-structures*
Karmen Grizelj: *Transgression in the relative Weil algebra*
Zhagnwen Guo: *Interpreting the standard cotractor connection associated to a (generalized) path geometry*
Leszek Hadasz: *Non-rational* $\widehat{su}(2)$ *cosets and Liouville field theory*

Christoph Harrach: *On the relation between discrete series representations and BGG-complexes*

Md Fazlul Hoque: *Nonstandard integrable and superintegrable classical systems in non-vanishing magnetic fields*

Stanislav Hronek: *Quantum corrections in double field theory*

Ondřej Hulík: *TBA*

Goce Chadzitaskos: *Space proper time manifold*

Josef Janyška: *Minimal coupling of gravitational and electromagnetic fields in General Relativity*

Branislav Jurčo: *Colour-kinematics duality, double copy, and homotopy algebras*

Igor Khavkine: *IDEAL characterization of pp-wave spacetimes*

Peter Kristel: *The geometry of Lagrangian subspaces*

Andrey Krutov: *Schubert calculus for the quantum Grassmanianns*

Svatopluk Krýsl: *Schur–Weyl–Howe type duality and ellipticity of twistor complexes in symplectic geometry*

Radosław Kycia: *How to solve parallel transport equation on associated vector bundle*

Roman Lávička: *Massless fields in dimension 4 for any spin*

Tibor Macko: *The homological part of the total surgery obstruction*

Omid Makhmali: *Path geometry of chains and dancing: a characterization for surfaces*

Antonella Marchesiello: *Bifurcations of symmetric resonances*

Michal Marvan: *Matching van Stockum dust to Papapetrou vacuum*

David Duncan McNutt: *Symmetries in the presence of torsion*

Peter Michor: *Pulling back metrics from the space of all Riemannian metrics to the diffeomorphism groups and the elasticity complex*

Pau Mir Garcia: *A b-symplectic Hamiltonian model for dissipative dynamics*

Jan Novák: *Graviton as a phonon and dark energy problem*

Réamonn Ó Buachalla: *Towards a quantum BGG sequence for the A-series full quantum flag manifolds*

Svilen Popov: *On Shelah categoricity conjecture, abstract elementary classes and rich families of models*

Tomáš Procházka: *Bethe equations and 2d CFT*

Roland Púček: *Separable geometries and new examples of extremal Kähler metrics*

Ajay Raj: *Classification Problems of Sphere Bundles Over Spheres*

Dominik Rist: *Non-Abelian Gerbes with Connections*

Tomáš Rusin: *Bounds for the cup-length of some oriented Grassmann manifolds*

Katja Sagerschnig: *Parabolic quasi-contact cone structures with an infinitesimal symmetry*

Martin Schnabl: *Conformal Perturbation Theory from String Field Theory*

Eivind Schneider: *Finding ODEs that are invariant under a given Lie algebra of vector fields*

Mária Šimková: *Are two finite H-spaces homotopy equivalent?*

Jan Slovák: *Applications of Finsler geometry in Medical Imaging*

Libor Šnobl: *Pairs of commuting quadratic elements in the universal enveloping algebra of Euclidean algebra and integrals of motion*

Vladimír Souček: *Grushin complexes as generalized BGG complexes*

Wijnand Steneker: *Killing tensors in Koutras–McIntosh spacetimes*

Karen Strung: *Realising quantum flag manifolds as graph* C^**-algebras*

David Sykes: *Constant nilpotent symbol CR hypersurfaces from multi-weighted homogeneous polynomials*

Josef Šilhan: *Variational characterization of circles in low dimensions*

Dennis The: *On uniqueness of submaximally symmetric geometric structures*

Vít Tuček: *Applications of flag manifolds*

Fridrich Valach: *On G-algebroids*

Rikard von Unge: *New techniques for gauge theories in Projective superspace*

Gideon Vos: *Holography for bulk states in* $3d$ *quantum gravity*

Jan Vysoký: *Palatini variation in supergravity*

Henrik Winther: *Compact and Non-Compact Parabolic Space Forms*

Lenka Zalabová: *Conformal Killing trajectories on conformal Riemannian sphere*

Martin Zika: *Correspondences of Quantum* L_∞ *Algebras*

ABSTRACTS

Spyridon Afentoulidis Almpanis: *Dirac cohomology for the BGG category $\mathcal{O}$*
Dirac operators were used in the context of Representation Theory by Parthasarathy in 1972, as invariant first order differential operators acting on sections of homogeneous vector bundles over symmetric spaces G/K in order to obtain realizations of the discrete series representations of G. In a series of lectures in 1997, Vogan introduced an algebraic analogue of Parthasarthy's Dirac operator. By using this operator, he defined the so-called Dirac cohomology of $(\mathfrak{g}, K)$-modules X and conjectured a relation between the Dirac cohomology of X and its infinitesimal character, proved by Huang and Pandžić in 2001. Since then, Dirac cohomology has been computed for various families of modules, including highest weight modules, $A_{\mathfrak{q}}(\lambda)$ modules, generalized Enright-Varadarajan modules, unipotent representations, etc. In this talk, we will present some results concerning Dirac operators for modules belonging to the standard BGG category $\mathcal{O}$ of a complex semisimple Lie algebra $\mathfrak{g}$. This category consists of the finitely generated, locally $\mathfrak{n}$-finite weight modules of $\mathfrak{g}$ and seems to be the "correct"module category to study questions raised by Verma concerning composition series and embeddings of Verma modules, and Jantzen concerning his so-called translation functors.

Anton Alekseev: *Virasoro Hamiltonian spaces and 2D-1D duality*
Recent progress in the Jackiw-Teitelboim (JT) gravity led to discovery of an interesting 2D-1D duality pioneered by Saad-Shenker-Stanford. The 1D part of this duality is the Schwarzian theory on the Teichmueller orbit of the Virasoro algebra. In this lecture series, we attempt to give a mathematical interpretation of (part of) these results. We start with a finite dimensional Hamiltonian geometry and recall the notions of symplectic reduction and equivariant localization. We will then focus on Hamiltonian geometry of Virasoro actions. The main examples include Virasoro coadjoint orbits and moduli spaces of hyperbolic metrics on 2-manifolds. The latter example makes contact to the JT gravity. The 2D-1D duality arises as equivalence between these two types of examples. These lectures are based on joint works with O. Chekeres, E. Meinrenken, S. Shatashvili and D. Youmans. Plan: Lecture 1: Introduction. Finite dimensional Hamiltonian geometry: Darboux charts, Marsden-Weinstein reduction, Duistermaat-Heckman localization. Lecture 2: Hamiltonian geometry of Virasoro actions. Classification of coadjoint orbits. Darboux charts and Stanford-Witten integrals. Lecture 3: Moduli of hyperbolic metrics on 2-manifolds. Mathematical interpretation of 2D-1D duality.

Teresa Arias-Marco: *4-dimensional Riemannian homogeneous manifolds*
Four-dimensional Riemannian homogeneous spaces have been classified by Ishihara. Moreover, Bérard-Bergery proved that the simply connected ones are either symmetric, or isometric to a Lie group equipped with a left-invariant Riemannian metric. We shall speak about the reason for revising the last afirmation.

Samuel Blitz: *Toward a Classification of Conformal Hypersurface Invariants*
Hermann Weyl's classical invariant theory has been instrumental in the study of myriad geometrical systems. In the setting of hypersurfaces embedded in Riemannian manifolds, Gover and Waldron extended this classification to show that all (natural and local) hypersurface invariants can be expressed in terms of the ambient curvature, the boundary conormal, the second fundamental form, and their derivatives. In this talk, we consider the setting of a hypersurface embedded in an even-dimensional conformal manifold. We then construct a finite and minimal family of hypersurface tensors—the curvatures intrinsic to the hypersurface and the so-called

"conformal fundamental forms"—that enable the construction of every (natural, local) conformal hypersurface invariant that is expressible in terms of sufficiently few derivatives of the ambient metric. Further extensions of this result to a broader family of conformal hypersurface invariants is the subject of ongoing work.

Andreas Čap: *BGG sequences and generalizations of the Korn inequality*
The classical Korn inequality is an important tool in applied mathematics (elasticity theory). It contains a symmetrized derivative that can be interpreted as the Killing operator for a flat metric on a domain in $\mathbb{R}^n$ acting on non-smooth (Sobolev) vector fields. In my talk, I will discuss a simplified version of the BGG machinery which on Riemannian manifolds applies in a Sobolev setting. I will then sketch how this machinery can be used to prove a generalization of the Korn inequality on Riemannian manifolds which involves any first BGG operator of order one.

Alessandro Carotenuto: *TBA*
TBA

Gabriella Clemente: *Curvature in almost-complex and complex geometry*
The interplay between the almost-complex and Riemannian geometries of a manifold can be perceived through curvature. For instance, non-flat constant curvature Riemannian metrics obstruct the existence of certain special complex structures. The question of whether there can be a (compact) almost-complex manifold of real dimension at least 6 that is not complex remains unanswered. The aim of this talk will be to explore the more tractable, related question: what is the effect of constraining the various curvatures of a Riemannian metric on integrability in the almost-hermitian setting?

Carlo Alberto Cremonini: *Branes, kappa symmetry and all that*
We will describe the ongoing project related to (super)branes and their relation with Chevalley-Eilenberg cohomology. The project is in collaboration with B. Jurčo and P.A. Grassi.

Georgios Dimitroglou Rizell: *Quantitative perspective on Legendrians and non-Legendrians, and applications to C^0-contact topology*
In a recent joint work with M. Sullivan we show the following three results: First, we use pseudoholomorphic curve techniques to show a rigidity results: the Chekanov-Hofer-Shelukhin distance is non-degenerate on closed Legendrian submanifolds. Second, we generalize a flexibility result by Rosen-Zhang: the Chekanov-Hofer-Shelukhin distance vanishes on the space of parameterized non-Legendrian submanifolds. Third, we use the latter result to show that the image of a Legendrian submanifold under a homeomorphism that is the C^0-limit of a sequence of contactomorphisms is again Legendrian, under the additional assumption that the image is smooth.

Martin Doležal: *Geometric structure of a variation of the 3-link snake robot model*

Boris Doubrov: *Homogeneous deformations of the adjoint orbit of $\mathfrak{sl}(3)$*
We present the classification of all locally homogeneous embeddings $M^3 \to P^7$ of 3-dimensional contact manifolds into 7-dimensional projective space that have the symbol as the projectivized adjoint orbit of the Lie group SL(3). This includes a unique non-flat model with 4-dimensional symmetry and several families of embeddings with 3-dimensional (simply transitive) symmetry.

Maciej Dunajski: *Conformal geodesics can not spiral*
We show that conformal geodesics on a Riemannian manifold cannot spiral: there does not exist a conformal geodesic which becomes trapped in every neighbourhood of a point.

Zdeněk Dušek: *Structure of geodesics for Finsler geodesic orbit (α, β) metrics*
If a homogeneous Riemannian geodesic orbit metric admits a modification to a homogeneous Finsler (alpha,beta) metric, this Finsler metric is also geodesic orbit metric. This fact was proved recently by the description of the geodesic graph for the modified metric. This phenomenon will be illustrated with examples.

Serhii Dylda: *Algebraic Surgery over simplicial complexes and ball complexes*
This talk will make an introduction to the topic of Algebraic Surgery theory in the context of algebraic bordism categories over simplicial complexes, including minimal toolset needed: algebraic bordisms, chain dualities, L-theory. We will discuss problems that arise in this context, e.g. product formulas for visible signature and total surgery obstruction, and will proceed with a proposed solution to these: generalization from algebraic bordism categories over simplicial complexes to those over ball complexes.

Rui Loja Fernandes: *Solving Cartan's realization problems*
Robert Bryant formalized a method originally due to Élie Cartan to solve many classification problems in Differential Geometry – hence, also in Mathematical-Physics – in a format which he called a Cartan realization problem. Bryant also observed that the local solutions to the problem involved a form of Lie's Third Theorem for Lie algebroids. Going one step further, I will explain in these lectures that, by incorporating the structure group into the problem, one can actually extend this approach to find the global solutions and to classify them, allowing to completely solve these type of problems, provided the moduli space is finite dimensional. Throughout the lectures I will attempt to illustrate the method with examples. These lectures are based on joint work with Ivan Struchiner (USP) and on our joint paper "The Global Solutions to Cartan's Realization Problem", arXiv:1907.13614 (to appear in Memoirs of the AMS).

Ana Cristina Ferreira: *Geometry of spaces of split skew torsion*
Generalized Wallach spaces are homogeneous spaces of type III, sometimes also called tri-symmetric spaces in the literature. The 'original' Wallach spaces are those of positive sectional curvature and there exist only three of them in dimensions 6, 12 and 24. The three cases are related to the complex, quarternionic and octonionic division algebras, respectively. The 6-dimensional Wallach space is a flag manifold and has been intensively studied in the literature – it has the remarkable property of carrying both a Kahler and a nearly Kahler metric. In this talk, we will discuss these spaces and their properties in the context of spaces of split skew torsion. Time permitting, we will discuss their Dirac operators and some estimates for the first eigenvalue. This is joint work with Ilka Agricola and Stefan Vasilev (Marburg).

Joel Fine: *Knots, minimal surfaces and J-holomorphic curves*
I will describe a programme to define invariants of a knot or link K in a 3-manifold Y, using an asymptotically hyperbolic 4-manifold M with ideal boundary Y and counting minimal surfaces in M with ideal boundary equal to K. A generalisation of this is to count J-holomorphic curves in an infinite volume symplectic 6-manifold Z, with boundary $\partial Z \cong Y \times S^2$, where the symplectic form blows up in a controlled way at ∂Z. I will focus on the simplest setting, in which this idea has been fully carried out: Let K be a knot in the 3-sphere, viewed as the ideal boundary of hyperbolic 4-space $\mathbb{H}^4$. I will prove that the number of minimal discs in $\mathbb{H}^4$ with ideal boundary K is a knot invariant. I.e. the number is finite and does not change under isotopies of K. To define the count, the knot must be generic in a certain sense and then minimal discs are counted with an appropriate sign. These counts actually give a family of knot invariants, indexed by an integer describing the extrinsic topology of how the disc sits in $\mathbb{H}^4$. These invariants can be seen

as Gromov–Witten invariants counting J-holomorphic discs in the twistor space Z of $\mathbb{H}^4$. Whilst Gromov–Witten theory suggests the general scheme for constructing the minimal disc invariants, there are substantial differences in how this must be carried out in our situation. These are due to the fact that the geometry of both $\mathbb{H}^4$ and Z becomes singular at infinity, and so the J-holomorphic curve equation is degenerate, rather than elliptic, at the boundary. This means that both the Fredholm and compactness arguments involve completely new features, in some places more complicated and in others simpler, when compared with the usual story. Plan of talks: 1. Overview: description of main results for counting minimal surfaces in hyperbolic 4-space; definition of twistor space and the Eells-Salamon correspondence; singular behaviour of J near infinity; conjecture relating counts of minimal surfaces to the HOMFLYPT polynomial; possible extensions to counting minimal surfaces in other asymptotically hyperbolic 4-manifolds and J-holomorphic curves in other symplectic 6-manifolds. 2. Fredholm theory: asymptotic expansion of a J-holomorphic curve; asymptotic expansion of the linearised CR operator; brief review of the 0-calculus; proof that the moduli space of J-holomoprhic curves is a smooth infinite dimensional Banach manifold, and that the boundary map is Fredholm and has index zero. 3. Compactness theory: proof that if a sequence of minimal surfaces has boundaries which converge, then the surfaces also converge near infinity; proof that the corresponding J-holomorphic maps converge to a possibly nodal limit.

Anton Galaev: *Losik classes and Reeb foliations*
Developing ideas of Gelfand's formal geometry, Losik suggested to consider characteristic classes of foliations as elements of cohomology of certain bundles over the leaf spaces of foliations. These classes come from the Gelfand-Fuchs cohomology. In this way, for a codimension-one foliation appear two characteristic classes modifying the classical Godbillon-Vey class. We study these classes for the case of the Reeb foliations on the 3-dimensional sphere. The Godbillon-Vey class of all these foliations is trivial. In contrast, one of the classes under consideration is non-trivial for all Reeb foliations, and it detects the compact leaf with non-trivial holonomy. The other characteristic class is more delicate: it is non-trivial for some Reeb foliations and it is trivial for some other Reeb foliations, i.e., this class is very sensitive to the dynamics of the non-compact leaves and it distinguishes non-diffeomorphic Reeb foliations. The talk is based on joint work with Yaroslav Bazaikin and Pavel Gumenyuk.

Alfonso Garmendia: *Lie Algebroids, Groupoids and Quantization*
This talk will present a case of deformation quantization. In this case the quantization coincides with the convolution algebra of a Connes groupoid. The Connes groupoid can be seen as a real indexed family of groupoids. The 0-index is a Lie algebroid with the sum, given commutative convolution algebra. For any other index the algebra is not commutative.

Roman Golovko: *On non-geometric augmentations of Legendrian submanifolds*

Ángel González-Prieto: *Topological Quantum Field Theories in representation theory*
The algebraic structure of moduli spaces of representations of surface groups (aka character varieties) has been widely studied in the past decades, partially due to their close relation with the moduli spaces of Higgs bundles and flat connections. Nevertheless, very little is known about the geometry of character varieties when we allow poles in the Higgs field, the so-called parabolic setting. In this framework, new singularities arise in the moduli space that prevent the classical methods to work. In this talk, we will introduce a new hope. We will construct a TQFT that encodes the Grothendieck motives of parabolic character varieties and we will apply it to obtain explicit expressions of these motives, even with highly non-generic parabolic data. This

framework also provides a new interpretation of the singularities: at the side of the TQFT they arise as an interference phenomenon that leads to drastic changes in the geometry.

Jan Gregorovič: *On integrability of compatible G-structures*
A K-structure and L-structure are compatible if their intersection induces a $K \cap L$-structure. For example, an almost complex structure and metric that is Hermitian w.r.t. the complex structure induce a $U(n) = GL(n, \mathbb{C}) \cap O(2n)$-structure. I will discuss, how the integrability of compatible $K-$ and L-structures is related to integrability of the induced $K \cap L$-structure. In particular, I will show that there is a condition that ensures that if K- and L-structures admit a torsion free connection preserving the structure, then $K \cap L$-structure admits it, too. If this condition is not satisfied by K and L, then there is intrinsic torsion component of $K \cap L$-structures that is neither intrinsic torsion component for K-structure nor L-structure. I will show an explicit example of a compatible hypercomplex and symplectic structures such that the induced $SO^*(2n)$-structure does not admit a torsion-free connection.

Karmen Grizelj: *Transgression in the relative Weil algebra*
This is a joint work with K. Calvert, A. Krutov and P. Pandžić. Let $\mathfrak{g}$ be a complex semisimple Lie algebra. Kostant proved a so-called "ρ-decomposition"of the Clifford algebra $C(\mathfrak{g})$. He also conjectured that two filtrations on the Cartan subalgebra coincide; the first one comes from grading by degree on the primitive invariants and the second one is given by the principle $\mathfrak{sl}_2$ embedding. It was later proved by Alekseev and Moreau and independently by Joseph. Let G be a real reductive Lie group and $\mathfrak{g}$ be the complexification of its Lie algebra. We assume that $\mathfrak{g}$ is quadratic, meaning that there is a nondegenerate symmetric invariant bilinear form on $\mathfrak{g}$ which is also nondegenerate on $\mathfrak{k}$, the subalgebra of the fixed points of the Cartan involution. With this assumption we obtain an orthogonal Cartan decomposition $\mathfrak{g} = \mathfrak{k} \oplus \mathfrak{p}$. We are interested in the structure of the $\mathfrak{k}$-invariant part of the Clifford algebra $C(\mathfrak{p})$ and finding an analogue of the Kostant Clifford conjecture mentioned above. One of the main tools we used is the realtive version of the transgession map, which was defined by Chevalley in the absolute case. The talk will present new results about those questions, but also conjectures and possible ways to move forward. One possible application would be the Schubert calculus for the corresponding symmetric spaces.

Zhagnwen Guo: *Interpreting the standard cotractor connection associated to a (generalized) path geometry*
A path geometry encodes a class of systems of 2nd order ODEs which have the same unparametrized solution curves and has a corresponding normal regular parabolic geometry. Choosing a so-called Weyl structure, the parabolic geometry can be described explicitly by data on the path geometry. In terms of these data we describe the tractor calculus on the standard cotractor bundle of the parabolic geometry.

Leszek Hadasz: *Non-rational $\widehat{su}(2)$ cosets and Liouville field theory*
During my presentation, I will discuss certain equivalences between conformal field theories with a continuous spectrum: Liouville theory, its supersymmetric extension, and models based on the affine $su(2)$ algebra with irrational level. The discussed results may be of relevance for constructing new relations between knot polynomials.

Christoph Harrach: *On the relation between discrete series representations and BGG-complexes*
In this talk we discuss the relation between discrete series representations on symmetric spaces of real rank 1 and the BGG-complex on their natural boundary. Explicitly, using mainly repre-

sentation theoretical methods we relate sections of the BGG-bundles to differential forms on the interior via equivariant maps. Moreover, for the cases of real and complex hyperbolic space the image of these operators yield a description of discrete series representations in terms of L^2-harmonic forms in the right degree.

Md Fazlul Hoque: *Nonstandard integrable and superintegrable classical systems in non-vanishing magnetic fields*
The talk presents the construction of all nonstandard integrable systems in magnetic fields whose integrals have leading order structures that are elements of the universal enveloping algebra of the three-dimensional Euclidean algebra. We show how these pairs of commuting elements lead to distinct independent integrals of motion in several nonvanishing magnetic fields. We also search for additional first- and second-order integrals of motion of these systems to arrive at superintegrable systems. We construct the corresponding Poisson algebras of integrals of motion. The talk is based on joint work with Libor Šnobl.

Stanislav Hronek: *Quantum corrections in double field theory*
Double field theory is a formalism in string theory used to capture the notion of T-duality. Mathematically it is similar to generalized geometry. I will be interested in the low energy effective limit of string theory, describing a stringy version of gravity, sometimes called "super-gravity". The formalism of double-field theory allows us to write down the quantum α' corrections more systematically than the standard approach. In this talk, I will review my work on these quantum corrections for the bosonic and talk about ongoing work on quantum corrections for the superstring (i.e. including fermions).

Ondřej Hulík: *TBA*

Goce Chadzitaskos: *Space proper time manifold*
Interchanging the function of time and proper time in space-time leads to interesting consequences. The flow of proper time is understood as the distance traveled by the spatial component of space-time, and the time is the distance traveled by a particle (point) in a four-dimensional space. Some interesting implications of this approach are discussed.

Josef Janyška: *Minimal coupling of gravitational and electromagnetic fields in General Relativity*
In covariant formulation of quantum mechanics in a galilean framework (J.Janyška, M.ModugnoM: An Introduction to Covariant Quantum Mechanics, Springer 2022) we found a natural minimal coupling of electromagnetic field with the gravitational connection. Such a coupling works for classical field theory in several directions and also for quantum mechanics. We extend these results to an einsteinian general relativistic framework.

Branislav Jurčo: *Colour-kinematics duality, double copy, and homotopy algebras*
Colour-kinematics duality is a remarkable property of Yang-Mills theory. Its validity implies a relation between gauge theory and gravity scattering amplitudes, known as double copy. Albeit fully established at the tree level, its extension to the loop level is conjectural. Lifting the on-shell, scattering amplitudes-based description to the level of action functionals, we argue that a theory that exhibits tree-level colour-kinematics duality can be reformulated in a way such that its loop integrands manifest a generalised form of colour-kinematics duality. Moreover, we show how the structures of higher homotopy theory naturally describe this off-shell reformulation of colour-kinematics duality.

Igor Khavkine: *IDEAL characterization of pp-wave spacetimes*
An alternative to the well-known Cartan moving frame approach to the invariant characterization of pseudo-Riemanning metric geometries is the so-called IDEAL characterization. It relies on tensorial identities covariantly constructed from the metric and the curvature, without introducing an auxiliary frame. Important black hole and cosmological spacetimes in General Relativity have already been characterized in this way. We examine the strengths and weaknesses of the IDEAL approach on the case of pp-wave spacetimes. Lessons learned from this exercise could help decide whether IDEAL characterization can be upgraded from an ad-hoc to a systematic method.

Peter Kristel: *The geometry of Lagrangian subspaces*
Given a symplectic vector space, we consider the geometry of the Grassmannians of Lagrangian subspaces of that vector space. These Grassmannian play an important role in geometric quantization.

Boris Kruglikov: *Supersymmetries of geometric structures*
In this mini course I will discuss holonomic and nonholonomic supergeometries and their symmetries. It is based on joint works with Andrea Santi, Dennis The and Andreu Llabres. Superanalysis was introduced by Berezin, Leites and Kostant as a common ground for bosonic (even) and fermionic (odd) variables. We start with a discussion of classical basic Lie superalgebras, their Weyl groupoid and Dynkin diagrams, reviewing Kac and Serganova, and also discuss homogeneous superspaces and generalized flag supervarieties. The classical Bott-Borel-Weil theorem gives some information about vector fields on those supervarieties. Then we discuss vector superdistributions, reductions of structure supergroups, and a superversion of the Tanaka theory. Finally, we consider realization of Lie superalgebras by vector fields, jet-prolongations of those, and then present exceptional Lie superalgebras $G(3)$ and $F(4)$ as symmetries of super differential equations in several non-equivalent ways, giving their first geometric realization.

Andrey Krutov: *Schubert calculus for the quantum Grassmanianns*
Schubert calculus is a remarkable area of mathematics which studies the de Rham cohomology of (generalised) flag manifolds from a combinatorial point of view. From its computational origins in enumerative geometry, its concrete formulation was deemed important enough for Hilbert to name it as his 15th problem. The cohomologies of classical irreducible flag manifolds have remarkable ring structure which is closely related to representation theory. For example, in the case of Grassmaniannas the multiplication table is given by Littelewood–Richardson coefficients. In this talk we will show that the equivariant part of the cohomology ring of the quantum Grassmanianns is isomorphic to the classical one. This is joint work with R. Ó Buachalla (Praha).

Svatopluk Krýsl: *Schur–Weyl–Howe type duality and ellipticity of twistor complexes in symplectic geometry*
We describe a Schur–Weyl–Howe type duality for complexes of symplectic spinor valued exterior forms and use it to reformulate and prove the ellipticity of symplectic twistor complexes for Weyl-flat Fedosov manifolds admitting a metaplectic structure (symplectic spin manifolds). Symplectic spinor valued exterior forms can be thought of as the Grassmann algebra twisted (tensor multplied) by the infinite dimensional Segal–Shale–Weil (SSW) representation of the metaplectic group, the connected double cover of the non-compact symplectic group. In particular, the bundles in the complexes are infinite rank Banach bundles since the SSW representation is an infinite dimensional unitary representation.

Radosław Kycia: *How to solve parallel transport equation on associated vector bundle*
I will show how to solve the parallel transport equation (locally) on an associated vector bundle using only the Poincare lemma and related linear homotopy operator. The solution only sometimes exists, and I will show where there is a problem. Moreover, using the homotopy operator and its Hodge star dual on the Riemannian manifold, I will show how to solve many other differential equations that contain exterior derivative and coderivative (from equations on Clifford bundle to the inverse problem of variational calculus), which we called geometry-based differential equations. This also includes the algebraic equation for the kernel of curvature operator, where the curvature is treated as the square of the exterior covariant derivative. Our method provides a quick, easy, and algorithmic way of solving such problems that even students can grasp. This method is all you need to do local differential geometry.

Roman Lávička: *Massless fields in dimension 4 for any spin*
The talk is based on joint work with F. Brackx, H. De Schepper, V. Souček and W. Wang. Classical Clifford analysis provides a rich function theory of the Dirac equation in Euclidean spaces for spin 1/2 fields. For any spin, as a proper analogue of the massless field equations in Euclidean spaces, we have suggested the so-called generalized Cauchy-Riemann equations (GCR). In this talk, we explain recent results about solutions of GCR in dimension 4.

Tibor Macko: *The homological part of the total surgery obstruction*
A fundamental problem in surgery theory is to decide whether a given finite CW-complex X of dimension $n \geq 5$ satisfying Poincare duality is homotopy equivalent to a topological manifold. In the classical surgery theory due to Browder-Novikov-Sullivan-Wall this question is answered by a two-stage obstruction method. Ranicki came up with a one-stage method where the answer to the question is yes if and only if a certain element, which he called "the total surgery obstruction" $TSO(X)$, is zero in a certain abelian group $S_n(X)$. This group is related to the so-called "assembly map" which yields a new approach for answering the fundamental question in certain situations. The method of Ranicki is called "algebraic surgery" and its crucial component is the notion of a cobordism of quadratic chain complexes. In our project we aim at simplifying the proof of the main theorem about the TSO. The "homological part" of the original proof makes heavy use of orientations of a Poincare complex with respect to various L-theory spectra. We want to replace this by employing certain Mayer-Vietoris type of argument. In the talk I will present an overview, some background of Ranicki's method and main ideas in the modified proof.

Omid Makhmali: *Path geometry of chains and dancing: a characterization for surfaces*
Path geometry on surfaces are abstractly defined in terms of a 3-dimensional manifold with a contact distribution that has a splitting. Such contact manifolds have two families of distinguished curves that are transversal to the contact distribution. One family is referred to as chains and the other family arises from the so-called dancing construction. We give a characterization of 3D path geometries arising from chains or dancing.

Antonella Marchesiello: *Bifurcations of symmetric resonances*
We consider families of Hamiltonian systems in two degrees of freedom with an equilibrium in $m : n$ resonance. In particular, we are interested in systems symmetric under reflection with respect to both coordinates axes that are relevant to galactic dynamics. The symmetry turns the $m : n$ resonance into a higher order resonance, and therefore we also speaks of $2m : 2n$ resonance. After normalization, we focus on the $2 : 2$ and $2 : 4$ resonances. We study the bifurcations related to these resonances in their own right, not restricted to natural Hamiltonian systems where $H = T + V$ would consist of kinetic and (positional) potential energy. Joint work

with G. Pucacco and H. Hanssmann.

Michal Marvan: *Matching van Stockum dust to Papapetrou vacuum*
We show that every van Stockum dust can be matched to a 1-parametric family of non-static Papapetrou vacuum metrics, and the converse. Examples include the spinning Chazy–Curzon metric, several Bonnor metrics, and a new vacuum exterior to the Lanczos–van Stockum dust metric. We also provide means to find dust clouds with a prescribed boundary, including toroidal ones.

David Duncan McNutt: *Symmetries in the presence of torsion*
Often, in the search for a solution of a particular alternative gravity theory, it is useful to require that a solution has a particular symmetry group, such as spherical symmetry, to simplify the resulting equations that must be solved. However, in Riemann-Cartan geometries, the symmetry group of a given geometry can be smaller than its analogue in Riemannian geometry due to the existence of non-zero torsion. In this setting, the Killing equations are no longer a reliable tool to generate new solutions in alternative gravity theories based off of Riemann-Cartan geometries. In this talk I will introduce an entirely general approach to determining the most general Riemann-Cartan geometries which admit a given symmetry group and apply these results to teleparallel geometries.

Peter Michor: *Pulling back metrics from the space of all Riemannian metrics to the diffeomorphism groups and the elasticity complex*
The Lie group $\mathrm{Diff}_{\mathcal{S}}(\mathbb{R}^n)$ acts on the space $\mathrm{Met}_{\mathcal{S}}(\mathbb{R}^n)$ of allRiemannian metrics. Pulling back Riemannian metrics from Met to Diff leads to interesting metrics. Describing the orbits of Diff in Met involves the elasticity complex.

Eva Miranda: *From fluid computers to escape trajectories: Two sides of a mirror*
Is hydrodynamics capable of performing computations? (Moore 1991). Can a mechanical system (including a fluid flow) simulate a universal Turing machine? (Tao, 2016). Etnyre and Ghrist unveiled a mirror between contact geometry and fluid dynamics reflecting Reeb vector fields as Beltrami vector fields. With the aid of this mirror, we can answer the questions raised by Moore and Tao by combining techniques developed by Alan Turing with modern Geometry (contact geometry) to construct a "Fluid computer"in dimension 3. This construction shows, in particular, the existence of undecidable fluid paths. I will also explain applications of this mirror to the detection of escape trajectories in Celestial mechanics (for which I'll need to extend the mirror to a singular set-up and introduce basics in b-symplectic and b-contact geometry). This mirror allows us to construct a tunnel connecting problems in Celestial mechanics and Fluid Dynamics. Planning: Session 1: Basics in contact geometry and Euler flows. The mirror: Etnyre and Ghrist correspondence. Session 2: Constructing Fluid computers in dimension 3 via contact geometry. Existence of undecidable paths and the Navier-Stokes conjecture. Session 3: Singular symplectic and contact geometry, the (singular) Weinstein conjecture and escape trajectories in Celestial mechanics.

Pau Mir Garcia: *A b-symplectic Hamiltonian model for dissipative dynamics*
In this talk we will see how b-symplectic geometry provides an appropriate setting to work with simple dissipative systems. In particular, we will see that the twisted b-cotangent model represents Hamiltonian systems with a singularity on the fiber of the cotangent bundle and can model fluids with dissipation. We will discuss more general physical interpretations of the twisted and non-twisted b-symplectic models and observe that escape orbits also appear in this

context. We will see how general a Hamiltonian formulation for systems which are dissipative can be, extending the horizons of Hamiltonian dynamics and opening a new approach to study non-conservative systems.

Stefan Nemirovski: *Lorentz geometry and contact topology*
Roger Penrose observed four decades ago that the space of light rays of a reasonable spacetime carries a natural contact structure and raised the problem of describing the causality relation of the spacetime in its terms. The lectures will introduce the relevant notions from Lorentz and contact geometry and present known results and open problems in this direction.

Jan Novák: *Graviton as a phonon and dark energy problem*
One of the biggest open problems in cosmology is to find a model of the accelerated expansion of the Universe in the last 5 billion years. There were trials to investigate it classically with adding some other fluid, modifying the field equations of general relativity or using the extra-dimensional models. But one can also utilize quantum gravity. We formulated a new approach to the quantization of gravity, which we call ring paradigm. Graviton is not a true particle, but it emerges as a vibration of a grid of rings that are new phenomenological objects. This has an immediate consequence for the resolution of the dark energy problem, and we obtain a new model of the accelerated expansion. A solution to the old problem of the cosmological constant is presented. As a further application, the black hole information paradox is solved, and we show that the space curvature of the Universe must be positive. The theory has a connection with the very interesting issues concerning the plabic graphs in algebraic geometry and links in algebraic topology.

Réamonn Ó Buachalla: *Towards a quantum BGG sequence for the A-series full quantum flag manifolds*
We present some recent progress towards the construction of a quantum BGG-sequence for the A-series Drinfeld–Jimbo full quantum flag manifold $\mathcal{O}_q(F_n)$. This is based on the q-deformed anti-holomorphic Dolbeault complex of $\mathcal{O}_q(F_n)$ constructed from Lusztig's positive root vectors for $U_q(\mathfrak{sl}_n)$.

Svilen Popov: *On Shelah categoricity conjecture, abstract elementary classes and rich families of models*
This works deals with Shelah Categoricity Conjecture (SCC), we are interested on the combinatorics assumed in order that SCC should be valid. There are several examples (studying Shelah amalgamation theorem and its applications in an absense of maximal models) as we can see there are several counter examples of the general notion of (SCC) in the literature. We see that some versions of the diamond, for instance Delvin and Shelah Diamond's version, are assumed in order to show the validity of the amalgamation property. We know that exactly this kind of the diamond is used for the positive solution of the Whitehead problem (S. Shelah and as well J. Trlifaj), however independently from the main focus of the current paper, following Eklof and Shelah again do find in Trlifaj's work on general projective test module problem – the negative answer. On the hand, we investigate the technique of the rich models and the elementary models derived from the classic categoricity setting of the Up and Down Löwenheim–Skolem Theorems, the aim is to be studied the theory of the nonseparable Banach Spaces, as we know the reverse direction also holds witnessing the existence or not existence of measurable cardinals, i.e. when the ultrapower of separable C^*-algebras are separable or not, which as we know is a problem independent from ZFC, being a model of an existence or a failure of existence of a non-trivial, complete, and κ-additive free measure of some indexing set with cardinality κ (of the ultrapower).

Tomáš Procházka: *Bethe equations and 2d CFT*

Roland Púček: *Separable geometries and new examples of extremal Kähler metrics*
We define separable toric Kähler geometries and reason that these are suitable for generating new examples of extremal metrics, i.e. solve the Euler-Lagrange equations of the Calabi functional which form a 4th order non-linear PDE. They come in families as quotients of particular Sasaki geometries obtained from factorization structures. The latter can be viewed as a coordinate system on the image of the momentum map (Delzant polytope) given by 1-parametric families of hyperplanes. This construction unifies all known toric extremal metrics and produces new ones.

Ajay Raj: *Classification Problems of Sphere Bundles Over Spheres*
After John Milnor discovered exotic spheres, classification of sphere bundles over spheres in various categories like smooth, topological, piecewise linear has been an interesting problem. This classification has been done for S^3 bundles over S^4 and S^7 bundles over S^8. We would make an attempt to do the same for S^{11} bundles over S^{12} and try so say something about general case. The tools that we will use are invariants like Euler and Pontrjagin classes; linking forms, J homomorphism, the structure set. The structure set of a manifold classifies manifolds up to homeomorphism that are homotopy equivalent to the given manifold. The structure set can be calculated using the surgery exact sequence.

Dominik Rist: *Non-Abelian Gerbes with Connections*
Higher forms arise as gauge potentials in a number of contexts within physics. The prime example is the Kalb–Ramond B-field of string theory, which is found also in the low-energy supergravity limits. Mathematically, these gauge potentials are connections on higher or categorified principal bundles also known as gerbes. In the Abelian case, the theory of gerbes is well-established and used in many contexts. In this seminar, I will talk about how one can extend this theory to the non-Abelian setting. There, the situation is much more subtle. Although the topological construction of non-Abelian gerbes is relatively straightforward (one just lifts the cocycle relations for transition functions of an ordinary principal bundle to hold up to homotopies, which are then encoded in higher components of the cocycle), defining a connection on such a gerbe requires much more work. After formulating the general construction I will illustrate it by lifting the principal bundle corresponding to an instanton–anti-instanton pair to a string 2-group bundle. Such "string structures" are believed to play a role in the dynamics of $M5$-branes. This talk is based on our recent work arXiv:2203.00092.

Tomáš Rusin: *Bounds for the cup-length of some oriented Grassmann manifolds*
We will present a review of the problem of determining the bounds for the $\mathbb{Z}_2$–cup-length of oriented Grassmann manifolds $\widetilde{G}_{n,k} = SO(n)/(SO(k) \times SO(n-k))$ for low values of k. Related invariants will also be discussed.

Katja Sagerschnig: *Parabolic quasi-contact cone structures with an infinitesimal symmetry*
I will report on an aspect of recent joint work with Omid Makhmali on a class of parabolic geometries that includes conformal structures, $(2, 3, 5)$ distributions and $(3, 6)$ distributions equipped with a transversal infinitesimal symmetry.

Martin Schnabl: *Conformal Perturbation Theory from String Field Theory*
I will present some new results on how to properly define two dimensional conformal perturbation theory using the tools of open string field theory.

Eivind Schneider: *Finding ODEs that are invariant under a given Lie algebra of vector fields*
Through examples I will discuss the problem of finding ODEs and ODE systems that are invariant under a given Lie algebra of vector fields. We approach this problem by considering the prolonged Lie algebra action on appropriate jet spaces. While the generic ODE systems can be given in terms of (scalar) absolute differential invariants, the task of finding all invariant systems requires us to also compute relative differential invariants, conditional differential invariants and vector-valued differential invariants. This talk is based on joint work with B. Kruglikov and the examples are taken from the recent preprint *ODEs whose symmetry groups are not fiber-preserving.*

Mária Šimková: *Are two finite H-spaces homotopy equivalent?*

Jan Slovák: *Applications of Finsler geometry in Medical Imaging*
The poster will display some of recent results related to geodesical tractography, segmentation, and biomarkers based on appropriate Finsler metrics.

Libor Šnobl: *Pairs of commuting quadratic elements in the universal enveloping algebra of Euclidean algebra and integrals of motion*
Motivated by the consideration of integrable systems in three spatial dimensions in Euclidean space with integrals quadratic in the momenta we classify three-dimensional Abelian subalgebras of quadratic elements in the universal enveloping algebra of the Euclidean algebra under the assumption that the Casimir invariant $\overrightarrow{p} \cdot \overrightarrow{l} = 0$ vanishes in the relevant representation. We show explicit examples demonstrating that in the presence of magnetic field, i.e. terms linear in the momenta in the Hamiltonian, this classification allows for pairs of commuting integrals whose leading order terms cannot be written in the famous classical form of [Makarov A.A., Smorodinsky J.A., Valiev K. and Winternitz P., Il Nuovo Cimento (1967) A 10 106184]. Some of these models find direct physical application, e.g. in description of helical undulators in magnetic fields. Inspiration and need for this work came from numerous discussions with Pavel Winternitz over many years and we dedicate it to his memory.

Vladimír Souček: *Grushin complexes as generalized BGG complexes*

Wijnand Steneker: *Killing tensors in Koutras–McIntosh spacetimes*
The Koutras–McIntosh family of metrics include conformally flat pp-waves and the Wils metric. It appeared in a paper of 1996 by Koutras–McIntosh as an example of a pure radiation spacetime without scalar curvature invariants or infinitesimal symmetries. Here we demonstrate that these metrics have no "hidden symmetries", by which we mean Killing tensors of low degrees. For the particular case of Wils metrics we show the nonexistence of Killing tensors up to degree 6. The technique we use is the geometric theory of overdetermined PDEs and the Cartan prolongation-projection method. Application of those allows to prove the nonexistence of polynomial in momenta integrals for the equation of geodesics in a mathematical rigorous way. Using the same technique we can completely classify all lower degree Killing tensors and, in particular, prove that for generic pp-waves all Killing tensors of degree 3 and 4 are reducible.

Karen Strung: *Realising quantum flag manifolds as graph C^*-algebras*
In this talk, we show how the C^*-completions of the Drinfeld–Jimbo quantum flag manifolds can be realised as graph C^*-algebras. We begin by recalling how to construct a C^*-algebra from a directed graph, how to read the K-theory groups of the C^*-algebra directly from the, and how to see its ideal structure. We then briefly recall the construction of a quantum flag manifold, and how to compute the primitive ideal space by using Dijkhuizen and Stokmann's description of a complete set of irreducible representations. Finally, we show how to construct a graph

directly from the Weyl group of the associated Lie algebra, and show that we recover some known isomorphisms between the C-algebras of quantum flag manifolds, as well as determining surprising new ones. This is joint work with Tomasz Brzeziński, Ulrich Krähmer and Réamonn Ó Buachalla.

David Sykes: *Constant nilpotent symbol CR hypersurfaces from multi-weighted homogeneous polynomials*
The talk will introduce a class of 2-nondegenerate tubular CR hypersurfaces (found in joint work with Martin Kolář and Ilya Kossovskiy) arising in arbitrary CR dimensions greater than 2 that naturally generalize the unique most symmetric 2-nondegerate 7-dimensional CR hypersurface structure. This class consists of perturbations of polynomials that are multi-weighted homogeneous with respect to special weighting systems. These structures are amenable to a Tanaka-theoretic general method (developed in joint work with Igor Zelenko) for solving local equivalence problems applicable to a broad class of 2-nondegenerate hypersurface-type CR manifolds. We will outline how this method is applied to the considered classes in any fixed CR dimension, presenting, as an example, a complete solution to the equivalence problem for the considered 11-dimensional structures, a complete description of their differential invariants, and a classification of the homogeneous structures among them.

Josef Šilhan: *Variational characterization of circles in low dimensions*
A variational characterization of straight lines in Euclidean spaces is well known, these curves are critical points (and also minimizers) of the length of energy functional. A similar question or circles – i.e. whether circles in Euclidean spaces are critical points of some functional along curves – is much more difficult. We shall solve this problem in dimensions two and three.

Dennis The: *On uniqueness of submaximally symmetric geometric structures*
Among parabolic geometries of a fixed type, it is well-known that there exists a locally unique maximally symmetric structure. I will discuss the corresponding local classification problem for those structures admitting the next realizable, i.e. submaximal, symmetry dimension. I will also present results concerning the corresponding submaximally symmetric classification problem for ODE systems of C-class (obtained in joint work with Johnson Kessy).

Vít Tuček: *Applications of flag manifolds*
Flag manifolds $Fl(1, 2, 3, \ldots k; n)$ are closely related to SVD of rank k matrices of size $n \times n$. The geodesic interpolation on this manifold can be used in applications in wireless communication. The Grassmann manifolds appear as a means of estimation-free communication over the wireless channel.

Fridrich Valach: *On G-algebroids*
G-algebroids are structures that generalise both Lie and Courant algebroids, as well as the particular Leibniz algebroids used in the exceptional generalised geometry. I will discuss their definition, basic structure theorems, and their relation to dualities and consistent truncations of M-theory and type IIA/B string theory. This is a joint work with M. Bugden, Ondrej Hulik, and Daniel Waldram.

Rikard von Unge: *New techniques for gauge theories in Projective superspace*
We present new techniques for manipulation with superspace expressions in Projective superspace. In particular we expain how the Chern-Simons action appears in $N = 3$ supersymmetry in three dimensions.

Gideon Vos: *Holography for bulk states in $3d$ quantum gravity*
This talk will corroborate a precursor to the AdS/CFT correspondence which was the discovery that the states of $SL(2,\mathbb{R}) \times SL(2,\mathbb{R})$ Chern-Simons theory are given by $2d$ conformal blocks. This will be done by considering the Hartle-Hawking state preparation of an initial state for Chern-Simons theory on the topology $Disk \times \mathbb{R}$, we will find that in the semi-classical limit the on-shell action is given by the solution to a monodromy problem that generates $2d$ conformal blocks in the large central charge limit.

Jan Vysoký: *Palatini variation in supergravity*
Generalized geometry proved to be a right mathematical tool for the description of an action and equations of motion of the bosonic sector of supergravity. In particular, the action can be written in the Einstein-Hilbert fashion using the particular class of Levi-Civita Courant algebroid connections on a generalized tangent bundle. To justify these choices, we resort to a simple idea. One can consider a general Courant algebroid and write an action for three independent dynamical fields - a volume form on the base manifold, a generalized metric and a general Courant algebroid connection. Amazingly, the corresponding equations of motion tie those fields together in a way resembling the well-known Palatini variation in general relativity. Necessary mathematical notions are recalled in this talk.

Henrik Winther: *Compact and Non-Compact Parabolic Space Forms*
Let G be a connected complex or real simple Lie group and P its parabolic subgroup. In the complex case, G/P is a compact Kähler manifold. In the real case, it is known that G/P is compact as long as the center $Z(G)$ is finite. On the other hand, there are no guarantees about compactness when this fails. We give a classification of all groups G and parabolic subgroups $P = P_I$ for which the *universal space form* $\widetilde{G/P}$ is non-compact. Interestingly, the set of such groups turns out to be a proper subset of the groups which admit infinite center. Joint work with B. Kruglikov.

Lenka Zalabová: *Conformal Killing trajectories on conformal Riemannian sphere*
We study the flows of conformal Killing fields on a Riemannian sphere. We describe their invariants and we show when all flows of a conformal Killing field are conformal circles.

Martin Zika: *Correspondences of Quantum L_∞ Algebras*
The quantum odd symplectic "category" is constructed from the odd symplectic "category" via an enhancement of Lagrangian relations by half-densities. We will show this approach can be extended this approach to the finite-dimensional setting of Batalin-Vilkovisky quantum field theories — the framework of quantum L_∞ algebras — given by a formal power series S satisfying the quantum master equation. In particular, we will show that the construction of effective observables known from Feynman perturbation theory can be described by morphisms in the quantum odd symplectic "category" using the homological perturbation lemma. Furthermore, we will introduce a notion of equivalence of quantum L_∞ algebras generalizing the well known homotopy transfer to the minimal model.

GENERAL INFORMATION

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Contact

Geometry and Physics 2023
Department of Mathematics
Faculty of Sciences – Masaryk University
Kotlářská 2
611 37 Brno
Czech Republic

srni@math.muni.cz

Organized by

Union of Czech Mathematicians and Physicists
Faculty of Mathematics and Physics, Charles University, Prague
Faculty of Science, Masaryk University, Brno

Sponsored by

Hotel information

Hotely Srní
Srní 117
341 94 Srní

Tel.: +420 376 599 212