Differential Geometry and its Applications

DGA2016

Programme and Abstracts

July 10–15

Masaryk University
Brno, Czech Republic

http://web.math.muni.cz/dga2016

The 13^{th} Conference on Differential Geometry and its Applications
Programme and Abstracts
Brno 2016

1. Conference Schedule

The scientific programme is composed of plenary talks and seven programme sections. The rough scheme of the programme is given in the table below. The Latin capital letters within the session blocks indicate the individual sections, see the list below.

	Monday	Tuesday	Wednesday	Thursday	Friday
8:30	Registration				
9:00 – 12:30	plenary	A D F	plenary	A D E+C	plenary
12:30 – 14:00					
14:00 – 14:30	A B C	poster session	Excursions	poster session	A B C
14:30 – 18:00		G B C		A B E	

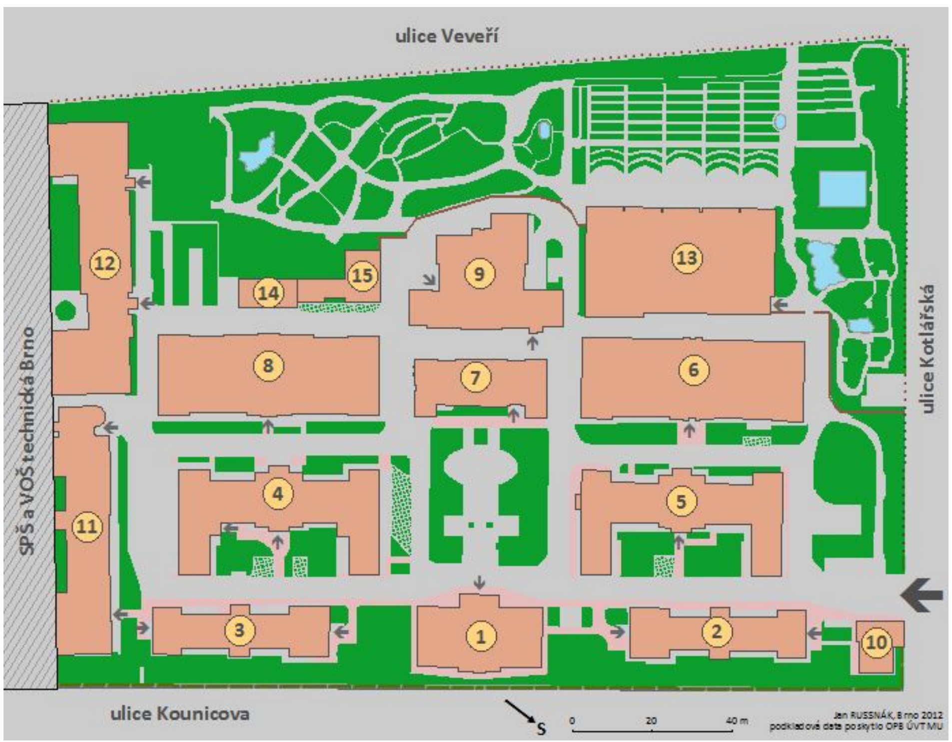
A. *Riemannian Geometry and Geometric Analysis*
(Berndt, Kowalski, García Río – chair, Gilkey)
B. *Geometric Structures and Representation Theory*
(Čap, Eastwood – chair, Kolář, Slovák)
C. *Geometry and Physics* (Rossi)
D. *Finsler Geometry* (Shen)
E. *Nonlinear PDE* (Vinogradov)
F. *The Geometry of Matrix Multiplication* (Landsberg)
G. *Progress in Surface Geometry* (Pedit, Lynn)

Along with the invited talks, there are also contributions by the participants in the form of contributed talks or posters, as decided by the chairs of the individual sections. There are never more than three sessions running in the main programme in parallel. The entire programme will be recorded and available via the web page of the conference.

There are three lecture halls serving the sessions of the programme, called L1, L2, and L3. The L1 room is located at the ground floor of the Library building (building nr. 12 in the scheme below). The plenary sessions, Section A, and Section G will be in this room.

The L2 room is located in the Maths department building (building 8), opposite to the conference office. Sections B and D will be in this room. The poster sessions will be in a dedicated room in the same building.

The third room, L3, is in the building 11, at the first floor. The Sections C, E and F will take part there. There will be signs posted in the campus.



During the week there will be a working group on the geometry and complexity of matrix multiplication with participants Bläser, Buczynski, Gesmundo, Ikenmeyer, Landsberg, Manivel and Michalek. Similarly there will be a working group related to the section G.

We believe, all this will create a fine meeting for wide audience combining specialized talks with those of broader interest.

2. General Information

About the conference

The tradition of the international conference Differential Geometry and its Applications goes back more than 35 years and the current DGA meeting is the 13th one in the series.

The conferences take place regularly at one of the Czech universities every three years. The previous two meetings were also in Brno, preceded by Olomouc (2007), Prague (2004), Opava (2001), Brno (1998, 1995), etc.

Special issue of Differential Geometry and its Applications

This series of conferences was always related to the journal carrying the same name and many of the distinguished Editors will come. The direct support of Elsevier to the conference is much appreciated and there will be a *special thematic volume of the journal Differential Geometry and its Applications* related to the topics of the conference DGA2016.

All contributions will undergo regular peer review procedure following the same high standards as for contributions to regular issues of the journal. The status of the contribution in the conference does not influence the reviewing procedure. *All participants will obtain a printed copy* of this special volume. **The deadline for the contribution is October 31, 2016.**

Social Programme

During the conference week three social events are planned: the Welcome Party, trips to various parts of Moravia, and the Farewell Party.

Welcome Party, July 10, 2016, from 6pm till 11pm.

The welcome party takes place at the Faculty of Social Studies, Masaryk University.

Address: Joštova 218/10, Brno

How to get there: (some pictures and maps with the paths indicated are displayed in the more detailed description)

From railway station - Tram 4 (direction NAMESTI MIRU) to the stop Komenskeho namesti.

From railway station - Tram 12 (direction TECHNOLOGICKY PARK) to the stop Ceska. From the stop Ceska you can walk (takes 3-5 min.) or take Tram 4 (direction NAMESTI MIRU) to the stop Komenskeho namesti (1 stop only).

From Hotel Continental - on foot (takes 10 min.).

From Josef Taufer Student Dormitory - Tram 12 (direction KOMAROV) to the stop Ceska. From stop Ceska you can walk (takes 3-5 min.) or take the Tram 4 (direction NAMESTI MIRU) to the stop Komenskeho namesti (1 stop only).

Farewell Party, July 15, 2016, from 7pm till 12pm.

The farewell party takes place at the Old Brno Abbey of the St. Augustine Order.
Address: Mendlovo namesti 1, Brno
How to get there:

From the conference venue Trolleybus 25 (direction STARY LISKOVEC) or Troll 26 (direction KAMENNY VRCH) from the stop Konecneho namesti to the stop Mendlovo namesti.

From Hotel Continental on foot to the stop Ceska and take Tram 5 (direction USTREDNI HRBITOV) or Tram 6 (direction STARY LISKOVEC) to the stop Mendlovo namesti.

From Josef Taufer Student Dormitory - Tram 12 (direction KOMAROV) to the stop Ceska and take Tram 5 (direction USTREDNI HRBITOV) or Tram 6 (direction STARY LISKOVEC) to the stop Mendlovo namesti.

Conference trips (excursions), July 13, 2016

The departure place and time for the individual trips will be communicated during the conference. The excursions are fully covered in the conference fees, including the registered accompanying persons. The participants will be asked to fix the choice of one of the excursions during their registration at the desk or before Tuesday. The individual excursions have got limited capacity.

Option A) Brno City: (sightseeing tour and dinner) Guided tour of the most interesting historical sights in Brno with the commentary of a professional guide. The dinner will be served at the Starobrno brewery restaurant.

Option B) Moravian Karst, Punkva Caves: (visit and dinner) A trip to the world-famous region of karst caves. It lies on the territory of Moravia near Brno City.

Option C) Castle Rájec nad Svitavou: (a guided tour of the castle Rájec nad Svitavou and dinner) The town Rájec-Jestřebí lies in a valley on both banks of the River Svitava and is surrounded by large forests. You can enjoy a visit of the unique Renaissance castle in the style of Louis XVI.

3. Programme

Plenary Section
Invited Talks

Monday • 9:00-12:30 • Room: L1

- *Eugene V. Ferapontov* (9:00–9:50)
  On the integrability in Grassmann geometries: integrable systems associated with fourfolds in $\mathrm{Gr}(3, 5)$

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- *Laurent Manivel* (10:30–11:20)
  Hyperkähler varieties as parameter spaces
- *Katrin Wendland* (11:30–12:20)
  Can singularities govern conformal field theory?

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Section A
Riemannian Geometry and Geometric Analysis

Monday • 14:00–18:00 • Room: L1

- *Ivan Minchev* (14:00–14:30)
  The qc Yamabe equation on a 3-Sasakian manifold
- *Igor Ernst, Dmitry Oskorbin, Eugene Rodionov* (14:30–15:00)
  Ricci solitons on some low-dimensional (pseudo)Riemannian manifolds
- *Nurlan Abiev* (15:00–15:30)
  On Ricci flow and positively curved invariant Riemannian metrics on the Wallach spaces

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- *Peter Gilkey* (16:00–16:40)
  Homogeneous affine surfaces - affine Killing vector fields, gradient Ricci solitons, and moduli spaces
- *Jong Taek Cho* (16:45–17:15)
  Gap theorem of 4-dimensional compact Ricci solitons

- *Homare Tadano* (17:20–17:50)
  Some Myers type theorems and Hitchin-Thorpe inequalities for shrinking Ricci solitons

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SECTION B
Geometric Structures and Representation Theory

MONDAY • 14:00–18:00 • ROOM: L2

- *Rod Gover* (14:00–14:40)
  Higher dimensional analogues of the Willmore energy and invariant
- *Boris Kruglikov* (14:50–15:30)
  Jet-determination of symmetries in parabolic geometry

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- *Andreas Čap* (16:00–16:30)
  C-projective compactness
- *Vladimir Souček* (16:40-17:20)
  The BGG complexes for Grassmannians in singular infinitesimal character
- *Simon G. Gindikin* (17:30-18:00)
  Complex geometry of real symmetric spaces

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SECTION C
Geometry and Physics

MONDAY • 14:00–18:10 • ROOM: L3

- *Geoff Prince* (14:00–14:40)
  A new, exterior and intrinsic form of the structure equations and Bianchi identities
- *Willy Sarlet* (14:45–15:25)
  On embedding the intersections of two families of surfaces in $\mathbb{R}^3$ into the set of integral curves of a Lagrangian system

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- *Wlodzimierz Marek Tulczyjew* (15:50–16:30)
  Equilibrium configurations and higher order differential geometry.

- *Marcella Palese* (16:35–17:05)
  Classical Higgs fields on gauge gluon bundles
- *Marco Modugno* (17:10–17:40)
  On the quantum potential in covariant Quantum Mechanics
- *Josef Janyška* (17:40–18:10)
  Covariant quantum dynamics

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Section A

Riemannian Geometry and Geometric Analysis

Tuesday • 9:00–12:30 • Room: L1

- *Makoto Kimura* (9:00–9:30)
  Twistor space of complex 2-plane Grassmannian and submanifolds in complex projective space
- *Víctor Sanmartín López* (9:30–10:00)
  Anti-De Sitter space and complex hyperbolic space: their isoparametric hypersurfaces

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- *Sadahiro Maeda* (10:30–11:10)
  A characterization of homogeneous real hypersurfaces of types (C), (D) and (E) in a complex projective space
- *Young Jin Suh* (11:15–11:45)
  Recent progress on real hypersurfaces in the complex quadric
- *Antonio Martinez* (11:50–12:20)
  A Geometric bridge between $\mathbb{H}^3$ and $\mathbb{R}^3$
- *Sergey Stepanov* (joint with Josef Mikeš) (12:25–12:55)
  New applications of the global divergence theorems & On the global geometry of projective submersions

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Section D
Finsler Geometry

Tuesday • 9:00–12:30 • Room: L2

- *Behroz Bidabad* (9:00–9:30)
  Evolution of Ricci scalar under Finsler Ricci flow
- *Lili Zhao* (9:30–10:00)
  Constructions of Einstein Finsler Metrics

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- *Xinyue Cheng* (10:30–11:10)
  Einstein Finsler metrics and Killing vector fields on Riemannian manifolds
- *Morteza Mirmohamad Rezae* (11:15–11:45)
  Harmonic vector fields and harmonic 1-forms in Finsler geometry
- *Salah Gomaa Ahmed Ali Elgendi* (11:50–12:20)
  A note on: Sur le noyau de l'opérateur de courbure d'une variété finslérienne, C. R. Acad. Sci. Paris, ser. A, t. 272 (1971), 807-81

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Section F
The Geometry of Matrix Multiplication

Tuesday • 9:00–12:30 • Room: L3

- *Fulvio Gesmundo* (9:00–9:50)
  Matrix rigidity and the complexity of a linear map

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- *Christian Ikenmeyer* (10:30–11:20)
  Matrix multiplication algorithms with symmetry
- *Mateusz Michalek* (11:30–12:20)
  Local algebraic geometry and computational complexity

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Poster Session
Sections B and C

Tuesday • 14:00–15:00 • Room: Poster

Ozgur Acik, Extremal motions of p-branes induced by Killing spinors
Adara-Monica Blaga, On Ricci solitons in different geometries
Felipe Contatto, First integrals of affine connections and Hamiltonian systems of hydrodynamic type
Ümit Ertem, Extended superalgebras from twistor and Killing spinors
Matthias Fischmann, Conformal symmetry breaking differential operators on differential forms
Jordi Gaset, A multisymplectic formalism for the Einsteins equations of gravity
Jan Gregorovič, Generalizations of symmetric space in theory of parabolic geometries
Jaroslav Hrdina, Extremals of sub Riemanian geometry based on trident snake like mechanisms
Cristian Ida, Holomorphic last multipliers on complex manifolds
Giorgi Khimshiashvili, Geometry of equilibrium configurations of point charges on planar curves
Ivan Kolář, Covariant approach to Weil bundles
Jan Kurek, The modified vertical Weil functors 2-fibred manifolds
Miroslav Kureš, On the orientability of Weil contact elements and bundles
Rafael Mrdjen, Singular BGG resolutions over symplectic Grassmannian
Aleš Návrat, An analogue of Paneitz operator for almost Grassmannian geometries with a torsion
Marcella Palese, Algebraic structures generating reaction-diffusion models: the activator-substrate system
Liviu Popescu, Symmetries of second order differential equations on Lie algebroids
Xavier Rivas, A constraint algorithm for k-precosymplectic field theories and some applications
Tomáš Salač, Elliptic complex on the Grassmannian of oriented 2-planes in $\mathbb{R}^{2+n}$
Hiroyasu Satoh, Information geometry of divergences and means on the space of all probability measures having positive density function
Asaf Shachar, On strain measures and the geodesic distance to SO_n in the general linear group
Aleksandr Shelekhov, The Geometry of some special Bol three-webs
Eivind Schneider, Differential invariants of self-dual conformal structures
Reinier Storm, A new construction of naturally reductive spaces
Volodymyr Sushch, On geometric discretization of the Dirac-Kähler equation

Jiří Tomáš, Bundles of (p, s, A)-covelocities, (p, s, A)-jets and some kind of product preserving bundle functors
Gamaliel Torres, Dynamics of a particle constrained on a surface with auxiliary variables
Petr Vašík, On local control of snake–like mechanisms
Stefan Vasilev, Metric connections with totally skew-symmetric torsion acting on differential forms
Raquel Villacampa, Balanced Hermitian geometry on compact quotients of Lie groups
Andreas Vollmer, Higher-rank Killing tensors in Weyl space-times and similar geometries
Travis Willse, Almost Einstein $(2, 3, 5)$ conformal structures
Petr Zima, Killing spinor-valued forms

Section G
Progress in Surface Geometry

Tuesday • 14:50–18:10 • Room: L1

- *Lynn Heller* (14:50–15:30)
  Constrained Willmore minimizers

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- *Josef Dorfmeister* (16:00–16:40)
  The loop group method, a unifying scheme, and new examples
- *Masashi Yasumoto* (16:45–17:25)
  Construction of discrete constant mean curvature surfaces in Riemannian spaceforms and its applications
- *Dorel Fetcu* (17:30–18:10)
  On biconservative surfaces

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Section B
Geometric Structures and Representation Theory

Tuesday • 15:00–18:00 • Room: L2

- *Wolfgang Globke* (15:00–15:20)
  Compact pseudo-Riemannian solvmanifolds

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- *Arman Taghavi-Chabert* (15:40–16:00)
  Conformal Patterson-Walker lifts of projective structures
- *Josef Šilhan* (16:10–16:30)
  A projective-to-conformal Fefferman-type construction
- *Shin Young Kim* (16:40–17:00)
  Geometric structures modelled on smooth projective horospherical varieties of Picard number one
- *Kotaro Kawai* (17:10–17:30)
  Frölicher-Nijenhuis bracket and geometry of G_2-and $rmSpin(7)$-manifolds
- *Henrik Winther* (17:40–18:00)
  Submaximally symmetric quaternionic structures

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Section C
Geometry and Physics

Tuesday • 15:00–18:10 • Room: L3

- *Giovanni Falcone* (15:00–15:30)
  Compact derivations of the real forms of a complex Lie algebra of type $\{n, 2\}$

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- *Tom Mestdag* (15:50–16:20)
  Reduction and un-reduction of second-order ordinary differential equations
- *Thi Kim Thoan Do* (16:20–16:40)
  New solutions of the inverse problem of the calculus of variations
- *Enrico Pagani* (16:45–17:25)
  Differential geometric aspects of constrained calculus of variations: first and second variation.
- *Xavier Gràcia* (17:30–18:10)
  Some structural aspects of Hamilton-Jacobi theory

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Plenary section
Invited Plenary Talks

Wednesday • 9:00–12:30 • Room: L1

- *Boris Doubrov* (9:00–9:50)
  Complexification of integrable CR geometries

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- *Carlos Enrique Olmos* (10:30–11:20)
  Submanifolds and holonomy
- *Maciej Dunajski* (11:30–12:20)
  Gauge theory on projective surfaces and anti-self-dual Einstein metrics

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Free afternoon – excursions

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Section A
Riemannian Geometry and Geometric Analysis

Thursday • 9:00–12:30 • Room: L1

- *Andreas Arvanitoyeorgos, Yu Wang* (9:00–9:30)
  Homogeneous geodesics in a class of homogeneous spaces
- *Marina Statha* (9:30–10:00)
  Non-naturally reductive Einstein metrics on compact simple Lie groups

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- *Jürgen Berndt* (10:30–11:10)
  The index of symmetric spaces
- *Evangelia Samiou* (11:15–11:45)
  The X-ray transform on manifolds with many totally geodesic subspaces
- *Balázs Csikós* (11:50–12:20)
  Harmonic manifolds and the volume of tubes about curves

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Section D
Finsler Geometry

Thursday • 9:00–12:30 • Room: L2

- *Benling Li* (9:00–9:30)
  Finsler metrics with special flag curvature
- *Nasrin Sadegh Zadeh Nokhod Beriz* (9:30–10:00)
  Some properties of Spherically Symmetric Finsler metrics

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- *Bin Chen* (10:30–11:10)
  Modified scalar curvature in Finsler geometry
- *Bingye Wu* (11:15–11:45)
  Finsler Submanifolds:From Viewpoint Of Chern Connection
- *Bernadett Aradi* (11:50–12:20)
  Strong compatibility of Finsler functions and absolute parallelisms

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Sections E and C
Nonlinear PDE; Geometry and Physics

Thursday • 9:00–12:30 • Room: L3

- *Alexandre M. Vinogradov* (9:00–9:50)
  Observability, Hamiltonian formalism and energy

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- *Alfonso Giuseppe Tortorella* (10:30–11:00)
  Rigidity of integral coisotropic submanifolds of contact manifolds
- *David Saunders* (11:05–11:45)
  Vertical symmetries of Cartan geometries
- *Zoltan Muzsnay* (11:50–12:30)
  Euler-Lagrange functions and metrizability freedom of SODEs

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Poster Session
Sections A, D, E, G

Thursday • 14:00–15:00 • Room: Poster

Inas Amacha, Problem of prescribed scalar curvature

Ergin Bayram, Surface family with a common involute asymptotic curve

Lakehal Belarbi, On translation surfaces weight zero Gaussian curvature in Sol_3

Mohamed Belkhelfa, Symmetry properties of complex contact space form

Mathias Fischer, Symplectic Lie groups with biinvariant metric

Ali Haji-Badali, On the certain homogeneous paracontact 3-manifolds

Cristina Hretcanu, On the geometry of warped product submanifolds in a metallic Riemannian product manifold

David Csaba Kertesz, Affine and Killing vector fields of Berwald manifolds

Gyu Jong Kim, Real hypersurfaces in complex hyperbolic Grassmannians of rank 2 with GTW Reeb Lie derivative structure Jacobi operator

Chang-Wan Kim, Entropy of nonpositively curved Finsler manifolds

Sebastian Klein, A spectral theory for certain constant mean curvature surfaces in the 3-dimensional space forms

Pavel Klepikov, Left-invariant pseudo Riemannian metrics on 4-dimensional Lie groups with zero divergence Weyl tensor

Piotr Kopacz, Application of Finslerian solutions to generalized Zermelo navigation problem to refine search models in the presence of perturbation

Rakesh Kumar, Semi-Invariant lightlike submanifolds of indefinite Kaehler manifolds with quarter symmetric non-metric connection

Deepika Kumari, On biconservative Lorentz hypersurfaces with non diagonal shape operator

Verónica López, Marginally trapped submanifolds in generalized Robertson-Walker spacetimes

Veronica Martin-Molina, Some remarkable paracontact metric manifolds

Francisco Milan, Improper affine spheres and the Hessian one equation

Rakesh Kumar Nagaich, On holomorphic sectional curvature of GCR-lightlike submanifolds of indefinite sasakian manifolds

Simona Nistor, Global properties of biconservative surfaces

Rachna Rani, Characterizations of holomorphic sectional curvature of GCR-lightlike submanifolds of indefinite nearly Kaehler manifolds

Eugene Rodionov, Left-invariant pseudo Riemannian metrics on 4-dimensional Lie groups with zero divergence Weyl tensor

Bayram Sahin, Hemi-slant Riemannian maps

Lara Saliba, Liouville type theorems for extrinsic biharmonic maps

Alexey Samokhin, Periodic boundary conditions for KdV-Burgers equation on a

finite interval
Nikolaos Panagiotis Souris, Geodesic orbit and two-step geodesic orbit homogeneous spaces
Yasemin Soylu, A Myers type compactness theorem by the use of Bakry-Emery Ricci tensor
Kamel Tahri, Fourth order elliptic equation with singularity
Abhitosh Upadhyay, Complete classification of biconservative hypersurfaces with diagonalizable shape operators in pseudo-Euclidean spaces
Changhwa Woo, Real hypersurfaces in complex two-plane Grassmannians with Lie derivative Ricci tensors
Amirhesam Zaeim, On symmetries of homogeneous three-dimensional Walker manifolds

Section A
Riemannian Geometry and Geometric Analysis

Thursday • 15:00-18:00 • Room: L1

- *Anton Galaev* (15:00-15:30)
  Higher order Lorentzian symmetric spaces

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- *Reza Mirzaei* (16:00–16:30)
  On Riemannian G-manifolds of nonpositive curvature
- *Hassan Jolany* (16:40–17:10)
  Fiberwise singular Kahler Einstein metric is semi-positive

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Section B
Geometric Structures and Representation Theory

Thursday • 15:00–18:00 • Room: L2

- *Miroslav Doupovec* (15:00–15:30)
  Vertical functors on all fibered manifolds

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- *Aleksandra Borówka* (16:00–16:30)
  A Swann bundle approach to a generalized Feix–Kaledin construction

- *Matthias Hammerl* (16:40–17:10)
  Holography of BGG-Solutions
- *Igor Zelenko* (17:20–18:00)
  Tanaka prolongation of structures of nonconstant type with application to sub-Riemannian geometry

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SECTION E
Nonlinear PDE

THURSDAY • 15:00–18:00 • ROOM: L3

- *Ekkehart Winterroth* (15:00–15:30)
  Obstructions to global critical sections (with an application to Chern-Simons theories)

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- *Michal Marvan* (15:50–16:30)
  A summary of results on the constant astigmatism equation
- *Nina Khor'kova*(16:40–17:20)
  On some constructions in the nonlocal theory of partial differential equations
- *Ekaterina Shemyakova* (17:30–18:00)
  Darboux transformations of differential operators on the superline

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PLENARY SECTION
Invited Plenary Talks

FRIDAY • 9:00–12:30 • ROOM: L1

- *Ulrich Pinkall* (9:00–9:50)
  Schrödinger smoke

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- *Iosif Krasil'shchik* (10:30–11:20)
  Nonlocal geometry of PDEs and integrability
- *Theodore Voronov* (11:30–12:20)
  Classical and quantum microformal geometry, and homotopy algebras

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Section A

Riemannian Geometry and Geometric Analysis

Friday • 14:00–18:00 • Room: L1

- *María Angustias Cañadas-Pinedo* (14:00–14:30)
  Geometric properties of Cahen-Wallach manifolds
- *Irene Ortiz Sánchez* (14:30–15:00)
  Eigenvalue estimates for the Jacobi operator of compact CMC surfaces in Warped Products
- *Cornelia-Livia Bejan* (15:00–15:30)
  Geometric structures which are harmonic with respect to natural Riemann extension

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- *Ilka Agricola* (16:00–16:40)
  Spinorial description of $SU(3)$- and G_2-manifolds
- *Alfonso Carriazo* (16:50–17:20)
  Semi-Riemannian generalized Sasakian-space-forms

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Section B

Geometric Structures and Representation Theory

Friday • 14:00–17:50 • Room: L2

- *Maria Karmanova* (14:00–14:30)
  Maximal surfaces on sub-Lorentzian structures
- *Katharina Neusser* (14:35–15:05)
  C-projective structures of degree of mobility at least 2
- *Konrad Schöbel* (15:10–15:40)
  An algebraic geometric classification of superintegrable systems in the Euclidean plane

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- *Dennis The* (16:00-16:30)
  Exceptionally simple PDE

- *Lenka Zalabova* (16:40-17:10)
  Symmetric and locally symmetric parabolic geometries

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Section C

Geometry and Physics

Friday • 14:00–18:00 • Room: L3

- *Claudiu Remsing* (14:00–14:30)
  A few remarks on control systems on the Engel group
- *Dennis Barrett* (14:30–14:50)
  Invariant nonholonomic Riemannian structures on three-dimensional Lie groups
- *Rory Biggs* (14:55–15:25)
  Isometries of Riemannian and sub-Riemannian structures on 3D Lie groups

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- *Hong Van Le* (15:50–16:10)
  Floer-Novikov homology and symplectic fixed points
- *Zoran Škoda* (16:15–16:45)
  Correcting coexponential map for Lie algebroids
- *Yaroslav Bazaikin* (16:50–17:20)
  Geometry and Sintering
- *Adam Chudecki* (17:25–17:55)
  Congruences of null strings in pseudo-Riemannian geometries

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4. Abstracts

Nurlan Abiev

On Ricci flow and positively curved invariant Riemannian metrics on the Wallach spaces

Monday • 15:00–15:30 • Room: L1

This talk is devoted to the study of the evolution of positively curved invariant Riemannian metrics on the Wallach spaces $SU(3)/T_{max}$, $Sp(3)/Sp(1) \times Sp(1) \times Sp(1)$ and $F_4/Spin(8)$. We proved that for all Wallach spaces, the normalized Ricci flow evolves all generic invariant Riemannian metrics with positive sectional curvature into metrics with mixed sectional curvature. For the spaces $Sp(3)/Sp(1) \times Sp(1) \times Sp(1)$ and $F_4/Spin(8)$, we proved that the normalized Ricci flow evolves all generic invariant Riemannian metrics with positive Ricci curvature into metrics with mixed Ricci curvature. We also get partial results for some generalized Wallach spaces.

Ozgur Acik

Extremal motions of p-branes induced by Killing spinors

Tuesday • 14:00–15:00 • Room: Poster

Some results considering the properties of extended objects induced from the existence of Killing spinors in spacetime were found in our previous works. To gain more physical information from these results we want to study the motion of p-branes exhibiting some of these properties. A general method firstly assumes extremal motion for the collisionless ideal p-fluid particle representing the whole fluid in a macroscopically irreducible manner. Secondly, the only unknown parameter of the system namely the density of the condensate is determined by Einstein's equations. We intend to follow the same path, but instead of using Einstein's equations, we choose an alternative method for determining the density of the condensate suggested by the equations that we have at hand. This foresight is reasonable because of the web of physical and geometrical reasons contained in our construction. This key point will be explained in the talk.

Ilka Agricola

Spinorial description of $SU(3)$- and G_2-manifolds

Friday • 16:00–16:40 • Room: L1

We present a uniform description of $SU(3)$-structures in dimension 6 as well as G_2-structures in dimension 7 in terms of a characterizing spinor and the spinorial field equations it satisfies. We apply the results to hypersurface theory to obtain new embedding theorems, and give a general recipe for building conical manifolds. The approach also enables one to subsume all variations of the notion of a Killing spinor.

Salah Gomaa Ahmed Ali Elgendi

A note on: Sur le noyau de l'opérateur de courbure dune variété finslérienne, C. R. Acad. Sci. Paris, ser. A, t. 272 (1971), 807-81

TUESDAY • 11:50–12:20 • ROOM: L2

In this talk, adopting the pullback formalism of Finsler geometry, we show by a counterexample that the kernel Ker_R of the h-curvature R of Cartan connection and the associated nullity distribution N_R do not coincide, contrary to a result of Akbar-Zadeh (given in the article that appears in the title). We also give sufficient conditions for Ker_R and N_R to coincide.

Inas Amacha

Problem of prescribed scalar curvature

THURSDAY • 14:00–15:00 • ROOM: POSTER

On a smooth, compact, Riemannian manifold (M, g_0) of dimension $n > 3$ the problem of prescribed scalar curvature is to find conditions on a smooth function F to be the scalar curvature of a metric g conformal to g_0. This problem is equivalent to solve the following PDE:

$$4\frac{n-1}{n-2}\Delta_0 u + R_0 u = F u^{\frac{n+2}{n-2}}$$

One of the natural methods to solve this equation is the method of flow. We will introduce the following flows:

$$\partial_t g = -(R - F)g \text{ if } R_0 > 0$$

$$\partial_t g = -(R - \frac{F}{f})g \text{ if } R_0 < 0$$

then we will prove the global existence of this flows and study their behavior at infinity.

Bernadett Aradi

Strong compatibility of Finsler functions and absolute parallelisms

THURSDAY • 11:50–12:20 • ROOM: L2

A large class of smooth manifolds (including all Lie groups) admits an absolute parallelism, which can be described by simple axioms. A Finsler function for a parallelized manifold is called compatible with an absolute parallelism if it is 'preserved by parallel translations'. The compatibility is said to be strong if also the pre-geodesics of the two structures coincide. In the talk we show that the strong compatibility of a Finsler function and an absolute parallelism implies that the Finsler manifold is a Berwald manifold. If, in addition, over a connected manifold the parallelism has parallel torsion and is complete, then the Finsler function is induced by a bi-invariant Finsler function on a simply connected Lie group.

Andreas Arvanitoyeorgos

Homogeneous geodesics in a class of homogeneous spaces

Thursday • 9:00–9:30 • Room: L1

Joint contribution with Yu Wang.

Let $M = G/K$ be a homogeneous space. A geodesic $\gamma(t)$ through the origin o of M is called *homogeneous* if it is an orbit of a one-parameter subgroup of G, that is

$$\gamma(t) = \exp(tX)(o), \quad t \in \mathbb{R}, \tag{1}$$

where X is a non zero vector of $\mathfrak{g}$. A homogeneous Riemannian manifold is called a *g.o. space*, if all geodesics are homogeneous with respect to the largest connected group of isometries $I_o(M)$. A Riemannian metric g is called G-*g.o.*, if all the geodesics of a homogeneous Riemannian manifold (M, g) are homogeneous with respect to a group $G \subseteq I_o(M)$. Homogeneous geodesics have been studied by several authors in the past (e.g. [Al-Ar], [Al-Ni], [Du3], [Du-Ko1], [Du-Ko2], [Du-Ko-Ni], [Ko-Va]). They have also been extended to geodesics which are orbits of products of more than one exponential factors (cf. [Ar-Sou]). In the present work we investigate homogeneous geodesics in a class of homogeneous spaces called M-spaces, which are defined as follows. Let G/K be a generalized flag manifold with $K = C(S) = S \times K_1$, where S is a torus in a compact simple Lie group G and K_1 is the semisimple part of K. Then the *associated M-space* is the homogeneous space G/K_1. These spaces were introduced and studied by H.C. Wang in [Wan]. We prove that for some classes of M-spaces, the only g.o. metric is the standard metric. For other classes of M-spaces we give either necessary or necessary and sufficient conditions so that a G-invariant metric on G/K_1 is a g.o. metric. The analysis is based on properties of the isotropy representation $\mathfrak{m} = \mathfrak{m}_1 \oplus \cdots \oplus \mathfrak{m}_s$ of the flag manifold G/K, in particular on the dimension of the submodules $\mathfrak{m}_i$. This is a joint work with Guosong Zhao.

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[Al-Ar] D.V. Alekseevsky and A. Arvanitoyeorgos: *Riemannian flag manifolds with homogeneous geodesics*, Trans. Amer. Math. Soc. 359 (2007) 3769–3789.

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[Du3] Z. Dušek: *The existence of homogeneous geodesics in homogeneous pseudo-Riemannian and affine manifolds*, J. Geom. Physics 60(5) (2010) 687–689.

[Du-Ko1] Z. Dušek and O. Kowalski: *Geodesic graphs on the 13-dimensional group of Heisenberg type*, Math. Nachr. (254-255) (2003) 87–96.

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[Du-Ko-Ni] Z. Dušek, O. Kowalski and S. Nikčević: *New examples of g.o. spaces in dimension 7*, Differential Geom. Appl. 21 (2004) 65–78.

[Ko-Va] O. Kowalski and L. Vanhecke: *Riemannian manifolds with homogeneous geodesics*, Boll. Un. Mat. Ital. 5 (1991) 189–246.

[Wan] H.C. Wang: *Closed manifolds with homogeneous complex structure*, Amer. J. Math. 76(1) (1954) 1–32.

Dennis Barrett

Invariant nonholonomic Riemannian structures on three-dimensional Lie groups

FRIDAY • 14:30–14:50 • ROOM: L3

We consider invariant Riemannian metrics on Lie groups equipped with an invariant nonholonomic distribution. (These structures are prototypes for invariant mechanical systems on Lie groups with kinetic energy Lagrangians and nonholonomic constraints linear in velocities.) We classify all structures on the simply connected three-dimensional unimodular Lie groups and identify some basic isometric invariants. The classification naturally splits into two cases. In the first, it reduces to a well-known classification of invariant sub-Riemannian structures in three dimensions. In the second, we construct a canonical frame with which to directly compare equivalence classes. A complete set of invariants is exhibited in both cases.

Ergin Bayram

Surface family with a common involute asymptotic curve

THURSDAY • 14:00–15:00 • ROOM: POSTER

We construct a surface family possessing an involute of a given curve as an asymptotic curve. We express necessary and sufficient conditions for that curve with the above property. We also present natural results for such ruled surfaces. Finally we illustrate the method with some examples, e.g. circles and helices as given curves.

Yaroslav Bazaikin

Geometry and sintering

FRIDAY • 16:50–17:20 • ROOM: L3

Sintering is a physical process used to produce density-controlled materials and components from powders by applying thermal energy. In the talk we discuss the geometrical approach to describing sintering of sorbents based on calcium oxide. The physical picture is the following. The formation of monodisperse calcium oxide granules was exposed to cycles of sorption/regeneration process at high temperature. Resulting capacity of sorbent after many cycles depends of initial geometrical properties of formation. We describe sorbent as dense random packing of spheres which exposed to increase/decrease their diameters during sintering process. The simplest model of sintering process is the sintering of two initially tangent spheres. In this process common boundary surface of two spheres is deforming to decrease area and to smooth initial singularity. In our approach shrinkage factor μ is the main characteristic of sintering and we suggest the following dynamics of μ during sintering

$$\frac{d^2\mu}{dt^2} = -\kappa^2(\omega^2\delta(t) + \mu^2 - 1),$$

where κ, ω — some physical constants and $\delta(t)$ controls the depth of sorption/regeneration. The connection between initial geometry of sphere packing (pore distribution, surface area, density) and geometry of limiting shrinking formation is discussed in the talk.

Cornelia-Livia Bejan

Geometric structures which are harmonic with respect to natural Riemann extension

FRIDAY • 15:00–15:30 • ROOM: L1

Kowalski and Sekizawa introduced natural Riemann extensions on the total space of the cotangent bundle, by generalizing the (classical) Riemann extension which appeared for the first time in the work of Patterson and Walker, Willmore and then many other authors. A natural Riemann extension is a semi-Riemannian metric of neutral type. On the total space of the cotangent bundle endowed with this metric, we study the harmonicity of (local) functions, the harmonicity (in the sense of García-Río, et al.) of certain geometric structures given by (1,1)-tensor fields, and then we deal with some harmonic maps and morphisms. Some examples are constructed throughout the paper.

Lakehal Belarbi

On translation surfaces weight zero Gaussian curvature in Sol_3

THURSDAY • 14:00–15:00 • ROOM: POSTER

In this work we classified translation invariant surfaces with zero Gaussian curvature in the $3-$dimensional Sol group.

Mohamed Belkhelfa

Symmetry properties of complex contact space form

THURSDAY • 14:00–15:00 • ROOM: POSTER

It is well known that a Sasakian space form is pseudo symmetric (Belkhelfa et al.), therefore it is Ricci pseudo symmetric. In this talk, we study the Ricci semi symmetry, Ricci pseudosymmetry and holomorphically Ricci pseudo symmetry; of a normal complex contact manifold, in particular complex contact space form.

Jürgen Berndt

The index of symmetric spaces

THURSDAY • 10:30–11:10 • ROOM: L1

A well-known result, first proved by Iwahori, states that an irreducible Riemannian symmetric space admitting a totally geodesic hypersurface must be a space of constant curvature. Onishchik introduced the index of a Riemannian symmetric space M as the minimal codimension of a totally geodesic submanifold of M. He then gave an alternative proof for Iwahori's result and also classified the irreducible Riemannian symmetric spaces with index 2. He also determined the index of Riemannian symmetric spaces of rank 2. In the talk I will present some new ideas and results on the index of Riemannian symmetric spaces. The new methods allow us to calculate the index for many, but not all, irreducible Riemannian symmetric spaces M. As a consequence we also obtain the classification of all non-semisimple maximal totally geodesic submanifolds of M. We also show that the index is bounded from below by the rank of M, and classify all M for which the index coincides with the rank. This is joint work with Carlos Olmos.

Behroz Bidabad

Evolution of Ricci scalar under Finsler Ricci flow

Tuesday • 9:00–9:30 • Room: L2

Recently, we have studied evolution of a family of Finsler metrics along Finsler Ricci flow and proved its convergence in short time. Here, evolution equation of the reduced hh-curvature and the Ricci scalar along the Finslerian Ricci flow is obtained and it is proved that the Ricci flow preserves positivity of reduced hh-curvature on finite time. Next, it is shown that the evolution of Ricci scalar is a parabolic-type equation and if the initial Finsler metric is of positive flag curvature, then the flag curvature and the Ricci scalar remain positive as long as the solution exists. Finally, a lower bound for the Ricci scalar along the Ricci flow is obtained.

Rory Biggs

Isometries of Riemannian and sub-Riemannian structures on 3D Lie groups

Friday • 14:55–15:25 • Room: L3

It is known for left-invariant Riemannian structures on simply connected nilpotent Lie groups (resp. sub-Riemannian Carnot groups) that every isometry is the composition of a left translation and a Lie group isomorphism; for three-dimensional Lie groups, this covers only the structures on the Heisenberg group (and, trivially, on the Abelian group). In this contribution, we investigate the isometries of left-invariant Riemannian and sub-Riemannian structures on (non-nilpotent) simply connected three-dimensional Lie groups. Towards this end, we classify these structures up to isometric Lie group isomorphism. For each normal form, the isometry group is determined; this amounts to computing the isotropy subgroup of identity. In the Riemannian case, we calculate the (linearized) isotropy subgroup essentially by finding the group of linear isomorphisms preserving the metric, the curvature tensor R, and its covariant derivative ∇R. In the sub-Riemannian case, we show that any isometry of the structure must be an isometry of some Riemannian extension of that structure. In conclusion, we are able to show that (in both the Riemannian and sub-Riemannian case) the majority of isometries are in fact the composition of a left translation and a Lie group isomorphism.

Adara-Monica Blaga

On Ricci solitons in different geometries

TUESDAY • 14:00–15:00 • ROOM: POSTER

In the context of paracontact geometry, η-Ricci solitons are considered on manifolds satisfying certain curvature conditions: $R(\xi, X) cdot S = 0$, $S \cdot R(\xi, X) = 0$, $W_2(\xi, X) \cdot S = 0$ and $S \cdot W_2(\xi, X) = 0$. We prove that on a para-Kenmotsu manifold $(M, \varphi, \xi, \eta, g)$, the existence of an η-Ricci soliton implies that (M, g) is quasi-Einstein and if the Ricci curvature satisfies $R(\xi, X) \cdot S = 0$, then (M, g) is Einstein. Conversely, we give a sufficient condition for the existence of an η-Ricci soliton on a para-Kenmotsu manifold. We also prove that on a Lorentzian para-Sasakian manifold $(M, \varphi, \xi, \eta, g)$, if the Ricci curvature satisfies one of the previous conditions, the existence of η-Ricci solitons implies that (M, g) is Einstein manifold. We also conclude that in these cases there is no Ricci soliton on M with the potential vector field ξ. On the other way, if M is of constant curvature, then (M, g) is elliptic manifold. Cases when the Ricci tensor satisfies different other conditions are also discussed. If the potential vector field of an η-Ricci soliton or an η-Einstein soliton is of gradient type, $\xi := \mathrm{grad}(f)$, using Bochner formula, we derive from the soliton equation a nonlinear second order PDE. Under certain conditions, the existence of an η-Einstein soliton forces the manifold to be of constant scalar curvature. In a particular case of irrotational potential vector field we show that the soliton is completely determined by f.

Aleksandra Borówka

A Swann bundle approach to a generalized Feix–Kaledin construction

THURSDAY • 16:00–16:30 • ROOM: L2

B. Feix and D. Kaledin independently have constructed a hyperkähler structure on the cotangent bundle of any real-analytic Kähler manifold and, more generally, a hypercomplex structure on the tangent bundle of any real-analytic complex manifold with a real-analytic complex connection with curvature of type $(1,1)$. Together with D. Calderbank we generalized this construction: we constructed quaternionic structures on twisted tangent bundles of any real-analytic c-projective manifold S with the c-projective curvature of type $(1,1)$. In this talk I will discuss these constructions from the Swann bundle point of view. In particular I will show that the twisting line bundle with a connection on S, give a quaternionic twist on the Swann bundle.

María Angustias Cañadas-Pinedo

Geometric properties of Cahen-Wallach manifolds

FRIDAY • 14:00–14:30 • ROOM: L1

Cahen-Wallach manifolds are an important family of Lorentz symmetric spaces that were introduced to classify simply connected Lorentz symmetric spaces. The aim of this talk is to study several geometric properties of those manifolds. Namely, we focus on some results obtained from the existence and location of conjugate points.

Andreas Čap

C-projective compactness

MONDAY • 16:00–16:30 • ROOM: L2

My talk is based on joint work with A. Rod Gover (Auckland). Given an even-dimensional smooth manifold $\overline{M}$ with boundary ∂M and interior M, we study linear connections ∇ on TM, which preserve an almost complex structure J on M. In this situation, c-projective compactness of ∇ is a condition similar to conformal compactness of a pseudo-Riemannian metric. Here ∂M becomes a boundary at infinity, which inherits a (possibly non-integrable) CR structure. Via the associated canonical connection, this concept applies to Hermitian metrics on M, which are quasi–Kähler in the sense of Gray-Hervella. I will describe an asymptotic form for a (quasi–)Kähler metric, which is essentially equivalent to c-projective compactness. This also shows that the complete Kähler metrics on strictly pseudoconvex domains constructed in complex analysis are always c-projectively compact. An important role in the story is played by scalar curvature, which allows a surprising sufficient condition for c-projective compactness.

Alfonso Carriazo

Semi-Riemannian generalized Sasakian-space-forms

FRIDAY • 16:50–17:20 • ROOM: L1

In this talk we will review the main facts about generalized Sasakian-space-forms, as well as their possible extensions to semi-Riemannian geometry.

Bin Chen

Modified scalar curvature in Finsler geometry

THURSDAY • 10:30–11:10 • ROOM: L2

In this talk, a new notion of scalar curvature for a Finsler metric F is introduced, and two conformal invariants $Y(M,F)$ and $C(M,F)$ are defined. We prove that there exists a Finsler metric with constant scalar curvature in the conformal class of F if the Cartan torsion of F is sufficiently small and $Y(M,F)C(M,F) < Y(\mathbb{S}^n)$ where $Y(\mathbb{S}^n)$ is the Yamabe constant of the standard sphere.

Xinyue Cheng

Einstein Finsler metrics and Killing vector fields on Riemannian manifolds

TUESDAY • 10:30–11:10 • ROOM: L2

In this talk, we use a Killing form on a Riemannian manifold to construct a class of Finsler metrics. We find equations that characterize Einstein metrics among this class. In particular, we construct a family of Einstein metrics on S^3 with $\mathrm{Ric} = 2F^2$, $\mathrm{Ric} = 0$ and $\mathrm{Ric} = -2F^2$, respectively. This family of metrics provide an important class of Finsler metrics in dimension three, whose Ricci curvature is a constant, but the flag curvature is not.

Jong Taek Cho

Gap theorem of 4-dimensional compact Ricci solitons

MONDAY • 16:45–17:15 • ROOM: L1

Richard Hamilton, [Ham], introduced the Ricci flow for Riemannian metrics. Assume that manifolds are orientable and compact, and we consider the normalized Ricci flow. A soliton for the normalized Ricci flow is a metric that changes only by the pullback map of a one-parameter family of diffeomorphisms as it evolves under the normalized Ricci flow. It was proved that 2-dimensional compact Ricci solitons are of constant curvature ([Ham2], [Cho]). Thomas Ivey [Iv] proved that there are no 3-dimensional compact Ricci solitons other than spaces of constant curvature. In the present talk, we concentrate on 4-dimension compact Ricci solitons. Then we prove a fundamental gap theorem between compact Einstein manifolds and non-trivial compact Ricci solitons.

[Chow] B. Chow *The Ricci flow on the 2-sphere* J. Differential Geom. 33 (1991), 325–334.

[Ham] R. S. Hamilton *Three-manifolds with positive Ricci curvature* J. Differential

Geom. 17 (1982), 255–306.
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[Iv] T. Ivey *Ricci solitons on compact three-manifolds* Differential Geom. Appl. 3 (1993), 301–307.

Adam Chudecki

Congruences of null strings in pseudo-Riemannian geometries

Friday • 17:25–17:55 • Room: L3

4-dimensional complex and real spaces equipped with congruences of totally null, geodesic and self-dual (SD) 2-surfaces are considered. The properties of such congruences are discussed. The concept of the expansion of the congruence and the Sommers vector of the congruence is presented. It appeared, that the existence of the congruences of SD null strings has deep influence on possible Petrov-Penrose types of SD Weyl spinor and on traceless Ricci tensor as well. Spaces equipped with two such foliations are called para-Hermite spaces (or para-Kahler, if both congruences are parallely propagated). In such spaces traceless Ricci tensor is completely determined via geometrical objects which describe the properties of these congruences (expansion, Sommers vector). The possible algebraic types of traceless Ricci tensor in para-Hermite spaces are discussed. Spaces with SD Weyl spinor of the type II or I can admit even richer structure: three or four complementary congruences of SD null strings. Explicit metrics of such spaces are presented. Then the Einstein para-Hermite and para-Kahler spaces are considered. Such spaces have appeared recently in papers devoted to two bodies, rolling on each other without slipping and twisting. It is shown that in such spaces Einstein equations can be reduced to the single, nonlinear differential equation. It appeared that existence of the additional, ASD congruence of null strings is very helpful in finding the solutions of this equation. Finally, some explicit metrics of such spaces are presented and their properties are discussed.

Felipe Contatto

First integrals of affine connections and Hamiltonian systems of hydrodynamic type

Tuesday • 14:00–15:00 • Room: Poster

I will present necessary and sufficient conditions for a local geodesic flow of an affine connection on a surface to admit a linear first integral. The conditions are expressed in terms of two scalar invariants of differential orders 3 and 4 in the connection. I will use this result to find explicit obstructions to the existence of a Hamiltonian formulation of Dubrovin–Novikov type for a given one–dimensional system of hydrodynamic type. Joint work with Maciej Dunajski.

Balázs Csikós

Harmonic manifolds and the volume of tubes about curves

Thursday • 11:50–12:20 • Room: L1

This work is joint with Márton Horváth. H. Hotelling proved that in the n-dimensional Euclidean or spherical space, the volume of a tube of small radius about a curve depends only on the length of the curve and the radius. A. Gray and L. Vanhecke extended Hotelling's theorem to rank one symmetric spaces computing the volumes of the tubes explicitly in these spaces. We generalize these results by showing that every harmonic manifold has the above tube property. We compute the volume of tubes in the Damek–Ricci spaces. We show that if a Riemannian manifold has the tube property, then it is a 2-stein D'Atri space. We also prove that a symmetric space has the tube property if and only if it is harmonic. Our results answer some questions posed by L. Vanhecke, T. J. Willmore, and G. Thorbergsson.

Thi Kim Thoan Do

New solutions of the inverse problem of the calculus of variations

Tuesday • 16:20–16:40 • Room: L3

We present a new class of solutions for the inverse problem in the calculus of variations in arbitrary dimension n. This is the problem of determining the existence and uniqueness of Lagrangians for systems of n second order ordinary differential equations via a certain Cartan two-form. We also provide a number of new theorems concerning the inverse problem using exterior differential systems theory. Our techniques provide a significant advance in the understanding of the inverse problem in arbitrary dimension and, in particular, how to generalize Jesse Douglas's famous solution for $n = 2$. We give some non-trivial examples in dimensions two and three.

Josef Dorfmeister

The loop group method, a unifying scheme, and new examples

Tuesday • 16:00–16:40 • Room: L1

We will illustrate on (up to) 6 examples of surfaces in space forms and other manifolds how the loop group method works.

Boris Doubrov

Complexification of integrable CR geometries

Wednesday • 9:00–9:50 • Room: L1

We consider the relationship of integrable CR geometries with their complex analog: pseudo-product structures. The latter can be interpreted as systems of differential equations of finite type. The link between CR geometries and complex differential equations goes back to classical works of Segre. We discuss the relationship between symmetries, invariants, and Levi-degenerate cases. Finally, we show how this approach allows to obtain the complete classification of hypersurfaces in $\mathbb{C}^3$ with transitive symmetry algebras of dimension ≥ 6. In particular, this includes the boundaries of homogeneous (unbounded) domains in $\mathbb{C}^3$ and complements the classical result of Élie Cartan that all bounded homogeneous domains in this dimension are necessarily symmetric.

Miroslav Doupovec

Vertical functors on all fibered manifolds

Thursday • 15:00–15:30 • Room: L2

This contribution is a joint work of M. Doupovec (Brno), J. Kurek (Lublin) and W. M. Mikulski (Krakow). Recently, the second and the third author constructed generalized vertical Weil functors on the category of fibered manifolds with m-dimensional bases and fibered maps with embeddings as base maps. In this paper we show that the construction of generalized vertical Weil functors works also on the category $\mathcal{FM}$ of fibered manifolds and fibered manifold maps. We also observe that any fiber product preserving bundle functor on $\mathcal{FM}$ is automatically of vertical type. As a consequence we derive that the fiber product preserving bundle functors on $\mathcal{FM}$ are the generalized vertical Weil functors. We also reobtain the result of Kolav r and the third author saying that fiber product preserving bundle functors on $\mathcal{FM}$ commute.

Maciej Dunajski

Gauge theory on projective surfaces and anti-self-dual Einstein metrics

Wednesday • 11:30–12:20 • Room: L1

Given a projective structure on a surface N, I shall explain how to canonically construct a neutral signature Einstein metric with non-zero scalar curvature on the total space M of a certain rank 2 affine bundle $M \to N$. The homogeneous Einstein metric corresponding to the flat projective structure on $\mathbb{R}P^2$ is the non-compact real form of the Fubini-Study metric on $M = SL(3, \mathbb{R})/GL(2, \mathbb{R})$. There are many new non-homogeneous examples. Given a projective structure on a surface N, I shall explain how to canonically construct a neutral signature Einstein metric with non-zero scalar curvature on the total space M of a certain rank 2 affine bundle $M \to N$. The homogeneous Einstein metric corresponding to the flat projective structure on $\mathbb{R}P^2$ is the non-compact real form of the Fubini-Study metric on $M = SL(3, \mathbb{R})/GL(2, \mathbb{R})$. There are many new non-homogeneous examples.

Igor Ernst

Ricci solitons on some low-dimensional (pseudo) Riemannian manifolds

Monday • 14:30–15:00 • Room: L1

This is joint work with E.D.Rodionov, P.N.Klepikov, D.N.Oskorbin. Ricci solitons are an important generalization of Einstein metrics in the (pseudo) Riemannian geometry. Complete (pseudo) Riemannian manifold $(M; g)$ is called the Ricci soliton if the metric g satisfies the equation $r = Cg + L_X g$; where r is the Ricci tensor, $CinR$ is a constant, $L_X g$ is the Lie derivative of g in the direction of full differentiable vector field X. In this paper we investigate the problem of the existence of Ricci solitons on Lorentz-Walker manifolds (i.e. on n-dimensional Lorenzian manifolds admitting a parallel null distribution of d-planes, $d \leq \frac{n}{2}$. These spaces were introduced by Arthur Geffrey Walker in 1949. The geometry of Walker manifolds was considered by M., Brozos-Vázquez, E., García-Río, P. Gilkey, S. Nikcevic, R. Vazquez-Lorenzo. In result we have constructed new families of non-gradient Ricci solitons on four dimensional locally conformally flat Lorentz-Walker manifolds with the help of suitable local coordinate system of A. Galaev. For example, there exist nongradient Ricci soliton with a soliton constant of any sign. It is opposite to the case of gradient Ricci solitons on four-dimensional pp-waves when the Ricci soliton is steady. Let us note that gradient conformally flat Lorentzian Ricci solitons were investigated by S. Gavino Fernandez. In the case of three-dimensional Lorentzian manifolds of Walker we obtained new non-trivial solutions too. In addition, homogeneous Ricci solitons on four-dimensional Lie groups with a left invariant Riemannian metric were studied. The absence of nontrivial homogeneous invariant Ricci solitons was proved. The algebraic soliton equations were solved in terms of the structure constants of the metric Lie algebra.

Ümit Ertem

Extended superalgebras from twistor and Killing spinors

Tuesday • 14:00–15:00 • Room: Poster

The basic first-order differential operators of spin geometry that are Dirac operator and twistor operator are considered. Special types of spinors defined from these operators such as twistor spinors and Killing spinors are discussed. Symmetry operators of massless and massive Dirac equations are introduced and relevant symmetry operators of twistor spinors and Killing spinors are constructed from Killing-Yano (KY) and conformal Killing-Yano (CKY) forms in constant curvature and Einstein manifolds. The squaring map of spinors gives KY and CKY forms for Killing and twistor spinors respectively. They constitute a graded Lie algebra structure in some special cases. By using the graded Lie algebra structure of KY and CKY forms, extended Killing and conformal superalgebras are constructed in constant curvature and Einstein manifolds.

Giovanni Falcone

Compact derivations of the real forms of a complex Lie algebra of type $\{n, 2\}$

Tuesday • 15:00–15:30 • Room: L3

The real form of the $(2n+1)$-dimensional complex Heisenberg Lie algebra is a $(4n+2)$-dimensional real nilpotent Lie algebra with a 2-dimensional commutator ideal coinciding with the centre, and admitting the compact algebra $\mathfrak{sp}(2n)$ of derivations. We find a maximal compact algebra of derivations of any real nilpotent Lie algebra with a 2-dimensional commutator ideal coinciding with the centre, taking the occasion to resume a series of classic results.

Eugene V. Ferapontov

On the integrability in Grassmann geometries: integrable systems associated with fourfolds in Gr(3, 5)

Monday • 9:00–9:50 • Room: L1

The talk is based on joint work with B Doubrov, B Kruglikov and V Novikov. I will discuss a class of dispersionless integrable systems in 3D associated with fourfolds in the Grassmannian $\mathrm{Gr}(3,5)$, revealing a remarkable correspondence with Einstein-Weyl geometry and the theory of $GL(2,\mathbb{R})$ structures. Generalizations to higher dimensions will also be discussed.

[1] B. Doubrov, E.V. Ferapontov, B. Kruglikov, V.S. Novikov, On the integrability in Grassmann geometries: integrable systems associated with fourfolds in $\mathrm{Gr}(3,5)$, arXiv:1503.02274.

Dorel Fetcu

On biconservative surfaces

Tuesday • 17:30–18:10 • Room: L1

We will discuss some of our recent results concerning biconservative surfaces in space forms and product spaces. We will first present a classification result for non-minimal biconservative surfaces with parallel mean curvature vector field in $\mathbb{S}^n \times \mathbb{R}$ and $\mathbb{H}^n \times \mathbb{R}$ and then a result on the compactness of biconservative surfaces with constant mean curvature in Hadamard manifolds. Next, we will consider biconservative surfaces $\left(M^2, g\right)$ in a space form $N^3(c)$, with mean curvature function f satisfying $f > 0$ and $\nabla f \neq 0$ at any point, and determine a certain Riemannian metric g_r on M such that $\left(M^2, g_r\right)$ is a Ricci surface in $N^3(c)$. We will end our presentation with an intrinsic characterization of these biconservative surfaces. The talk is based on joint works with Cezar Oniciuc, Simona Nistor, and A. L. Pinheiro.

Mathias Fischer

Symplectic Lie groups with biinvariant metric

Thursday • 14:00–15:00 • Room: Poster

There is a one-to-one correspondence between Lie Groups with biinvariant metric and metric Lie algebras (finite-dimensional real Lie algebras equipped with a non-degenerate invariant symmetric bilinear form). I. Kath and M. Olbrich (Metric Lie algebras and quadratic extensions, Transform. Groups 11 (2006), no. 1, 87-131) obtained a classification scheme, allowing to determine the isomorphism classes of metric Lie algebras in terms of quadratic extensions and certain cohomology sets. We expand this scheme to include symplectic forms. Every metric, symplectic Lie algebra has the structure of a so called quadratic extension of an auxiliary Lie algebra $\mathfrak{l}$ endowed with a bijective derivation $D_{\mathfrak{l}}$ by an $(\mathfrak{l}, D_{\mathfrak{l}})$-module in a canonical way. We identify equivalence classes of quadratic extensions with so called quadratic cohomology sets and obtain a classification scheme for metric, symplectic Lie algebras and a complete classification of metric, symplectic Lie algebras of small dimension or small index.

Matthias Fischmann

Conformal symmetry breaking differential operators on differential forms

Tuesday • 14:00–15:00 • Room: Poster

We classify all conformal symmetry breaking differential operators on differential forms on euclidean space. Furthermore, we present two sets of factorization identities of conformal symmetry breaking differential operators by Branson-Gover operators, and by the differential and co-differential. Finally, we discuss their applications in view to the structure of Branson-Gover operators.

Anton Galaev

Higher order Lorentzian symmetric spaces

Thursday • 15:00-15:30 • Room: L1

Locally symmetric (pseudo-)Riemannian spaces are defined by the equality $\nabla R = 0$. We classify higher order symmetric Lorentzian spaces, i.e. Lorentzian manifolds satisfying the conditions $\nabla^k R = 0$, $\nabla^{k-1} R \neq 0$ (for $k = 2, 3$). The obtained spaces are pp-waves that generalize Cahen-Wallach symmetric spaces. This is a joint work with D.V.Alekseevsky.

Jordi Gaset

A multisymplectic formalism for the Einsteins equations of gravity

Tuesday • 14:00–15:00 • Room: Poster

In recent works an approach to first order General Relativity using multisymplectic techniques has bin developed, [vey], [ros]. In this work we apply the unified formalism to the original second-order Hilbert-Einstein Lagrangian using a recent work in second-order field theories, [per]. The unified formalism provides us with a Hamiltonian formalism for Einstein's General Relativity. We also study the degeneracy and symmetries of the theory.

[per] P. D. Prieto-MartXnez, N. Rom'an-Roy: "A new multisymplectic unified formalism for second order classical field theories", sl Journal of Geometric Mechanics **7**(2), (2015) 203-253.

[vey] D. Vey: Multisymplectic formulation of vielbein gravity. De Donder-Weyl

formulation, Hamiltonian $(n-1)$-forms, sl Quantum Grav. bf 2 (2015) 095005.
[ros] M.E. Rosado, J. Muñoz Masqué: Integrability of second-order Lagrangians admitting a first-order Hamiltonian formalism, *Differential Geometry and its Application* **35** (2014) 164-177.

Fulvio Gesmundo

Matrix rigidity and the complexity of a linear map

Tuesday • 9:00–9:50 • Room: L3

In the 1960's, the FFT algorithm revolutionized signal processing by reducing the Discrete Fourier Transform calculation from $O(n^2)$ to $O(nlog(n))$ arithmetic operations. In the 1970's, L. Valiant conjectured that one cannot do much better and provided a path to proving its conjecture introducing a notion called matrix rigidity. This path involves determining defining equations for certain cones over the variety of rank at most r matrices of size n. I will discuss approaches to this problem via classical and modern tools in algebraic geometry. This is joint work with J. Hauenstein, C. Ikenmeyer and J.M. Landsberg.

Peter Gilkey

Homogeneous affine surfaces - affine Killing vector fields, gradient Ricci solitons, and moduli spaces

Monday • 16:00–16:40 • Room: L1

The homogeneous affine surfaces have been classified by Opozda, "A classification of locally homogeneous connections on 2-dimensional manifolds" J. Diff. Geo. Appl. **21** (2004), 173–198. They may be grouped into 3 families, which are not disjoint. The connections which arise as the Levi-Civita connection of a surface with a metric of constant Gauss curvature form one family (Type $\mathcal{C}$); there are, however, two other families, one with constant Christoffel symbols on $\mathbb{R}^2$ (Type $\mathcal{A}$) and one with Christoffel symbols $\Gamma_{ij}{}^k := (x^1)^{-1} C_{ij}{}^k$ on $\mathbb{R}^+ \times \mathbb{R}$ and $C_{ij}{}^k$ constant (Type $\mathcal{B}$). For a surface of Type $\mathcal{B}$ or of Type $\mathcal{C}$, we examine the Lie algebra of affine Killing vector fields and we give a complete classification of the homogeneous affine gradient Ricci solitons. The rank of the Ricci tensor plays a central role in our analysis. If the Ricci tensor of a Type $\mathcal{A}$ affine surface is non-singular, we write down a complete set of invariants that determine the local isomorphism type and examine the structure of the associated moduli space. We show the moduli space of Type $\mathcal{B}$ surfaces which are not Type $\mathcal{A}$ and which are not flat is a simply connected real analytic 4-dimensional manifold with second Betti number equal to 1. We also present some preliminary results concerning 3-dimensional Type $\mathcal{A}$ manifolds. This is joint work with M. Brozos-V'azquez, E. García-Río, and J. H. Park.

Simon G. Gindikin

Complex geometry of real symmetric spaces

Monday • 17:30–18:00 • Room: L2

For Riemannian symmetric spaces Harmonic Analysis can be developed using the language of horospheres. However, it is not true for most of pseudo Riemannian symmetric spaces, including real semisimple Lie groups. Gelfand asked if it is possible to extend the method horospheres such a way that it would work at the general case. On the example of pseudo hyperbolic spaces I will explain how it is possible to do so using complex horospheres.

Wolfgang Globke

Compact pseudo-Riemannian solvmanifolds

Tuesday • 15:00–15:20 • Room: L2

Let M be a compact connected pseudo-Riemannian manifold on which a solvable connected Lie group G of isometries acts transitively. We show that G acts almost freely on M and that the metric on M is induced by a bi-invariant pseudo-Riemannian metric on G. Furthermore, we show that the identity component of the isometry group of M coincides with G. Our proofs make use of a Borel-type density theorem, combined with the reduction theory of pseudo-Riemannian metric Lie groups. This is joint work with Oliver Baues (Göttingen).

Rod Gover

Higher dimensional analogues of the Willmore energy and invariant

Monday • 14:00–14:40 • Room: L2

The Willmore energy of a surface is a conformal measure of its failure to be conformally spherical. In physics the energy is variously called the bending energy, or rigid string action. In both geometric analysis and physics it has been the subject of great recent interest. We explain that its Euler-Lagrange equation is an extremely interesting equation in conformal geometry: the energy gradient is a fundamental curvature that is a scalar-valued hypersurface analogue of the Bach tensor (of dimension 4) of intrinsic conformal geometry. Then we show that that these surface conformal invariants, i.e. the Willmore energy and its gradient, are the lowest dimensional examples in a family of similar invariants in higher dimensions. They arise in the asymptotics associated with a singular Yamabe problem on conformally compact manifolds. They also arise as the functional gradient of an "energy" given by an anomaly term in a related renormalised volume expansion, and this anomaly term is, in turn, the integral of a local Q-curvature quantity for hypersurfaces that generalizes Branson's Q-curvature by including coupling to the (extrinsic curvature) data of the embedding. This is joint work with Andrew Waldron arXiv:1506.02723, arXiv:1603.07367 and also Michael Glaros, Matthew Halbasch arXiv:1508.01838

Xavier Gràcia

Some structural aspects of Hamilton-Jacobi theory

Tuesday • 17:30–18:10 • Room: L3

A general geometric framework for the Hamilton-Jacobi theory has been recently developed by Cariñena et al. Within this framework, a complete solution of the HJ equation is understood as a "slicing"; of a given dynamical system, that is, a way to describe its solutions in terms of a collection of dynamics in lower-dimensional submanifolds. We study its interplay with some usual geometric structures that the system may possess; this includes, in particular, systems on fibred manifolds and Hamiltonian systems.

Jan Gregorovič

Generalizations of symmetric space in theory of parabolic geometries

Tuesday • 14:00–15:00 • Room: Poster

There are several possibilities, how to generalize (locally) symmetric spaces in the theory of parabolic geometries. I will review our recent work with L. Zalabová concerning these generalization. These generalization can be given either as homogeneous parabolic geometries with certain distinguished class of automorphisms of parabolic geometries or they can be related to transformations of geodesics of Weyl connections or natural transformations of generalized geodesics of the parabolic geometry. In the case of projective, conformal and many other types of parabolic geometries, we can show that these generalizations coincide with invariant geometric structures on (locally) symmetric spaces, when they are non–flat. On the other hand, we can construct examples of flat parabolic geometries, which are globally symmetric in the generalized sense, but they are not locally symmetric spaces. In the case of parabolic contact geometries, the generalizations can be related to certain known generalizations of symmetric spaces know as either generalized affine symmetric spaces or reflexion spaces.

Ali Haji-Badali

On the certain homogeneous paracontact 3-manifolds

THURSDAY • 14:00–15:00 • ROOM: POSTER

Three-dimensional homogeneous paracontact metric manifolds were classified by G. Calvarouso, so here a full classification of three-dimensional homogeneous paracontact manifolds for which the Reeb vector field of the underlying contact structure satisfies a nullity condition have been classified.

Matthias Hammerl

Holography of BGG-solutions

THURSDAY • 16:40–17:10 • ROOM: L2

We present a geometric framework to relate solutions of natural Riemannian equations for a Poincaré-Einstein manifold (M, g) with solutions of corresponding conformally invariant equations at the conformal infinity (M_0, c). Particularly interesting conformally invariant equations on (M_0, c) are the Einstein-scale equation, the conformal Killing-form equation and the twistor spinor equation. This talk is based on joint work with Travis Willse.

Lynn Heller

Constrained Willmore minimizers

TUESDAY • 14:50–15:30 • ROOM: L1

I consider compact immersed surfaces minimizing the Willmore energy under the constraint of prescribed conformal class. For spheres, where there exist only one conformal structure, the constrained Willmore minimizer is the round sphere. For topological tori the Willmore conjecture, solved by Marquez and Neves, shows that the Clifford torus minimizes the Willmore energy in the class of all immersions, and thus it clearly also minimizes the energy in its conformal class - the square class. The only other case where the constrained Willmore minimizers are determined (by Ndiaye and Schätzle) is for rectangular conformal classes in a small neighborhood of the square class, where the homogenous tori minimizes. I want to construct candidates of constrained Willmore minimizers for more generic conformal classes and then discuss how to generalize the Ndiaye and Schätzle result to an open neighborhood of the square class in Teichmüller space. This is joint work with Cheikh Ndiaye.

Jaroslav Hrdina

Extremals of sub Riemanian geometry based on trident snake like mechanisms

Tuesday • 14:00–15:00 • Room: Poster

We are exploring extremal curves of Sub-Riemanian geometry with respect to control distribution of class of mechanisms based on trident snake. We use fact that the control distribution of trident snake like mechanisms satisfes Chow-Rashevski condition. In particularly we discuss their applications in control of our mechanisms.

Cristina Hretcanu

On the geometry of warped product submanifolds in a metallic Riemannian product manifold

Thursday • 14:00–15:00 • Room: Poster

The main aim of this paper is to study the warped product submanifolds in a Riemannian product manifold.

Cristian Ida

Holomorphic last multipliers on complex manifolds

Tuesday • 14:00–15:00 • Room: Poster

The last multipliers (Jacobi last multipliers) are very useful tools in the study of completely integrate systems of first-order ODE's. The goal of this paper is to study the theory of last multipliers in the framework of complex manifolds with a fixed holomorphic volume form. The motivation of our study is based on the equivalence between a holomorphic ODE system and an associated real ODE system and we are interested how we can relate holomorphic last multipliers with real last multipliers. Also, we consider some applications of our study for holomorphic gradient vector fields on holomorphic Riemannain manifolds as well as for holomorphic Hamiltonian vector fields on holomorphic Poisson manifolds.

Christian Ikenmeyer

Matrix multiplication algorithms with symmetry

Tuesday • 10:30–11:20 • Room: L3

Among the set of all computationally optimal algorithms for matrix multiplication there are some algorithms that exhibit significant additional symmetry and interesting geometry. We present the state of the art in the study of these algorithms and how it can potentially lead to new and faster algorithms for matrix multiplication.

Josef Janyška

Covariant quantum dynamics

Monday • 17:40–18:10 • Room: L3

We apply the theory of natural and gauge-natural bundles and natural operators to classify covariant operators appearing in covariant approach to Quantum Mechanics based on a curved spacetime fibred on time and equipped with a spacelike Riemannian metric. Namely we classify all (2nd order) covariant kinetic quantum momenta, quantum probability vector fields, Schroedinger operators and quantum lagrangians.

Hassan Jolany

Fiberwise singular Kahler Einstein metric is semi-positive

Thursday • 16:40–17:10 • Room: L1

Existence of canonical metric on a projective variety was a long standing conjecture which the major part of this conjecture is about varieties which do not have definite first Chern class (most of the manifolds do not have definite first Chern class). There is a program which is known as Song-Tian program for finding canonical metric on canonical model of a projective variety by using minimal model program. In this talk, we investigate Song-Tian program on pair (X, D) which D is a snc divisor with conical singularities. We prove that when central fiber has canonical singularities then fiberwise Kahler Einstein metric is semi-positive along a holomorphic fiber space whose fibers are of general type.

Maria Karmanova

Maximal surfaces on sub-Lorentzian structures

Friday • 14:00–14:30 • Room: L2

For classes of Heisenberg group-valued mappings, we define a suitable notion of a variation and derive equation of maximal surfaces for 5-dimensional sub-Lorentzian structures those are non-holonomic generalization of Minkowsli geometry. A sub-Lorentzian <<square>> distance is defined on 5D structures as

$$(\widetilde{d}_{\infty}^{SL_2})^2(v,y) = \max\bigl\{\max\{y_1^2, y_2^2\} - y_4^2, \operatorname{sgn}(y_3^2 - y_5^2)\sqrt{|y_3^2 - y_5^2|}\bigr\}.$$

The main results describe necessary and sufficient maximality conditions for graph-surfaces. The necessary maximality condition is

$$\int\limits_{\Omega} \frac{X_1\xi_4(v)J_1(\varphi,v) + X_2\xi_4(v)J_2(\varphi,v) + \langle \widehat{D}_H\varphi, \widehat{D}\xi\rangle(v)J_3(\varphi,v)}{\sqrt{1-(X_1\varphi_4)^2(v)}\sqrt{1-(X_2\varphi_4)^2(v)}\sqrt{1-(X_3\varphi_5)^2(v)}}\, dv = 0,$$

with $J_k = J_k(\widehat{D}\varphi_4)$, and additional sufficient condition is

$$\int\limits_{\Omega} \Big(\mathbf{c}^5\big((X_1\xi_4)^2 + (X_2\xi_4)^2 + (\langle \widehat{D}_H\varphi, \widehat{D}\xi\rangle)^2\big)$$

$$+\langle \widehat{D}\xi, \widehat{D}\xi\rangle X_3\varphi_5 \frac{\sqrt{1-(X_1\varphi_4)^2}\sqrt{1-(X_2\varphi_4)^2}}{\sqrt{1-(X_3\varphi_5)^2}}\Big)\, d\mathcal{H}^4 \geq K\|\xi\|_8^2, \ \ \mathbf{c} \in (0,1).$$

The research is supported by RFBR (Grant 14-01-00768).

Kotaro Kawai

Frölicher-Nijenhuis bracket and geometry of G_2-and Spin(7)-manifolds

Tuesday • 17:10–17:30 • Room: L2

We extend the characterization of the integrability of an almost complex structure J on differentiable manifolds via the vanishing of the Frölicher-Nijenhuis bracket $[J,J]^{FN}$ to analogous characterizations of torsion-free G_2-structures and torsion-free Spin(7)-structures. We also explain the Fernández-Gray classification of G_2-structures and the Fernández classification of Spin(7)-structures in terms of the Frölicher-Nijenhuis bracket. For torsion-free G_2- and Spin(7)-manifolds we define and study new cohomology invariants of these manifolds using the Frölicher-Nijenhuis bracket and our characterization theorems. This is a joint work with Hông Vân Lê and Lorenz Schwachhöfer.

David Csaba Kertesz

Affine and Killing vector fields of Berwald manifolds

Thursday • 14:00–15:00 • Room: Poster

In 1955 J. Hano proved that a bounded affine vector field of a complete Riemann manifold is necessarily a Killing vector field. In this talk we shows that the same result is true for Berwald manifolds.

Giorgi Khimshiashvili

Geometry of equilibrium configurations of point charges on planar curves

TUESDAY • 14:00–15:00 • ROOM: POSTER

We aim at geometric characterization of those finite collections of points on a (non-necessarily connected) planar curve which can serve as stable equilibrium configurations of point charges with Coulomb interaction. For example, a triple of points on a convex curve can be represented as an equilibrium configuration of three (non-necessarily equal) point charges if and only if the normals to the curve at those points are concurrent. The structure of all such triples can be described in terms of the geometry of the caustic of given curve. Moreover, the possibility of representing a given triple as a stable equilibrium configuration of point charges is governed by the sign of a certain explicit expression involving the curvatures of the curve at the given points. These results are taken as a paradigm and extended in several directions. In particular, we give rather complete results in the case of an odd number of point charges on ellipse and system of nested circles. Some analogous results are available for configurations of points on a convex surface in three-dimensional Euclidean space.

Nina Khor'kova

On some constructions in the nonlocal theory of partial differential equations

THURSDAY • 16:40–17:20 • ROOM: L3

The structure of the determining equations for nonlocal symmetries led to the formulation of the reconstruction problem for nonlocal symmetries [1], [2]. An evolutionary derivation $\ni_\varphi$ is a local symmetry of the equation $\mathcal{E} = F = 0$ iff its generating function $\varphi \in \ker \ell_F$, where ℓ_F is the universal linearization operator for the equation $\mathcal{E}$. In nonlocal theory any symmetry in the covering $\tau : \tilde{\mathcal{E}} \to \mathcal{E}$ is of the form $\tilde{\ni}_\varphi + X$, where function $\varphi \in \mathcal{F}(\tilde{\mathcal{E}}) \bigcap \ker \tilde{\ell}_F$, while coefficients of the vector field X satisfy an additional system of equations [1], [2]. This system may have no solution for a given $\varphi \in \ker \tilde{\ell}_F$ (nonlocal shadow), that is not any shadow can be lifted to a nonlocal symmetry in the covering under consideration. Nevertheless one can try to find nonlocal symmetry for a given shadow φ in another covering. The reconstruction problem is important both from theoretical and practical points of view. So several constructions of coverings were suggested to solve it [1], [2], [4]. In this contribution we generalize constructions of the paper [3] (see also [2]), based on the use a special vector field ("universal symmetry")

S. Then we study interplay between the operator S and C-differential operators, Euler operator, symmetries, conservation laws in order to construct series of nonlocal symmetries and conservation laws (conserved densities and their generating functions) and to get formulas necessary for calculations.

[1] N.G. Khor'kova. Conservation laws and nonlocal symmetries. Math.Notes 44(1988), 562–568.
[2] A.V. Bocharov, V.N. Chetverikov, S.V. Duzhin, N.G. Khor'kova, I.S. Krasil'shchik, A.V. Samokhin, Yu.N. Torkhov, A.M. Verbovetsky, A.M. Vinogradov. Symmetries and Conservation Laws for Differential Equations of Mathematical Physics. Translations of Mathematical Monographs. Providence, RI, AMS, 1999, vol. 182.
[3] N.G. Khor'kova. Conservation laws and nonlocal symmetries. Trudy MVTU, 512 (1988), 105textendash 119 (Russian).
[4] A.M. Verbovetsky, V.A. Golovko, I. S. Krasil'shchik. On the Lie bracket for nonlocal shadows. Nauchny vestnik MGTU GA 91(2007), 13textendash 21 (Russian).

Gyu Jong Kim

Real hypersurfaces in complex hyperbolic Grassmannians of rank 2 with GTW Reeb Lie derivative structure Jacobi operator

THURSDAY • 14:00–15:00 • ROOM: POSTER

In complex two plane Grassmannians, it is known that a real hypersurface satisfying the condition $\hat{L}_{\xi}^{(k)} R_{\xi})Y = (\mathcal{L}_{\xi} R_{\xi})Y$ is locally congruent to an open part of a tube around a totally geodesic $G_2(\mathbb{C}^{m+1})$ in $G_2(\mathbb{C}^{m+2})$. In this paper, as an ambient space, we consider a complex hyperbolic two-plane Grassmannian NBt and give a complete classification of a real hypersurface in $SU_{2,m}/S(U_2{\cdot}U_m)$ with the above condition.

Shin Young Kim

Geometric structures modelled on smooth projective horospherical varieties of Picard number one

TUESDAY • 16:40–17:00 • ROOM: L2

Geometric structures modeled after rational homogeneous manifolds are studied to characterize rational homogeneous manifolds and to prove their deformation rigidity. To generalize these characterizations and deformation rigidity results to quasi homogeneous varieties, we first study horospherical varieties and geometric structures modeled after horospherical varieties. Using Cartan geometry, we prove that a geometric structure modeled after a smooth projective horospherical variety of Picard number one is locally equivalent to the standard geometric structure when the geometric structure is defined on a Fano manifold of Picard number one. We will apply this method to characterize smooth projective horospherical varieties of type B_m.

Chang-Wan Kim

Entropy of nonpositively curved Finsler manifolds

THURSDAY • 14:00–15:00 • ROOM: POSTER

In this talk, we discuss an estimate of Foulon for the measure theoretic entropy h_{mu} of the geodesic flows for compact Finsler manifolds with nonpositive flag curvature. Let M be a compact Finsler manifold with nonpositive flag curvature K. Then we have

$$h_m u \geq \int_{SM} tr\sqrt{-K(v)}\, d\mu(v),$$

where SM is the unit tangent bundle of M and μ is the normalized Liouville measure on SM. Equality holds if and only if the flag curvature is parallel along the geodesic flows. Our proof is simplification of the proof of Foulon and it works under the weaker assumption of nonpositive flag curvature. The proof of ours will be achieved by approximation of the flag curvature bounded above by a strictly negative constant, which does not mean that of the Finsler metric on M.

Makoto Kimura

Twistor space of complex 2-plane Grassmannian and submanifolds in complex projective space

TUESDAY • 9:00–9:30 • ROOM: L1

Twistor space Z of complex 2-plane Grassmannian $G_2(\mathbb{C}^{n+1})$ is naturally identified with the space of oriented geodesics is complex projective space $\mathbb{C}P^n$. Using this fact, we can construct (i) Hopf hypersurfaces and (ii) some Lagrangian submanifolds in $\mathbb{C}P^n$ from some submanifolds Z and $G_2(\mathbb{C}^{n+1})$. Similar construction of submanifolds in complex hyperbolic space CH^n is also obtained.

Sebastian Klein

A spectral theory for certain constant mean curvature surfaces in the 3-dimensional space forms

THURSDAY • 14:00–15:00 • ROOM: POSTER

For an immersed surface, M, in a 3-dimensional space form $E^3(\varkappa)$ of constant mean curvature (CMC) H, $H^2 > -\varkappa$, there exist local coordinates z near non-umbilic points so that the Gauss equation reduces to the sinh-Gordon equation

$$\triangle u + \sinh(u) = 0$$

for the conformal factor u of the immersion. In this setting CMC tori induce doubly periodic solutions u. Such solutions have been classified by Pinkall/Sterling, and independently by Hitchin. Hitchin's method was based on associating to each u so-called *spectral data* (Σ, D). Here the *spectral curve* Σ is a Riemann surface, and D is a divisor on Σ. In the poster I consider the more general situation of simply periodic u. Such solutions u give rise to a far larger class of CMC surfaces, for example the Lawson surfaces are included. I will describe how one can associate to a simply periodic solution u spectral data (Σ, D) that are analogous to the doubly periodic case. The fundamental difference between our case and the doubly periodic case is that now the spectral curve Σ generally has infinite genus. Its branch points accumulate near $\lambda = 0$ and near $\lambda = \infty$. The *direct problem* for a given simply periodic solution u is to construct and study the corresponding spectral data (Σ, D). In particular it turns out that, (Σ, D), asymptotically approximates near $\lambda = 0$ and $\lambda = \infty$ the spectral data (Σ^0, D^0) of the "vacuum solution" $u \equiv 0$. Finally, the *inverse problem* will be discussed, which concerns the reconstruction of a solution u of the sinh-Gordon equation, and consequently the corresponding CMC immersion from the spectral data (Σ, D).

Pavel Klepikov

Left-invariant pseudo Riemannian metrics on 4-dimensional Lie groups with zero divergence Weyl tensor

THURSDAY • 14:00–15:00 • ROOM: POSTER

This is joint work with Khromova O.P., Rodionov E.D. Riemannian manifolds with zero divergence Weyl tensor were investigated by many mathematicians. In particular, this class contains Einstein manifolds ($r = \lambda g$) and their direct products, locally symmetric spaces ($\nabla R = 0$), Ricci parallel manifolds ($\nabla r = 0$), and conformally flat manifolds ($W = 0$). In general case the classification problem of (pseudo) Riemannian manifolds with zero divergence Weyl tensor is very difficult. Therefore one can consider some restrictions. For example, Calvaruso G. and Zaeim A. have classified pseudo-Riemannian left-invariant Einstein metrics, metrics with parallel Ricci tensor, and conformally flat metrics on four-dimensional Lie groups.

Besides this, Khromova O.P., Rodionov E.D. and Slavskii V.V. have classified four-dimensional Lie groups with left-invariant Riemannian metric and zero divergence Weyl tensor. In this paper, we obtain full classification of left-invariant pseudo-Riemannian metrics on four-dimensional Lie groups with zero divergence Weyl tensor, which are neither Einstein metrics, nor conformally flat metrics, nor Ricci parallel metrics.

Ivan Kolář

Covariant approach to Weil bundles

TUESDAY • 14:00–15:00 • ROOM: POSTER

The basic properties of the covariant approach of Weil bundles will be presented. Some interesting applications will be discussed.

Piotr Kopacz

Application of Finslerian solutions to generalized Zermelo navigation problem to refine search models in the presence of perturbation

THURSDAY • 14:00–15:00 • ROOM: POSTER

We generalize the Zermelo navigation problem and its solution on Riemannian manifolds (M, h) admitting a space dependence of a ship's own speed $|u(x)|_h \leq 1$ in the presence of a perturbation W determined by a mild velocity vector field $|W(x)|_h < |u(x)|_h$, with application of Finsler metric of Randers type as well as under a stong wind, i.e. $|W(x)|_h = |u(x)|_h$, with application of Kropina metric. We investigate the refinements of the standard search patterns in case of acting background wind, based on the time-minimal paths as the Finslerian solutions to Zermelo's problem and in the context of real applications to navigation.

Iosif Krasil'shchik

Nonlocal geometry of PDEs and integrability

FRIDAY • 10:30–11:20 • ROOM: L1

Integrability of PDEs is linked to the existence of certain operators, such as recursion, symplectic and recursion ones. These operators relate to nonlocal geometry of equations (differential coverings) in two different ways. First, in many cases (and practically always for recursion operators) they contain nonlocal terms, such as $D - X^{-1}$ (or more complicated). Second, their geometric definition appeals to the construction of two special and natural coverings, the tangent and cotangent ones. I am going to give a general overview of the theory of differential covering over infinitely prolonged PDEs and of the role of this theory in the study of integrable systems.

Boris Kruglikov

Jet-determination of symmetries in parabolic geometry.

MONDAY • 14:50–15:30 • ROOM: L2

This is joint work with Dennis The. Jet-determination refers to the amount of data required to specify an automorphism of a specific geometry, and this is the classical topic in mathematics with the origin in works of Cartan, Tanaka, Chern, Moser and others. In the context of parabolic geometries a related concept, symmetries with higher fixed points, was studied recently by Cap-Melnick and Melnick-Neusser. We show that any symmetry of a (regular normal) parabolic geometry is 2-jet determined, and for many non-flat geometries we show they are in fact 1-jet determined. This generalizes the known results in conformal, projective, CR- and other classical geometries.

Rakesh Kumar

Semi-Invariant lightlike submanifolds of indefinite Kaehler manifolds with quarter symmetric non-metric connection

THURSDAY • 14:00–15:00 • ROOM: POSTER

In this paper, we study semi-invariant lightlike submanifolds of an indefinite Kaehler manifold with quarter symmetric non-metric connection $\tilde{D}$ and prove that the induced connection D on a semi-invariant lightlike submanifold is also a quarter-symmetric non-metric connection. We find a necessary and sufficient condition for the screen distribution of a semi-invariant lightlike submanifold to be integrable. We prove that a proper totally umbilical semi-invariant lightlike submanifold of an indefinite Kaehler manifold $\tilde{M}$ with quarter symmetric non-metric connection is a totally geodesic lightlike submanifold of $\tilde{M}$. We also obtain some characterization theorems for a semi-invariant lightlike submanifold of an indefinite Kaehler manifold $\tilde{M}$ with quarter symmetric non-metric connection to be a semi-invariant lightlike product manifold. Finally, we obtain some necessary and sufficient conditions for a proper totally umbilical semi-invariant lightlike submanifold of an indefinite Kaehler manifold $\tilde{M}$ with quarter symmetric non-metric connection $\tilde{D}$ to be minimal.

Deepika Kumari

On biconservative Lorentz hypersurfaces with non diagonal shape operator

Thursday • 14:00–15:00 • Room: Poster

In this paper, we prove that every biconservative Lorentz hypersurfaces M_1^n in E_1^{n+1} with non diagonal shape operator having complex eigen values with five distinct principal curvatures has constant mean curvature. The author acknowledges useful discussions and suggestions with Ram Shankar Gupta and Andreas Arvanitoyeorgos.

Jan Kurek

The modified vertical Weil functors 2-fibred manifolds

Tuesday • 14:00–15:00 • Room: Poster

This contribution is a joint work of M. Doupovec (Brno), J. Kurek (Lublin) and W. M. Mikulski (Kraków). We extend the concept of modified vertical Weil functors on the category $\mathcal{FM}_m$ of fibred manifolds of m-dimensional bases to the one of modified vertical Weil functors on the category $2-\mathcal{FM}_{m,n}$ of 2-fibred manifolds with (m, n)-dimensional bases. Then we prove that any fiber product preserving bundle functor on $2 - \mathcal{FM}_{m,n}$ is isomorphic to a modified vertical Weil functor.

Miroslav Kureš

On the orientability of Weil contact elements and bundles

Tuesday • 14:00–15:00 • Room: Poster

The talk is mainly devoted to the algebraic background of Weil contact elements: in particular, we investigate an eventual absence of orientation reversing maps by the description of Weil algebras having their group of automorphisms with only one connected component. In total, we discuss the orientability of contact elements, as well as bundles of contact elements (viewed as differentiable manifolds).

Hong Van Le

Floer-Novikov homology and symplectic fixed points

Friday • 15:50–16:10 • Room: L3

I shall present new results obtained jointly with Kaoru Ono on Floer-Novikov homology and symplectic fixed points. Our main theorem generalizes the homological version of the Arnold conjecture for Hamiltonian symplectic fixed points that has been proved by Fukaya-Ono and Liu-Tian. My talk is based on the e-print arXiv:1511.00638 and a new result obtained in this year.

Benling Li

Finsler metrics with special flag curvature

Thursday • 9:00–9:30 • Room: L2

Finsler metrics with scalar flag curvature play an important role to show the complexity and richness of general Finsler metrics. In this talk, we discuss the Finsler metrics with special flag curvature. We mainly focus on weakly isotropic flag curvature and constant flag curvature. Some recent results and related progresses will be introduced.

Verónica López

Marginally trapped submanifolds in generalized Robertson-Walker spacetimes

Thursday • 14:00–15:00 • Room: Poster

The concept of trapped surfaces was originally formulated by Penrose for the case of 2-dimensional spacelike surfaces in 4-dimensional spacetimes in terms of the signs or the vanishing of the so-called null expansions. More generally, and following the standard terminology in relativity, a codimension two spacelike submanifold is said to be marginally trapped if its mean curvature vector field is lightlike. In this work we consider codimension two marginally trapped submanifolds in the family of general Robertson-Walker spacetimes. In particular we derive some rigidity results for this type of submanifolds which guarantee that, under appropriate hypothesis, the only ones are those contained in slices. We also derive some interesting non-existence results for weakly trapped submanifolds. In particular, we give applications to some cases of physical relevance such as the Einstein-de Sitter spacetime and certain open regions of de Sitter spacetime, including the so called steady state spacetime. Our results will be an application of the (finite) maximum principle for closed manifolds and, more generally, of the weak maximum principle for stochastically complete manifolds. This is a joint work with Luis J. Alías and A. Gervasio Colares.

[1] L. J. Alías, V. L. Cánovas and A. G. Colares, Marginally trapped submanifolds in generalized Robertson-Walker spacetimes, Preprint (2016).

Sadahiro Maeda

A characterization of homogeneous real hypersurfaces of types (C), (D) and (E) in a complex projective space

TUESDAY • 10:30–11:10 • ROOM: L1

We give a necessary and sufficient condition that a Riemannian manifold M^{2n-1} isometrically immersed into a complex projective space $\mathbb{C}P^n(c)$ is locally congruent to one of homogeneous real hypersurfaces of types (C), (D) and (E) in this ambient space in terms of its restricted principal curvature distributions.

Laurent Manivel

Hyperkähler varieties as parameter spaces

MONDAY • 10:30–11:20 • ROOM: L1

Hyperkähler varieties are an important class of complex varieties, with a rich and beautiful general theory but only few examples when we restrict to the compact case. I will discuss the possibility to construct hyperkähler varieties as parameter spaces for cycles on varieties with special Hodge structures. In particular I will explain such a construction in connection with the series of exceptional complex Lie groups (joint work with Atanas Iliev).

Veronica Martin-Molina

Some remarkable paracontact metric manifolds

THURSDAY • 14:00–15:00 • ROOM: POSTER

A remarkable class among the paracontact metric manifolds is that of (κ, μ)-spaces, studied by numerous authors since their definition in [BKP]. An area of special interest has always been a particular class of paracontact metric manifolds which have no contact metric counterpart: the paracontact metric $(-1, \mu)$-spaces that satisfy $h^2 = 0$ but $h \neq 0$. I presented a local classification of those special manifolds in [mio] and showed examples of every possible constant rank of h and some new examples of non-constant rank in [mio], [mio2], [mio3]. I propose to talk about those works in order to give a survey on this very interesting topic.

[BKP] D. E. Blair, T. Koufogiorgos, B. J. Papantoniou, *Contact metric manifolds satisfying a nullity condition.* Israel J. Math., **91**, 189–214 (1995).

[mio] V. Mart'in-Molina, *Paracontact metric manifolds without a contact metric counterpart.* Taiwanese J. Math., **19**, no.1, 175–191 (2015).

[mio2] V. Mart'in-Molina, *Local classification and examples of an important class of paracontact metric manifolds.* Filomat **29**, no.3, 507–515 (2015).

[mio3] V. Mart'in-Molina, *On a remarkable class of paracontact metric manifolds.* Int. J. Geom. Methods Mod. Phys., **12**, no.8, 1560024 (6 pages) (2015).

Antonio Martinez

A Geometric bridge between $\mathbb{H}^3$ and $\mathbb{R}^3$

TUESDAY • 11:50–12:20 • ROOM: L1

It is well known that minimal surfaces in Euclidean space $\mathbb{R}^3$ and flat fronts in $\mathbb{H}^3$ admit a holomorphic representation. They also share in common the fact that there are many interesting global theorems about their geometry and topology. In addition, from the point of view of partial differential equations, both classes are intimately related to the Hessian one equation:

$$\mathrm{Det}(\nabla^2\phi) = 1.$$

However, despite these similarities, there is no direct geometric link between these two classes of surfaces that are immersed in different ambient spaces. In the talk we show a geometric construction that associates to a given flat front in $\mathbb{H}^3$ a pair of minimal surfaces in $\mathbb{R}^3$ that are related by a Ribaucour transformation. This construction is a particular case of a geometric method to associate a given frontal in $\mathbb{H}^3$ to a pair of frontals in $\mathbb{H}^3$ that are the envelopes of a smooth congruence of spheres. We show how this construction help to unravel interesting relation between surfaces immersed in $\mathbb{H}^3$ and$\mathbb{R}^3$.

Michal Marvan

A summary of results on the constant astigmatism equation

THURSDAY • 15:50–16:30 • ROOM: L3

The talk will concern the integrable equation $z_{yy} + (1/z)_{xx} + 2 = 0$. The equation represents surfaces characterized by constant difference between the principal radii of curvature, with x, y being the curvature coordinates. The same equation represents equiareal orthogonal patterns on the unit sphere. We shall summarize what is known about this equation and its solutions.

Tom Mestdag

Reduction and un-reduction of second-order ordinary differential equations

TUESDAY • 15:50–16:20 • ROOM: L3

By Lagrangian reduction, a lagrangian system with a symmetry Lie group can be reduced to a dynamical system on a quotient manifold. Un-reduction is the process where one associates to a Lagrangian system on a manifold a dynamical system on a principal bundle over that manifold, in such a way that solutions project. We show that, when written in terms of second-order ordinary differential equations (sodes), one may associate to the given system a "primary un-reduced sode", and we explain how all other un-reduced sodes relate to it. We give examples that show that the considered procedure exceeds the realm of Lagrangian systems.

Mateusz Michalek

Local algebraic geometry and computational complexity

TUESDAY • 11:30–12:20 • ROOM: L3

Estimating computational complexity of matrix multiplication is equivalent computing rank (or border rank) of a specific tensor. This in turn can be restated in geometric terms related to the secant varieties of the Segre product. Basing on a joint work with JM Landsberg, I will present local analogs of the above statements. In particular, we introduce subvarieties of the secant varieties, local in nature, which are important for the matrix multiplication problem. I will also sketch known and new approaches to providing lower bounds for the complexity of matrix multiplication.

Josef Mikeš

On the global geometry of projective submersions (with S.E. Stepanov)

TUESDAY • 12:25–12:55 • ROOM: L1

In the present report we will prove some Liouville type vanishing theorems (see [1]) for conformal, projective and holomorphically projective mappings of complete noncompact Riemannian and Kähler manifolds which generalize similar well known results for compact manifolds. Here we give an example of our result.

Theorem. *Let* (M, g, J) *be a complete noncompact Kählerian manifold and* $f\colon (M, g, J) \to (\bar{M}, \bar{g}, \bar{J})$ *be a holomorphically projective diffeomorphism onto another Kählerian manifold* $(\bar{M}, \bar{g}, \bar{J})$ *such that* $\mathrm{trace}\overline{Ric} \geq s$ *for the Ricci tensor* $\overline{Ric}$ *of* $(\bar{M}, \bar{g}, \bar{J})$ *and the scalar curvature* s *of* (M, g, J)*. If* $(dV_{\bar{g}}/dV_g) \in L^p(M, g)$ *for a positive number* $p \neq 1$ *then* f *is affine map.*

[1] Pigola S., Rigoli M., Setti A.G., Vanishing and finiteness results in geometric analysis. A generalization of the Bochner technique, Birkhäuser Verlag AG, Berlin, 2008.

Francisco Milan

Improper affine spheres and the Hessian one equation

Thursday • 14:00–15:00 • Room: Poster

The Hessian one equation and its complex resolution provides an important tool in the study of improper affine spheres. Conversely, the properties of these surfaces play an important role in the development of geometric methods for the study of their PDEs. We review some results of this good interplay and present our extension of the classical Ribaucour transformations to this subject. In particular, we construct new solutions and families of improper affine spheres, periodic in one variable, with any even number of complete embedded ends and singular set contained in a compact set. Also, we compare the Cauchy problem for the elliptic and non-elliptic Hessian equation, with some results about their admissible singularities, mainly, isolated singularities and singular curves with cuspidal edges and swallowtails.

Ivan Minchev

The qc Yamabe equation on a 3-Sasakian manifold

Monday • 14:00–14:30 • Room: L1

The talk will based on results obtained in collaboration with S. Ivanov and D.Vassilev. I will present a solution to the quaternionic contact Yamabe equation on the 3-Sasakian sphere of dimension $4n + 3$ as well as a related result concerning the uniqueness of solutions of the quaternionic contact Yamabe problem on compact locally 3-Sasakian manifolds.

Morteza Mirmohamad Rezae

Harmonic vector fields and harmonic 1-forms in Finsler geometry

Tuesday • 11:15–11:45 • Room: L2

In the present work, we try to extend the definition of harmonic vector fields on Finsler manifolds. For aiming this purpose, we define suitable Dirichlet energy and introduced harmonic vector fields as the critical points of action.

Reza Mirzaei

On Riemannian G-manifolds of nonpositive curvature

Thursday • 16:00–16:30 • Room: L1

We give a topological description of orbits and orbit spaces of some Riemannian G-manifolds of nonpositive curvature.

Marco Modugno

On the quantum potential in covariant Quantum Mechanics

MONDAY • 17:10–17:40 • ROOM: L3

We discuss the quantum potential in the framework of Covariant Quantum Mechanics. We deal with a geometric covariant approach to Quantum Mechanics based on a curved spacetime fibred on time and equipped with a spacelike riemannian metric. We analyse the relation between the observed classical potential $A[o]$ of the classical cosymplectic phase 2–form Ω and the observed quantum potential $A[b, o]$ of the upper quantum connection $\Gamma^{\uparrow}$. Moreover, we discuss the transition rule of the observed quantum potential and the associated distinguished invariants. Eventually, we discuss the role of the quantum potential in the dynamics of the classical fluid associated with a quantum section.

Rafael Mrdjen

Singular BGG resolutions over symplectic Grassmannian

TUESDAY • 14:00–15:00 • ROOM: POSTER

It is well known that any finite dimensional G-module can be resolved over generalized flag manifold G/P by homogeneous vectors bundles and G-invariant differential operators (Bernstein-Gelfand-Gelfand resolution). Recently, Pandžić and Souček constructed analogous resolutions in singular infinitesimal characters on the Hermitian pairs of type A_n, by using the Penrose transform. Here we use their method to construct such resolutions on the Hermitian pair of type C_n.

Zoltan Muzsnay

Euler-Lagrange functions and metrizability freedom of SODEs

THURSDAY • 11:50–12:30 • ROOM: L3

In this talk we are investigating Finsler metrizable second order homogeneous differential equations by considering the questions how many essentially different Finsler metrics exist for a given spray. Searching for geometric quantity characterizing the metrizability freedom we show that in the regular case the holonomy distribution, generated by the tangent direction to the parallel translations, can be used to calculate it. We are also considering $h(2)$-variationality, when the regular Lagrange function is homogeneous of degree two in the directional argument. As a working example, the class of isotropic sprays is considered. Section: Finsler Geometry (Shen) Finsler manifolds with infinite dimensional holonomy group The holonomy group of a Riemannian or Finslerian manifold is the group generated by parallel translations along loops. The Riemannian holonomy groups have been extensively studied and by now, the complete classification of is known. The holonomy properties of Finsler spaces are different from the Riemannian one. In this talk we show that the topological closure of the holonomy group of a certain class of projectively flat Finsler 2-manifolds of constant curvature is infinite dimensional and isomorphic to the connected component of the diffeomorphism group of the circle. The result provides the first examples describing completely infinite dimensional Finslerian holonomy structures. We also prove that the holonomy group of a simply connected locally projectively flat Finsler manifold of constant curvature is a finite dimensional Lie group if and only if it is flat or it is Riemannian. In particular, the holonomy group of non-Riemannian projective Finsler manifolds of nonzero constant curvature is infinite dimensional.

Aleš Návrat

An analogue of Paneitz operator for almost Grassmannian geometries with a torsion

Tuesday • 14:00–15:00 • Room: Poster

Paneitz operator is a well known conformally invariant operator of order four acting on functions. I find its analogue on manifolds equipped with an almost Grassmannian structure with an arbitrary torsion. It is obtained by translating a Grassmannian analogue of the Laplace operator to a certain tractor bundle with a specific tractor connection, which is not normal in general.

Rakesh Kumar Nagaich

On holomorphic sectional curvature of GCR-lightlike submanifolds of indefinite sasakian manifolds

Thursday • 14:00–15:00 • Room: Poster

We obtain the expressions for sectional curvature, holomorphic sectional curvature and holomorphic bisectional curvature of a GCR-lightlike submanifold of an indefinite Sasakian manifold and obtain some characterization theorems on holomorphic sectional and holomorphic bisectional curvature.

Katharina Neusser

C-projective structures of degree of mobility at least 2

Friday • 14:35–15:05 • Room: L2

In recent years there has been renewed interest in c-projective geometry, which is a natural analogue of real projective geometry in the setting of complex manifolds, and its applications in Kähler geometry. A c-projective structure on a complex manifold (M, J) is given by an equivalence class of affine complex torsion-free connections $[\nabla]$ that have the same J-planar curves, where a curve is J-planar with respect to a connection ∇ if $\nabla_{\dot{c}}\dot{c}$ lies in the span of $\dot{c}$ and $J\dot{c}$. In this talk I will be mainly concerned with c-projective manifolds $(M, J, [\nabla])$ that admit compatible Kähler metrics, i.e. Kähler metrics whose Levi-Civita connections are contained in $[\nabla]$, and will present some work on the geometric and topological consequences of having at least two compatible Kähler metrics. An application of these considerations is a proof of the Yano—Obata conjecture for complete Kähler manifolds. This talk is based on joint work with D. Calderbank, M. Eastwood and V. Matveev.

Simona Nistor

Global properties of biconservative surfaces

Thursday • 14:00–15:00 • Room: Poster

Biconservative submanifolds are the submanifolds with divergence-free stress-bienergy tensor. We will present here some recent results concerning the classification of the surfaces that admit biconservative immersions into three-dimensional space forms and their properties.

Carlos Enrique Olmos

Submanifolds and holonomy

Wednesday • 10:30–11:20 • Room: L1

In this lecture we will give a survey on Submanifolds and holonomy. We will put into perspective the central results of the theory. There is a subtle relation between the normal holonomy of Euclidean submanifolds and the Riemannian holonomy. In particular, by means of submanifold geometry, with normal holonomy ingredients, one can give applications to Riemannian geometry: a geometric proof of the Berger holonomy theorem and a proof of the so-called skew-torsion holonomy theorem (with interesting consequences for naturally reductive spaces). On the other hand, the Simons theorem on holonomy systems has a recent interesting application (C.O.-J.Berndt) to the classical problem of studying maximal dimensional totally geodesic submanifolds of symmetric spaces and the determination of the so-called Onishchick index. We will also present some new results in the theory, including some progress to the so-called normal holonomy conjecture for orbits (C.O.-R.Riaño).

Irene Ortiz Sánchez

Eigenvalue estimates for the Jacobi operator of compact CMC surfaces in warped products

FRIDAY • 14:30–15:00 • ROOM: L1

Constant mean curvature surfaces (CMC) are characterized as critical points of the area functional restricted to those variations which preserve certain volume function. For such critical points the stability is given by the Jacobi operator J, then a surface is said to be strongly stable if the first eigenvalue associated to the mentioned operator is non negative. Our aim is the search of estimates for the first stability eigenvalue for compact CMC surfaces immersed into three-dimensional warped product spaces satisfying a suitable and well studied convergence condition. We also characterize the cases when the upper bound is reached. As an application, we derive some consequences for those surfaces that are stable, obtaining some classification results. This is a joint work with Miguel A. Meroño.

[1] Meroño, Miguel A.; Ortiz, Irene, On the first stability eigenvalue of CMC surfaces into warped products with two-dimensional fiber. Differ. Geom. Appl. 45 (2016), 67-77.

Dmitry Oskorbin

Ricci solitons on some low-dimensional (pseudo)Riemannian manifolds

MONDAY • 14:30–15:00 • ROOM: L1

Joint with E.D. Rodionov, P.N. Klepikov, and I.V. Ernst. See I. Ernst.

Enrico Pagani

Differential geometric aspects of constrained calculus of variations: first and second variation

TUESDAY • 16:45–17:25 • ROOM: L3

A geometric setup for constrained variational calculus is presented. The analysis deals with the study of the extremals of an action functional defined on piecewise differentiable sections, subject to differentiable, non-holonomic constraints. The problem of minimality is analyzed within the class of piecewise differentiable extremal curves. A covariant representation of the second variation, based on a family of local gauge transformations of the original Lagrangian will be proposed. The necessity of pursuing a local adaptation process, rather than the global one in absence of corners, is seen to depend on the value of certain attributes of the extremaloid, called the corners' strengths. Necessary and sufficient conditions for minimality are proved. Reference: E. Massa, G. Luria, E. Pagani, Geometric constrained variational calculus. III: The second variation (Part II), Int. J. Geom. Methods Mod. Phys. Vol. 13 (2016) 1650038-1-39

Marcella Palese

Classical Higgs fields on gauge gluon bundles

MONDAY • 16:35–17:05 • ROOM: L3

Classical Higgs fields and related canonical conserved quantities are defined by invariant variational problems on suitably defined gauge gluon bundles. We consider Lagrangian field theories which are assumed to be invariant with respect to the action of a gauge-natural group. Since the group $\mathrm{Diff}(X)$ is not canonically embedded into the group $\mathrm{Aut}(P)$ of all automorphisms of the underling principal bundle P, there is priori no natural way of relating infinitesimal gauge transfomations with infinitesimal base transformations, so that Lie derivatives of a gauge field with respect to infinitesimal base transformations could be defined neither in a natural nor, at least a priori, in a canonical way. In particular, we characterize canonical covariant Lagrangian conserved quantities in classical field theory in terms of Higgs fields on such gauge principal bundles having the richer structure of a gauge-natural prolongation. Under this perspective, topological conditions for the existence of a Cartan connection on the principal bundle $W^{(r,k)}P$ turn out to be necessary conditions for the existence of global solutions of Jacobi equations associated with the existence of canonically defined global conserved quantities. As an outcome, the Lie derivative of fields is constrained and it is parametrized by a Higgs field h defined by the space of Jacobi fields.

Marcella Palese

Algebraic structures generating reaction-diffusion models: the activator-substrate system

TUESDAY • 14:00–15:00 • ROOM: POSTER

We obtain activator-substrate reaction-diffusion models from integrable towers with algebraic skeleton and explore the possibility of an algebraic foundation of integrability properties and of stability of equilibrium states. Long-

distance negative feedback for pattern formation is recognized as a condition on the internal symmetry properties of a system.
We start from an algebraic skeleton generating a twisted reaction-diffusion model with a zero basic production term, which contains, as a limit feature, the particular case of a model for pattern formation on the shells of molluscs. By performing a slight change in the algebraic skeleton we generate the Koch and Meinhardt activator-substrate reaction-diffusion model. Commutator relations of the skeleton are the algebraic counterpart of nonlinear population interactions.
The condition of long-distance negative feedback is characterized algebraically: parameters in a given model, even the form of the model itself, can be "controlled" already at an algebraic level. While Lie group actions generate algebraic forms of dynamics, "deformations" of Lie algebraic structures, such as skeletons, originate the nonlinear content. Our results are of general nature and in principle could be applied to other real world models, in perspective also to models with delay.

M. Palese, *Ecological Complexity* (2016) doi:10.1016/j.ecocom.2016.01.003

Ulrich Pinkall

Schrödinger smoke

Friday • 9:00–9:50 • Room: L1

At very low temperature and very small scales fluids like liquid Helium exhibit quite special behavior: They lose all viscosity and all the vorticity becomes concentrated in one-dimensional filaments of uniform strength. In Physics, the motion for these "superfluids" or "quantum fluids"; is described by the so-called nonlinear Schrödinger equation. The vortex filaments are given as the zero-set of the corresponding complex-valued wave function on the fluid domain. Therefore they are of a topological nature and thus extremely stable. Fluid simulations in Computer Graphics struggle with the problem that on the one hand in most situations of interest the real flow is dominated by very thin vortex sheets and filaments, which also are responsible for much of the fine detail of the flow. On the other hand, feasible numerical grid resolutions are unable to resolve these thin structures. Many rather artificial remedies have been proposed for this problem. In this talk we propose to use equations similar to those used for quantum fluids also for the simulation of ordinary fluids. We demonstrate that this can help to overcome some of the mentioned problems. Moreover, the resulting numerical algorithm is extremely simple and efficient. A lot of interesting Differential Geometry enters in the discussion of this algorithm.

Liviu Popescu

Symmetries of second order differential equations on Lie algebroids

Tuesday • 14:00–15:00 • Room: Poster

In this paper we investigate the relations between semispray, nonlinear connection, dynamical covariant derivative and Jacobi endomorphism on Lie algebroids. Using these geometric structures, we study the symmetries of second order differential equations in the general framework of Lie algebroids.

Geoff Prince

A new, exterior and intrinsic form of the structure equations and Bianchi identities

Monday • 14:00–14:40 • Room: L3

We give an elegant formulation of the structure equations (of Cartan) and the Bianchi identities in terms of exterior calculus without reference to a particular basis and without the exterior covariant derivative. We demonstrate the equivalence of this new formulation to both the conventional vector version of the Bianchi identities and to the exterior covariant derivative approach. Contact manifolds, codimension one foliations and the Cartan form of classical mechanics are studied as examples of its utility.

Rachna Rani

Characterizations of holomorphic sectional curvature of GCR-lightlike submanifolds of indefinite nearly Kaehler manifolds

Thursday • 14:00–15:00 • Room: Poster

We obtain the expressions for sectional curvature, holomorphic sectional curvature and holomorphic bisectional curvature of a GCR-lightlike submanifold of an indefinite nearly Kaehler manifold and obtain characterization theorems for holomorphic sectional and holomorphic bisectional curvature. We also establish a condition for a GCR-lightlike submanifold of an indefinite complex space form to be a null holomorphically flat.

Claudiu Remsing

A few remarks on control systems on the Engel group

Friday • 14:00–14:30 • Room: L3

We consider left-invariant control affine systems on the four-dimensional

Engel group. These systems are classified under detached feedback equivalence (DF) and under strongly detached feedback equivalence (SDF); the DF-classification is based on the classification of the affine subspaces of the associated Lie algebra.

Xavier Rivas

A constraint algorithm for k-precosymplectic field theories and some applications

TUESDAY • 14:00–15:00 • ROOM: POSTER

Nonautonomous classical field theories can be described using k-cosymplectic geometry. In particular, those theories described by singular lagrangian are of special interest because of their role in modern physics. The systems of PDEs appearing in these systems (Euler-Lagrange and Hamilton-de Donder-Weyl) have a problem: the incompatibility of solutions. However, sometimes there exist submanifolds of the manifold where we have the equations defined, where we can find consistent solutions. In this poster we define the concept of k-precosymplectic manifold, prove the existence of Reeb vector fields and develop a geometric constraint algorithm in order to find a constraint submanifold where we have assured the existence of solutions of singular k-cosymplectic field theories.

Eugene Rodionov

Ricci solitons on some low-dimensional (pseudo)Riemannian manifolds

MONDAY • 14:30–15:00 • ROOM: L1

Joint with P.N. Klepikov, D.N. Oskorbin, I.V. Ernst. See I. Ernst.

Eugene Rodionov

Left-invariant pseudo Riemannian metrics on 4-dimensional Lie groups with zero divergence Weyl tensor

THURSDAY • 14:00–15:00 • ROOM: POSTER

Joint with Khromova O.P., Klepikov P.N.. See P. Klepikov.

Nasrin Sadegh Zadeh Nokhod Beriz

Some properties of spherically symmetric Finsler metrics

THURSDAY • 9:30–10:00 • ROOM: L2

In the article, we study quadratic curvature of a special class of Finsler metrics. We find equations that characterize the metrics of R-quadratic, W-quadratic and Ricci-quadratic types. In particular, every non-Riemannian metric of this class is R-quadratic if it is R-flat ($R^i_k = 0$). Also, the Finsler metric is W-quadratic if and only if it is of scalar curvature.

Bayram Sahin

Hemi-slant Riemannian maps

THURSDAY • 14:00–15:00 • ROOM: POSTER

We first introduce hemi-slant Riemannian maps from almost hermitian manifolds to Riemannian manifolds, provide examples and obtain totally geodesicity and harmonicity conditions for such maps. Then we define hemi-slant Riemannian maps from Riemannian manifolds to almost hermitian manifolds , give examples and investigate relations between hemi-slant Riemannian maps and PHWC-maps. We also find decompositions theorems on the total manifold and the base manifold by using the existence of hemi-slant Riemannian maps.

Tomáš Salač

Elliptic complex on the Grassmannian of oriented 2-planes in $\mathbb{R}^{2+n}$

TUESDAY • 14:00–15:00 • ROOM: POSTER

Let $V(2,n)$ be the Grassmannian of oriented 2-dimensional subspaces in $\mathbb{R}^{2+n}$ and E', resp. F' be the tautological oriented 2-dimensional, resp. n-dimensional vector bundle over $V(2,n)$. Then E' F' do not admit Spin-structures but they do admit Spin^c-structures. Then we can form a spin bundle S over $V(2,n)$ by associating the spin representation $\mathbb{S}$ to Spin$^c(n)$-structure associated to F'. Then we will show that there is an elliptic complex

$$S \to E' \otimes S \to \ E' \otimes S \to S \tag{2}$$

of SO($n+2$)-invariant differential operators. We will shortly explain how the Grassmannian $V(2,n)$ can be realized as a global leaf space of the Grassmannian M of oriented totally isotropic 2-planes in $\mathbb{R}^{2,n+2}$ by a distinguished infinitesimal symmetry and how the complex (2) descends from the complex starting with the 2-Dirac operator which lives on M. The procedure of descending invariant differential operators is a joint project with A. Čap from the University of Vienna.

Lara Saliba

Liouville type theorems for extrinsic biharmonic maps

Thursday • 14:00–15:00 • Room: Poster

We will prove some Liouville type theorems for extrinsic biharmonic maps from the Euclidean space $\mathbb{R}^m$ to spheres, which are critical points of the hessian energy functional that is the integral of the square of the norm of the laplacien. More precisely we prove that there are no non-constant biharmonic maps when this hessian energy functional is finite. Next we study the Dirichlet problem for extrinsic biharmonic maps defined on compact manifolds with constant boundary data.

Evangelia Samiou

The X-ray transform on manifolds with many totally geodesic subspaces

Thursday • 11:15–11:45 • Room: L1

We prove injectivity and a support theorem for the X-ray transform on 2-step nilpotent Lie groups with many totally geodesic 2-dimensional flats. The result follows from a general reduction principle for manifolds with uniformly escaping geodesics.

Alexey Samokhin

Periodic boundary conditions for KdV-Burgers equation on a finite interval

Thursday • 14:00–15:00 • Room: Poster

For the KdV-Burgers equation on a finite interval the development of a regular profile starting from a constant one under a periodic perturbation on the boundary is studied. The equation describes a medium which is both dissipative and dispersive. For an appropriate combination of dispersion and dissipation the asymptotic profile looks like a periodical chain of shock fronts with a decreasing amplitude (similarly to the Burgers equation case). But due to dispersion each such front is followed by increasing oscillation leading to the next shock - like the ninth wave in rough seas. The development of such a profile is preceded by an initial shock of a constant height. Nonlinear superposition is also discussed.

Víctor Sanmartín López

Anti-De Sitter space and complex hyperbolic space: their isoparametric hypersurfaces.

TUESDAY • 9:30–10:00 • ROOM: L1

In this talk we will present different families of isoparametric hypersurfaces in the complex hyperbolic space. Moreover, using their relation with some families of isoparametric hypersurfaces in the anti De Sitter space we deduce a classification in the complex hyperbolic space. Finally, we will see some additional results for these kind of hypersurfaces in the anti De Sitter space.

Willy Sarlet

On embedding the intersections of two families of surfaces in $\mathbb{R}^3$ into the set of integral curves of a Lagrangian system

MONDAY • 14:45–15:25 • ROOM: L3

Let $\phi(x^1, x^2, x^3) = c_1, \psi(x^1, x^2, x^3) = c_2$ be two given families of surfaces. There is an extensive literature on the problem of finding a potential $V(x^i)$ such that the intersecting curves of both families are integral curves of a system with Lagrangian $L = T - V$, where T is the standard Euclidean kinetic energy function. This problem is often referred to as Szebehely's inverse problem of dynamics, but is also related to older work of Dainelli, Suslov and Joukovsky. We discuss a generalization, where T is allowed to be of the more general form $T = \frac{1}{2}g_{ij}\dot{x}^i\dot{x}^j$, with g_{ij} to be determined as a non-singular symmetric but constant matrix (to keep the forces independent of velocities). In principle, the search for a potential V is a matter of solving a set of partial differential equations, one of first and one of second order, but both depending on the extra six parameters coming from our metric g. In practice, on the other hand, the best way of approaching the problem often consists of an integrability analysis of two first-order equations. We pay particular attention to the interesting case where the orthogonal complement of the direction tangent to the given curves is integrable. It is shown that the problem always has a solution in that case.

Hiroyasu Satoh

Information geometry of divergences and means on the space of all probability measures having positive density function

TUESDAY • 14:00–15:00 • ROOM: POSTER

The space of all probability measures having positive density function on a compact connected C^∞-manifold M, denoted by $\mathcal{P}^+(M)$, carries the Fisher metric G. By using divergence functions we can define a family of torsion-free affine connections $\nabla^{(\alpha)}$, $\alpha \in \mathbb{R}$ which satisfies that $\nabla^{(-\alpha)}$ is the dual connection of $\nabla^{(\alpha)}$ with respect to G and $\nabla^{(0)}$ is the Levi-Civita connection of G. In this talk we define generalized means, called the power mean, of two probability measures and give characterizations of geodesic segments of $\nabla^{(\alpha)}$, $\alpha = -1, 0, 1$ in terms of means of its endpoints. Moreover, we show that integrations of kinetic energy of (± 1)-geodesic segments are equal to the symmetrized Kullback-Leibler divergence of endpoints. This is based on joint work with Mitsuhiro Itoh.

David Saunders

Vertical symmetries of Cartan geometries

Thursday • 11:05–11:45 • Room: L3

Élie Cartan's 'éspaces généralizés' are, intuitively, curved geometries where the geometrical structure is that of a flat Klein geometry (a homogeneous space of a group) being rolled around a curved manifold without slipping or twisting. In modern terminology we may think of such a Cartan geometry as a fibre bundle with a means of lifting curves in the base manifold to curves in the Lie groupoid of structure-preserving fibre maps. The infinitesimal geometry will then be the Lie algebroid of certain projectable vector field on the fibre bundle, together with a horizontal lift to represent the connection. In this talk I shall describe symmetries of these structures, and explain why any vertical symmetry—projecting to the identity on the base manifold of the bundle—must necessarily be trivial.

Asaf Shachar

On strain measures and the geodesic distance to SO_n in the general linear group

Tuesday • 14:00–15:00 • Room: Poster

This talk is about various notions of strains, that is quantitative measures for the deviation of a linear transformation from an isometry. The main approach, which is motivated by physical applications and follows the work of Patrizio Neff and co-workers, is to select a Riemannian metric on GL_n, and use its induced geodesic distance to measure the distance of a linear transformation from the set of isometries. We give a short geometric derivation of the formula for the strain measure for the case where the metric is left-GL_n-invariant and right-O_n-invariant. If time permits, we will mention alternative distance functions on GL_n, and the properties of their induced strain measures. (For example Euclidean distances and inverse-invariant distances.)

Aleksandr Shelekhov

The Geometry of some special Bol three-webs

Tuesday • 14:00–15:00 • Room: Poster

We consider the local differential-topological theory of three-webs formed by 3 foliations of co-dimension r given on the smooth manifold M, $\dim M = 2r$, whose algebraic equivalent is the class of the so-called Bol loops defined by the middle Bol identity $w \circ ((u \circ v)w) = (w/v) \circ (uw)$. We give a classification for 2 subclasses of such webs (1) for elastic 3-webs defined by the elasticity identity $(xy)x = x(yx)$, and (2) for the Bol 3-webs with the covariantly constant curvature tensor.

Ekaterina Shemyakova

Darboux transformations of differential operators on the superline

Thursday • 17:30–18:00 • Room: L3

Darboux transformations are used to obtain new solutions of linear and non-linear differential equations. Examples of such transformations were known to Euler and Laplace. They were used by Darboux, Moutard and other classics of differential geometry of XIX century. They were rediscovered in 1970s in connection with soliton theory. We consider differential operators on the superline and Darboux transformations for them. (Darboux transformations are defined by intertwining relation $NL = L_1 M$.) We give a full classification of such transformations by showing that any such transformation is a composition of elementary first order transformations. We also show that every Darboux transformation on the superline can be expressed via "super-Wronskians", thus generalizing classical formulas due to Darboux, Crum, and Matveev. Based on joint work with Th. Voronov and my students.

Konrad Schöbel

An algebraic geometric classification of superintegrable systems in the Euclidean plane

Friday • 15:10–15:40 • Room: L2

We prove that the set of second order maximally superintegrable systems in the complex Euclidean plane carries a natural structure of a projective variety by deriving the corresponding system of homogeneous algebraic equations. We then solve these equations explicitly and give a detailed analysis of the algebraic geometric structure of the corresponding projective variety. This naturally associates a unique completely decomposable ternary cubic as well as a planar line triple arrangement to every superintegrable system, providing intrinsic geometric as well as algebraic labelling schemes for superintegrable systems and their normal forms under isometries. This is a joint work with Jonathan Kress and initiates a programme to "algebro-geometrise" the classification of superintegrable systems and their applications to special functions.

Eivind Schneider

Differential invariants of self-dual conformal structures

TUESDAY • 14:00–15:00 • ROOM: POSTER

Let M be an oriented four dimensional manifold with a pseudo-Riemannian metric g of signature $(4,0)$ or $(2,2)$. For such manifolds the Hodge star defines an endomorphism on $\bigwedge^2 T^*M$ with the property that $*^2 = Id$. Denoting the Weyl tensor of g by W, we say that M is self-dual if $*W = W$. Self-duality is invariant with respect to conformal re-scalings, and so is an invariant property of the conformal structure $[g]$. We give a description of invariants of such self-dual conformal structures with respect to the group of diffeomorphisms $\mathrm{Diff}(M)$. This is done in two different ways. First we consider all conformal metrics satisfying $*W = W$. Locally these are solutions to a system of five differential equations in nine unknown functions, which is then factored by the pseudogroup $\mathrm{Diff}_{\mathrm{loc}}(M)$. The other method (applicable only in split-signature) uses a normal form of (anti-) self-dual metrics due to Dunajski, Ferapontov and Kruglikov, in which the self-duality equation is written as a system of three differential equations in three unknown functions and we factor this system by its symmetry pseudogroup.

Vladimír Souček

The BGG complexes for Grassmannians in singular infinitesimal character

MONDAY • 16:40–17:20 • ROOM: L2

In the lecture, a geometric construction of the BGG complexes for Grassmannians in any singular infinitesimal character will be given. The main tool for the construction will be the Penrose transform as formulated and described in the book by R. Baston and M. Eastwood. The lecture is based on the common work with P. Pandzic (Zagreb).

Nikolaos Panagiotis Souris

Geodesic orbit and two-step geodesic orbit homogeneous spaces

THURSDAY • 14:00–15:00 • ROOM: POSTER

Geodesic curves in Riemannian manifolds have been extensively studied by authors for their geometrical as well as physical implications. Of particular interest are Riemannian manifolds (M, g) such that all geodesics in M are orbits of an one-parameter subgroup of a group G of isometries of (M, g) acting on M. These manifolds are called G-geodesic orbit manifolds and include the classes of symmetric and weakly symmetric manifolds. We present new results about the generalized class of two-step G-geodesic orbit manifolds, which are Riemannian manifolds with the property that there exists a group G of isometries of (M, g) acting on M, such that the geodesics in M are orbits of the curve $\gamma : \mathbb{R} \to G$ with $\gamma(t) = \exp tX \exp tY$, $X, Y \in \mathrm{Lie}(G) \setminus \{0\}$. We find sufficient conditions on a homogeneous manifold M implying the existence of geodesics that constitute such orbits. As a result, we prove that any homogeneous manifold G/K where G is a reductive Lie group, endowed with a "deformation" metric induced by a Riemannian submersion $\phi : G/K \to G/H$, $K \subset H \subset G$, is a two-step G-geodesic orbit space.

[Ar-So] A. Arvanitoyeorgos and N.P. Souris: *Two-step homogeneous geodesics in homogeneous spaces*, Taiwanese J. Math. (to appear 2016).

Yasemin Soylu

A Myers type compactness theorem by the use of Bakry-Emery Ricci tensor

THURSDAY • 14:00–15:00 • ROOM: POSTER

Let (M, g) be a complete and connected Riemannian manifold of dimension n. By using the Bakry-Emery Ricci curvature tensor, we prove a Myers type compactness theorem which corresponds to the compactness theorem proved by Cheeger-Gromov-Taylor.

Marina Statha

Non-naturally reductive Einstein metrics on compact simple Lie groups

THURSDAY • 9:30–10:00 • ROOM: L1

A Riemannian manifold (M, g) is called Einstein if $\mathrm{Ric}(g) = \lambda g$ for some $\lambda \in \mathbb{R}$. For compact Lie groups, G. Jensen 1979 proved the existence of left-invariant Einstein metrics. Later J. E. D'Arti and W. Ziller 1979 in the work *Naturally reductive metrics and Einstein metrics on compact Lie groups*, they obtained a large number of left-invariant Einstein metrics that are *naturally reductive.* They also asked whether G admits a non-naturally reductive Einstein metric. The problem of finding *non-naturally reductive* left-invariant Einstein metrics on compact simple Lie groups seems to be harder, and in fact this is stressed by the above authors. In some previous works of K. Mori 1994, A. Arvanitoyeorgos, K. Mori, Y. Sakane 2012, Z. Chen, K. Liang 2014, and I. Chrysikos, Y. Sakane 2015 the authors found new non-naturally reductive Einstein metrics on several Lie groups.

In the present work we prove existence of new left-invariant Einstein metrics on compact Lie groups $G \in \{\mathrm{SO}(n), \mathrm{Sp}(m)\}$, $n \geq 7$, $m \geq 3$ and $\mathrm{SU}(\ell+3)$, $\ell \geq 2$, which are not naturally reductive. The space of metrics has been studied from the generalized Wallach spaces $G/(G_1 \times G_2 \times G_3)$, where $G_i \in \{\mathrm{SO}(k_i), \mathrm{Sp}(k_i)\}$, $i = 1, 2, 3$, the generalized flag manifold $\mathrm{SU}(1+2+\ell)/\,\mathrm{S}(\mathrm{U}(1) \times \mathrm{U}(2) \times \mathrm{U}(\ell))$, and the homogeneous space $\mathrm{SU}(\ell+3)/(\mathrm{U}(1) \times \mathrm{SO}(3) \times \mathrm{SU}(\ell))$. In the last two cases the Einstein metrics obtained, are different from those obtained by Mori.

Sergey Stepanov

New applications of the global divergence theorems

THUESDAY • 12:25–12:55 • ROOM: L1

Joint work with J. Mikeš. In our report we prove Liouville-type theorems for some types of complete Riemannian almost product manifolds and submersions of complete Riemannian manifolds which generalize similar well known results for compact manifolds. Our proofs will be based on the generalized divergence theorem (see [1]). Here is an example from the listing of our results.

Theorem. *Let (M, g) be a complete and oriented Riemannian manifold with two orthogonal complementary totally umbilical distributions V and H such that their mean curvature vectors ξ_V and ξ_H satisfy the condition $\|\xi_V + \xi_H\| \in L^1(M, g)$. If the mixed scalar curvature s_{mix} of (M, g) is non-positive then (M, g) is isometric to a direct product $(M_1 \times M_2, g \oplus g_2)$ of some Riemannian manifolds (M_1, g_1) and (M_2, g_2).*

[1] Pigola S., Setti A.G., Global divergence theorems in nonlinear PDE's and geometry, Ensaios Mat. 26 (2014), 1–77.

Reinier Storm

A new construction of naturally reductive spaces

TUESDAY • 14:00–15:00 • ROOM: POSTER

A new construction of naturally reductive spaces is presented. This construction gives a large amount of new families of naturally reductive spaces. First the infinitesimal models of the new naturally reductive spaces are constructed. A concrete transitive group of isometries is given for the new spaces and also the naturally reductive structure with respect to this group is explicitly given.

Young Jin Suh

Recent progress on real hypersurfaces in the complex quadric

TUESDAY • 11:15–11:45 • ROOM: L1

In this talk, we will give some backgrounds on the geometry of complex quadric $Q^m = SO(m+2)/SO(2)xSO(m)$ which can be regarded as Hermitian Symmetric Space with rank 2 of compact type. As a survey talk, we will give some detailed explanations about recent progress on real hypersurfaces in the complex quadric Q^m related to Ricci parallelism, commuting Ricci tensor, harmonic curvature, parallel normal Jacobi operator, pseudo-Einstein real hypersurfaces, and pseudo-anti commuting and Ricci soliton problems etc.

Volodymyr Sushch

On geometric discretization of the Dirac-Kähler equation

TUESDAY • 14:00–15:00 • ROOM: POSTER

In this talk we propose a geometric discretization scheme based on the language of differential forms. We present a discrete analogue of the Dirac-Kähler equation in which some key geometric aspects of the continuum counterpart are captured. It is known that the Dirac-Kähler equation describes fermion fields in terms of inhomogeneous differential forms. Let Ω be a complex-valued inhomogeneous form on Minkowski space-time. The Dirac-Kähler equation on exterior forms is given by

$$i(d+\delta)\Omega = m\Omega,$$

where d denotes the exterior differential, $\delta = *d*$ is the co-differential and $*$ is the Hodge star operator. Here, i is the usual complex unit and m is a real nonnegative constant. Discrete exterior calculus are constructed and a discrete Dirac-Kähler equation is obtained using these tools. The algebraic relations between the operators d, δ and $*$ are captured by their discrete analogues. We show that the geometric discretization scheme as developed in [1] can be used to find a new discrete formulation of the Dirac equation for a free electron in the Hestenes form. The relation between the discrete Dirac-KXahler equation and a discrete analogue of the Hestenes equation is discussed. This work is a direct continuations of the papers [1], [2].

[1] V. Sushch, On the chirality of a discrete Dirac-Kähler equation, *Rep. Math. Phys.* **76** (2015), no. 2, 179–196.

[2] V. Sushch, A discrete model of the Dirac-Kähler equation, *Rep. Math. Phys.* **73** (2014), no. 1, 109–125.

Josef Šilhan

A projective-to-conformal Fefferman-type construction

TUESDAY • 16:10–16:30 • ROOM: L2

Projective structure (M^n, p) on a smooth manifold M^n is a class of affine connections p sharing the same geodesics (as unparametrised curves). This structure can be also given by a normal Cartan connection ω on M^n. Then, using a homomorphism of suitable Lie groups, one can apply the Fefferman-type constructions to construct another Cartan connection $\tilde{\omega}$ on a manifold $\tilde{M}^{2n}$. By construction, this gives a conformal structure $(\tilde{M}, c)$ where c is the class of Levi-Civita connections of conformally related metrics. However, the new Cartan connection $\tilde{\omega}$ is not normal unless (M^n, p) is projectively flat. We shall describe how $\tilde{\omega}$ differs from the corresponding normal conformal Cartan connection. Further we indicate how to use this result to relate geometric objects on M^n and $\tilde{M}^{2n}$.

Zoran Škoda

Correcting coexponential map for Lie algebroids

FRIDAY • 16:15–16:45 • ROOM: L3

Lie algebroids and their higher categorical analogues, L-infinity algebroids, represent infinitesimal symmetries and under some cohomological restrictions integrate to global symmetry objects (Lie groupoids and higher analogues). Their behaviour is less regular than that of Lie algebras, for example the appropriate generalization of the symmetrization or coexponential map from the symmetric to the universal enveloping algebra does not respect the coalgebra structure with consequences on physical applications like the construction of the corresponding noncommutative phase spaces. In the first part of the talk I will present a way to correct the coexponential map (using a connection on a Lie algebroid) so that the corrected map respects the coalgebra structure. This part is a joint work with G. Sharygin (Moscow). I will also sketch a relationship between this problem and the study of realizations of sections of the Lie algebroid by vector fields in suitable coordinates (in special cases the exponential map for Lie groupoids plays a role). In the second part I will present a related work in progress on enlarging the universal enveloping of the Lie algebroid by including certain automorphism operators so that the whole structure enhances to a quantum groupoid in certain precise sense. This quantum groupoid is motivated by constructions of new noncommutative spaces of relevance to mathematical physics and by deformation theory.

Homare Tadano

Some Myers type theorems and Hitchin-Thorpe inequalities for shrinking Ricci solitons

MONDAY • 17:20–17:50 • ROOM: L1

Ricci solitons were introduced by Hamilton in 1982 and are natural generalization of Einstein manifolds. They correspond to self-similar solutions to the Ricci flow and often arise as singularity models. The importance of Ricci solitons was demonstrated in three papers by Perelman [5, 6, 7], where Ricci solitons played crucial roles in his affirmative resolution of the Poincar'e conjecture. Besides their geometric importance, Ricci solitons are also of great interest in theoretical physics and have been studied actively in relation to string theory. In this talk, after reviewing basic facts on Ricci solitons, we shall establish some compactness criteria and diameter estimates for complete shrinking Ricci solitons [9, 10, 11]. Our compactness theorems generalize previous ones obtained by Fernández-López and García-Río [1], Wei and Wylie [14], Limoncu [3, 4], Rimoldi [8] and Zhang [15]. As applications of these compactness theorems, we shall give some upper diameter bounds for compact Ricci solitons. Moreover, by using such diameter bounds, we shall provide some new sufficient conditions for four-dimensional compact Ricci solitons to satisfy the Hitchin-Thorpe inequality. After we reviewed geometry of Ricci solitons, we shall consider a natural generalization of Ricci solitons in Sasakian geometry which is called a Sasaki-Ricci soliton [2] and we shall give a gap theorem [12] and a lower diameter bound [13] for compact gradient Sasaki-Ricci solitons.

[1] M. Fernández-López and E. García-Río, A remark on compact Ricci solitons, Math. Ann. 340 (2008)

[2] A. Futaki, H. Ono and G. Wang, Transverse Kähler geometry of Sasaki manifolds and toric Sasaki-Einstein manifolds, J. Differential Geom. 83 (2009)

[3] M. Limoncu, Modifications of the Ricci tensor and applications, Arch. Math.

(Basel) 95 (2010)
[4] –, The Bakry-Emery Ricci tensor and its applications to some compactness theorems, Math. Z. 271 (2012)
[5] G. Perelman, The entropy formula for the Ricci flow and its geometric applications, arXiv:math/0211159, Preprint (2002)
[6] –, Ricci flow with surgery on three-manifolds, arXiv:math/0303109, Preprint (2003)
[7] –, Finite extinction time for the solutions to the Ricci flow on certain three-manifolds, arXiv:math/0307245, Preprint (2003)
[8] M. Rimoldi, A remark on Einstein warped products, Pacific J. Math. 252 (2011)
[9] H. Tadano, Remark on a diameter bound for complete Riemannian manifolds with positive Bakry-Emery Ricci curvature, Diff. Geom. Appl. 44 (2016)
[10] –, An upper diameter bound for compact Ricci solitons with applications to the Hitchin-Thorpe inequality, arXiv:1504.05577 (2015)
[11] –, Some Ambrose and Galloway type theorems via Bakry-'Emery and modified Ricci curvatures, Preprint (2016)
[12] –, Gap theorems for compact gradient Sasaki-Ricci solitons, Internat. J Math. 26 (2015), 15400091
[13] –, Lower diameter bounds and transverse Hitchin-Thorpe inequalities for compact gradient Sasaki-Ricci solitons, in preparation (2016)
[14] G. Wei and W. Wylie, Comparison geometry for the Bakry-Emery Ricci tensor, J. Differential Geom. 83 (2009)
[15] S. Zhang, A theorem of Ambrose for Bakry-Emery Ricci tensor, Ann. Global Anal. Geom. 45 (2014)

Arman Taghavi-Chabert

Conformal Patterson-Walker lifts of projective structures

TUESDAY • 15:40–16:00 • ROOM: L2

There is a natural way, due to Patterson and Walker, of constructing a split-signature metric on the cotangent bundle of a smooth manifold equipped with a torsion-free affine connection. We generalize the construction by showing how a projective class of affine connections similarly gives rise to a conformal structure. We give characterizations of such conformal structures, and describe their infinitesimal conformal isometries, and Einstein metrics in the conformal class, in terms of projectively invariant data on the base manifold. This is based on joint work (arXiv:1604.08471) with M. Hammerl, K. Sagerschnig, J. Šilhan and V. Žádník.

Kamel Tahri

Fourth order elliptic equation with singularity

THURSDAY • 14:00–15:00 • ROOM: POSTER

Dennis The

Exceptionally simple PDE

FRIDAY • 16:00–16:30 • ROOM: L2

In back-to-back articles in 1893, Cartan and Engel gave the first realisations of G_2, the smallest of the exceptional complex simple Lie groups, as the symmetries of a geometric object. I will show how to generalize this story in a remarkably uniform manner to obtain analogous explicit geometric realisations for any complex simple Lie group (except SL_2).

Jiří Tomáš

Bundles of (p, s, A)-covelocities, (p, s, A)-jets and some kind of product preserving bundle functors

TUESDAY • 14:00–15:00 • ROOM: POSTER

For a manifold M and a Weil algebra A satisfying $\dim M = m < k = \operatorname{width} A$ we construct a T^A-respecting global section $s : G^r_{k,m} \mid G^r_k \to G^r_k$ with domain formed by right cosets of the jet group G^r_k with respect to the fibered jet group $G^r_{k,m}$, which induces a foliation on M. For any s of this kind, the associated foliation and any Lie group homomorphism $p : G^r_m \to \operatorname{Aut} A$, we generalize the bundle functors T^{A*}_p of (p, A)-covelocities and J^{A*}_p of (p, A)-jets from the cases of $m \geq k$ to the bundle functors $T^{A*}_{p,s}$ of (p, s, A)-covelocities and $J^A_{p,s}$ of (p, s, A)-jets defined for lower dimensions m. We identify the latter functors with the functors defined on the product category $\mathcal{M}f_m \times \mathcal{M}f$ of order r in the first factor and preserving products in the second factor, which have been described in [KOMI].

[KOMI] Kolář I. and Mikulski W. M., *On the fiber product preserving bundle functors*, Diff. Geometry and Appl., 11(1999), 105-115.

Gamaliel Torres

Dynamics of a particle constrained on a surface with auxiliary variables

TUESDAY • 14:00–15:00 • ROOM: POSTER

Several physical systems can be modeled as geometric surfaces, for example, biological membranes. Of particular interest is the motion of a particle constrained to move on a given surface Σ embedded in three dimensional Euclidean space. In this case the trajectory depends on the one hand, on the form of the surface, and on the other hand, on the external forces acting on it, in such a way the trajectories of the particles are coupled with the geometric information of the surface. Applying a recent formalism developed to study the confinement of curves on surfaces, in this contribution we obtain geometrically the basic elements of classical mechanics of particles moving on surfaces. In particular, we find the force $\boldsymbol{\lambda}$ acting on particles moving on surfaces, and we express it in terms of the normal curvature of the surface κ_n. Additionally for axisymmetric surfaces, the pseudosphere and catenoid, we also determine the trajectories of particles constrained to move on this surfaces under the effect of both a gravitational field and a magnetic field.

Alfonso Giuseppe Tortorella

Rigidity of integral coisotropic submanifolds of contact manifolds

Thursday • 10:30–11:00 • Room: L3

Unlike Legendrian submanifolds, the deformation problem of coisotropic submanifolds in contact manifolds can be obstructed. In this note, we point out the special class of emphintegral coisotropic submanifolds as the more direct generalization of Legendrian submanifolds for what concerns deformation theory. In fact, being integral coisotropic is proved to be a rigid condition, so that close integral coisotropic submanifolds are always conjugated by contactomorphisms, and the integral coisotropic deformation problem is unobstructed.

Wlodzimierz Marek Tulczyjew

Equilibrium configurations and higher order differential geometry.

Monday • 15:50–16:30 • Room: L3

A complete study of equilibrium configurations of physical systems requires the use of k-vectors and k-covectors. A rigorous construction of such objects will be offered.

Abhitosh Upadhyay

Complete classification of biconservative hypersurfaces with diagonalizable shape operators in pseudo-Euclidean spaces

Thursday • 14:00–15:00 • Room: Poster

In my talk, I want to give a brief introduction of biconservative hypersurfaces in E_2^5 . I will explain the complete classification of biconservative hypersurfaces with diagonalizable shape operator at exactly four distinct principal curvatures and also give an explicit example with four distinct principal curvatures.

Petr Vašík

On local control of snake–like mechanisms

TUESDAY • 14:00–15:00 • ROOM: POSTER

We present and compare different points of view into the local control of snake–like mechanisms, particularly we mention the serpenoid curve based control, methods of conformal geometric algebra and several observations from sub–Riemannian geometry.

Stefan Vasilev

Metric connections with totally skew-symmetric torsion acting on differential forms

TUESDAY • 14:00–15:00 • ROOM: POSTER

Consider a metric connection $\nabla_X Y = \nabla^g_X Y + \frac{1}{2}T(X,Y)$ with torsion T. While much is known about the properties of such connections on vector fields and spinor fields, a systematic investigation of its action on differential forms is missing. The goal of the present project is to fill this gap, especially in the case when $T(X,Y,Z) := \langle T(X,Y), Z\rangle$ is a 3-form. We introduce a couple of new operators, which appear frequently in computations. One of them, the Diamond operator, has appeared in previous occasions, which suggested its importance and separate definition.
We investigate a slightly different Laplacian, for which we derive a Weitzenböck formula and try to understand the role, played by the torsion in the resulting expressions.

Raquel Villacampa

Balanced Hermitian geometry on compact quotients of Lie groups

TUESDAY • 14:00–15:00 • ROOM: POSTER

Compact quotients of nilpotent or solvable Lie groups are a large family of manifolds that provide interesting examples solving problems in physics, differential and algebraic geometry. In this talk I will focus on compact complex solvmanifolds endowed with balanced metrics and discuss some problems that can be solved with these geometric objects, putting special attention to the applications in Heterotic String Theory.

Alexandre M. Vinogradov

Observability, Hamiltonian formalism and energy

THURSDAY • 9:00–9:50 • ROOM: L3

The talk will be an overview of some results and ideas related with introduction of observability principles in mathematics and physics. It is organised in 3 parts: In Part 1 the observation mechanism in classical physics will be mathematically formalized and then will be shown how differential calculus over algebras of observables naturally originates on the basis of this mechanism. In Part 2 some elements of the logic of differential calculus will be presented and shown how geometrical structures, known and unknown, result from this logic. As an example of application to physics new observable foundations of rational mechanics and of its various generalizations will be discussed in Part 3 on the basis of Parts 1 and 2. In particular, conceptual meaning of such notions as energy, etc, will be discussed as well as some consequences for mathematical modelling of physics.

Andreas Vollmer

Higher-rank Killing tensors in Weyl space-times and similar geometries

TUESDAY • 14:00–15:00 • ROOM: POSTER

Consider a 4-dimensional manifold endowed with a (pseudo-)Riemannian metric. Constants of motion are smooth functions on the phase space that remain unchanged along solutions of the geodesic equation. Such functions play a crucial role in physics, as for instance in the solution of the classical Kepler problem. A special class of constants of motion is defined by Killing tensors. A rank-d Killing tensor is a symmetric covariant tensor field such that the symmetrization of its covariant derivative vanishes. We will focus on such constants of motion. The most basic examples of Killing tensors are given by the metric itself and by Killing vectors (corresponding to rank-1 Killing tensors). For stationary and axially symmetric space-times, Brandon Carter (1968) characterized all metrics that admit a rank-2 Killing tensor in addition to those implied by the natural Killing vectors (we assume that the constants of motion commute w.r.t. the Poisson bracket). For Weyl metrics (static and axially symmetric vacuum metrics) we prove that there is no metric with an additional irreducible Killing tensor of rank 3. Furthermore, the existence of higher-rank Killing tensors in other space-time geometries will be discussed. Particularly, we will address C-metrics (which have an interpretation in black-hole theory) and Ricci solitons.

Theodore Voronov

Classical and quantum microformal geometry, and homotopy algebras

FRIDAY • 11:30–12:20 • ROOM: L1

I will speak about a construction that generalizes smooth maps between (super)manifolds and that can be used, in particular, to produce L-infinity morphisms of homotopy Poisson algebras. These "microformal" or "thick" morphisms of (super)manifolds are defined as certain formal canonical relations between cotangent bundles and they include ordinary smooth maps as a special case. Thick morphisms induce pull-backs of smooth functions which are non-linear (in general) formal maps of linear spaces. The derivative (at each point) of such a non-linear mapping of the algebras of functions is an algebra homomorphism. We obtain a formal category (in the sense that the composition law is given by power series) which is a formal neighborhood of the ordinary category of smooth (super)manifolds and smooth maps.

Applications of these constructions, besides homotopy algebras and Poisson geometry, include geometry of vector bundles and L-infinity (bi)algebroids. There is also a quantum version, in which "quantum thick morphisms" of (super)manifolds are some oscillatory integral operators acting on oscillatory wave functions. It is related with the classical picture described above in the same way as the Schrödinger equation is related with the Hamilton–Jacobi equation.

Yu Wang

Homogeneous geodesics in a class of homogeneous spaces

THURSDAY • 9:00–9:30 • ROOM: L1

Joint work with Andreas Arvanitoyergos. See A. Arvanitoyergos.

Katrin Wendland

Can singularities govern conformal field theory?

MONDAY • 11:30–12:20 • ROOM: L1

A known approach to the so-called simple singularities in differential geometry describes the bases of their semi-universal unfoldings as Frobenius manifolds. The latter had been introduced in the beginning of the 90's by Dubrovin, who showed that there is a 1:1 correspondence between families of

2-dimensional topological quantum field theories and Frobenius manifolds. This led to a classification of a family of conformal quantum field theories by means of the simple singularities, due to Cecotti and Vafa, also in the early 90's. After reviewing these results, without assuming background knowledge from quantum field theory, we will report on work in progress with Oliver Gray, which aims at generalizing these results to other families of conformal quantum field theories.

Travis Willse

Almost Einstein $(2,3,5)$ ***conformal structures***

TUESDAY • 14:00 – 15:00 • ROOM: POSTER

We analyze the classic problem of existence of Einstein metrics in a given conformal structure for the class of conformal structures induced via Nurowski's construction by (oriented) (2,3,5) distributions. We characterize in two ways such conformal structures that admit an almost Einstein scale: First, they are precisely the oriented conformal structures c that are induced by at least two distinct oriented (2,3,5) distributions; in this case there is a 1-parameter family of such distributions that induce c. Second, they are characterized by the existence of a holonomy reduction to $SU(1,2), SL(3,R)$, or a particular semidirect product $SL(2,R) \ltimes Q+$, according to the sign of the Einstein constant of the corresponding metric.

Via the curved orbit decomposition formalism such a reduction partitions the underlying manifold into several submanifolds, each naturally endowed with a geometric structure. This establishes novel links between (2,3,5) distributions and many other geometries, including: Sasaki-Einstein geometry contact projective geometry, and XXO geometry in dimension 5; Kähler-Einstein geometry, Fefferman Lorentzian conformal structures, and para-Fefferman neutral conformal structures in dimension 4; CR geometry and the point geometry of second-order ordinary differential equations $y'' = F(x,y,y')$ in dimension 3; and projective geometry in dimension 2. We describe a generalized Fefferman construction that builds from a 4-dimensional Khler-Einstein or para-Kähler–Einstein structure a family of (2,3,5) distributions that induce the same (Einstein) conformal structure. We exploit some of these links to construct new examples, establishing the existence of nonflat almost Einstein (2,3,5) conformal structures for which the Einstein constant is positive and negative.

Ekkehart Winterroth

Obstructions to global critical sections (with an application to Chern-Simons theories)

THURSDAY • 15:00–15:30 • ROOM: L3

We relate the existence of Noether global conserved currents associated with locally variational field equations to existence of global solutions for a local variational problem generating global equations. Both can be characterized as the vanishing of certain cohomology classes. We prove that, for a 3-dimensional Chern-Simons gauge theory, the cohomological obstruction corresponds to the usual obstruction in terms of Chern characteristic classes.

Henrik Winther

Submaximally symmetric quaternionic structures

TUESDAY • 17:40–18:00 • ROOM: L2

The symmetry dimension of an almost quaternionic structure on a manifold is the dimension of its full automorphism algebra. Let the quaternionic dimension n be fixed. The maximal possible symmetry dimension is realized by the quaternionic projective space $\mathbb{H}P^n$, which has symmetry group $G = PGl(n+1, \mathbb{H})$ of dimension $\dim(G) = 4(n+1)^2 - 1$. An almost quaternionic structure is called submaximally symmetric if it has maximal symmetry dimension amongst those with lesser symmetry dimension than the maximal case. We show that for $n > 1$, the submaximal symmetry dimension is $4n^2 - 4n + 9$. This is realized both by a quaternionic structure (torsion free) and by an almost quaternionic structure with vanishing Weyl curvature.

Changhwa Woo

Real hypersurfaces in complex two-plane Grassmannians with Lie derivative Ricci tensors

THURSDAY • 14:00–15:00 • ROOM: POSTER

We have considered a new relation between Lie derivatives of the Ricci tensor, that is, $(\widehat{\mathcal{L}}_X^{(k)} S)Y = (\mathcal{L}_X S)Y$ for real hypersurfaces M in complex two-plane Grassmannians $G_2(\mathbb{C}^{m+2})$. Using a new method of simultaneous diagonalization between Ricci tensor and shape operator, we give a complete classification for real hypersurfaces M in $G_2(\mathbb{C}^{m+2})$ with above condition.

Bingye Wu

Finsler submanifolds: From viewpoint of Chern connection

THURSDAY • 11:15–11:45 • ROOM: L2

This talk is based on author's recent work. We study the submanifold theory in terms of Chern connection. We introduce the notions of the second fundamental form and mean curvature for Finsler submanifolds in terms of Chern connection, and establish the fundamental equations by means of moving frame for the hypersurface case. We provide the estimation of image radius for compact submanifold, and prove that there exists no compact minimal submanifold in any complete noncompact and simply connected Finsler manifold with nonpositive flag curvature. We also characterize the Minkowski hyperplanes, Minkowski hyperspheres and Minkowski cylinders as the only hypersurfaces in Minkowski space with parallel second fundamental form.

Masashi Yasumoto

Construction of discrete constant mean curvature surfaces in Riemannian spaceforms and its applications

TUESDAY • 16:45–17:25 • ROOM: L1

In this talk we will introduce a construction method for discrete constant mean curvature (CMC) surfaces in 3-dimensional Riemannian spaceforms, called the DPW method for discrete CMC surfaces. Hoffmann introduced the DPW method for discrete non-zero CMC surfaces in Euclidean 3-space using matrix-splitting formulae. Based on his work, we extend the method to discrete CMC surfaces in spherical 3-space and hyperbolic 3-space. As an application, we constructed discrete constant positive Gaussian curvature surfaces in Riemannian spaceforms obtained by taking parallel surfaces of discrete CMC surfaces, and we then analyze their singularities. This talk is based mainly on joint work with Yuta Ogata (Kobe University), and partly on joint work with Wayne Rossman (Kobe University).

Amirhesam Zaeim

On symmetries of homogeneous three-dimensional Walker manifolds

THURSDAY • 14:00–15:00 • ROOM: POSTER

The concept of symmetry is of great relevance both in Mathematics and in Physics. We consider homogeneous three-dimensional Walker manifolds and present a full classification of their symmetries. More specifically, Killing, homothetic and affine vector fields were classified. Moreover, curvature related symmetries are considered, namely, Ricci and curvature collineations. Joint work with Giovanni Calvaruso.

Lenka Zalabová

Symmetric and locally symmetric parabolic geometries

Friday • 16:40-17:10 • Room: L2

We introduce a generalization of locally symmetric spaces to parabolic geometries. We discuss properties of generalized symmetries of parabolic geometries and give several (types of) examples. The talk follows recent joint work with J. Gregorovic.

Igor Zelenko

Tanaka prolongation of structures of nonconstant type with application to sub-Riemannian geometry

Thursday • 17:20–18:00 • Room: L2

I will describe the Tanaka-like prolongation procedure for a geometric structure with nonconstant Tanaka symbol and how it can be applied for construction of canonical connection for an arbitrary sub-Riemannian structure in a neighborhood of generic point.

Lili Zhao

Constructions of Einstein Finsler metrics

Tuesday • 9:30–10:00 • Room: L2

In this talk, we will talk about the warped product structures of Finsler metrics. We give the formulas of the flag curvature and Ricci curvature of these metrics, and obtain the characterization of such metrics to be Einstein. Some Einstein Finsler metrics of this type are constructed.

Petr Zima

Killing spinor-valued forms

Tuesday • 14:00–15:00 • Room: Poster

Killing type equations are particular invariant systems of PDEs naturally in (pseudo-)Riemannian and *Spin*-geometry. The equations are already well established for the cases of vectors, symmetric tensors, ordinary forms and spinors. The most prominent example are the Killing vectors which correspond to infinitesimal isometries. The aim of the current work is to fill in the case of spinor-valued forms. We first introduce Killing spinor-valued forms as a straightforward generalization of ordinary Killing forms and Killing spinors. Subsequently we compare their basic properties with the cases of forms and spinors. We also deduce explicit formula for prolongation of the equations which uncovers relationship to curvature of the underlying manifold.

5. List of DGA2016 participants

(as of July 6)

Nurlan Abiev; M. Kh. Dulaty Taraz State University; Kazakhstan
Luca Accornero; Turin University; Italy
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Ilka Agricola; Philipps-Universität Marburg; Germany
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Gassama Amadou; Geometry; Gambia
Inas Amacha; University of Western Brittany and Lebanese University; France
Inas Amacha; University of Western Brittany and Lebanese University; France
Bernadett Aradi; University of Debrecen; Hungary
Andreas Arvanitoyeorgos; University of Patras; Greece

Dennis Barrett; Rhodes University, Grahamstown; South Africa
Rob Baston; United Kingdom
Ergin Bayram; Ondokuz Mayıs University; Turkey
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Mohamed Belkhelfa; TAIBAH University, Mascara University; Saudi Arabia
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Behroz Bidabad; Amirkabir University of Technology, Tehran; Iran
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Maciej Dunajski; Cambridge University; United Kingdom

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