PLANARY LECTURES

1) Ilka Agricola (Philipps-University Marburg, Germany), **Dirac operators with torsion.** Joint work with Julia Becker-Bender and Hwajeong Kim.

In my talk, I will shortly review the classical eigenvalue estimates for the Riemannian Dirac operator and then expose what is known about the spectrum of Dirac operators associated to connection with skew torsion, and why this is interesting. In particular, I will introduce Killing and twistor spinors with torsion.

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2) Vestislav Apostolov (UQAM,Montreal, Canada), **Ambitoric 4-manifolds .** Joint work with D.M.J. Calderbank and P. Gauduchon

I will introduce the notion of ambitoric geometry in 4- dimensions and present a local classification of such structures in terms of a quadratic polynomial *q* and arbitrary functions *A* and *B* of one variable. I will discuss various motivations and applications to this class of metrics, including the classification of Einstein 4-metrics which are hermitian with respect to both orientations, as well a class of solutions to the Einstein--Maxwell equations. These can be seen as riemannian analogues of results by Debever--Kamran-- McLenaghan and Plebański--Demiański in relativity, and provide a natural extension of the classification of selfdual Einstein hermitian 4-manifolds, obtained independently by R. Bryant and P. Gauduchon and the speaker. A yet another application of the theory is the complete resolution of the existence problem for extremal Kähler metrics on toric 4-orbifolds with b_2 =2.

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3) Charles Boyer (University of New Mexico, USA), **Extremal Sasakian Geometry.**

I briefly review what is known about extremal Sasakian metrics especially in the toric case. In particular, the description of the pre moduli space of extremal Sasaki metrics belonging to a fixed isotopy class of contact structures is of interest. These are described in terms of bouquets of Sasaki cones. We focus our attention on manifolds of dimension five, both simply connected 5-manifolds, as well as the product of a Riemann surface and a 3-sphere. Complete results are presented for the genus one case. This is based on joint work with Christina Tönnesen-Friedman.

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4)** David Calderbank (University of Bath, UK),** **Extremal metrics and the ambitoric geometry of convex quadrilaterals.** Joint work with V. Apostolov and P. Gauduchon

Toric surface geometry is one of the simplest nontrivial contexts in which we can study the now-famous problem (formulated and developed by S-T. Yau, G. Tian, and S. Donaldson) of the relation between the existence of extremal Kaehler metrics and stability. In this toric context the problem has a reformulation in terms of symplectic 4-orbifolds and the combinatorics of rational Delzant polygons (developed by S. Donaldson, G. Szekelyhidi and many others).

For weighted projective planes (where b_2=1 and the rational Delzant polygon is a triangle) the problem is resolved easily (after work of R. Bryant and M. Abreu): all such symplectic 4-orbifolds are stable, and all admit extremal (indeed Bochner-flat) Kaehler metrics.

The next simplest rational Delzant polygons are convex quadrilaterals (corresponding to symplectic 4-orbifolds with =2). Here the problem is nontrivial but tractable, because explicit solutions to the extremal metric equations are available by separation of variables. Some such solutions (known as "orthotoric") have been used by E. Legendre to resolve the problem for a codimension one family of "equipoised" rational Delzant quadrilaterals.

More general "ambitoric" solutions of the extremal metric equations have been found recently (see the talk by V. Apostolov). In this talk, we uncover some attractive classical geometry behind separation of variable techniques, and hence show that ambitoric extremal Kähler metrics can be used to resolve the problem for arbitrary rational Delzant quadrilaterals. We find that the existence of an extremal Kähler metric is equivalent to a toric K-polystability condition. The metric is in principle explicitly computable if it exists, as are the obstructions to stability.

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5) Vicente Cortes (University of Hamburg, Germany), **From cubic polynomials to complete quaternionic Kähler manifolds.**

I will explain two supergravity constructions, which allow to construct certain special Riemannian manifolds starting with other special Riemannian manifolds. We show that the resulting manifolds are complete if the original manifolds are. By composition of the two constructions we obtain complete quaternionic Kähler manifolds out of certain cubic hypersurfaces. At the end I will formulate two open problems concerning such hypersurfaces.

The talk is based on arXiv:1101.5103 (hepth, mathdg).

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6) Maciej Dunajski (University of Cambridge, UK), **How to recognise a conformally Kahler metric.**

I will discuss the problem of characterising four dimensional conformal structures which admit a Kahler metric. The problem can be solved completely in the generic case, when the conformal curvature is not anti-self-dual. In the anti-self-dual case a one-to-one correspondence will be established between Kähler metrics in the conformal class, and parallel sections of certain rank 10 vector bundle with connection.

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7) Anna Fino (Universita di Torino, Italy), **An analog of selfduality in dimension nine.**

I will discuss a special Rimannian geometry in dimension nine, equipped with a certain differential 4-form. I will focus on similarities between this 9-dimensional geometry and a Riemannian geometry in dimension four, where the phenomenon of selfduality occurs.

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8) Thomas Friedrich (Humboldt University, Berlin, Germany), **Exotic geometries in special small dimensions.**

We discuss the topology and the geometry of five- , seven- and 14-dimensional Riemannian manifolds with special irreducible structures.

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9) *Sergey Galkin (IPMU, Tokyo, Japan),* **Generalized K3 automorphisms**.

Group of automorphisms of K3 surface can be extended either to automorphisms of related holomorphic symplectic manifolds or to derived automorphisms. I'll speak on relations between these groups and construct interesting examples via cubic fourfolds.

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10) Paul Gauduchon (Ecole Polytechniquie, Paris, France), **Non-existence of almost complex structures on quaternion-Kaehler manifolds of positive type.** Joint work with Andrei Moroianu and Uwe Semmelmann.

We show that, except for the complex Grassmannians Gr_2 (C^{n+2}), quaternion-Kaehler manifolds of positive type admit no almost complex structure.

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11) Dmitry Kaledin (Steklov Math Institute, Moscow, Russia) , **Cyclic K-theory.**

Cyclic K-theory is a version of algebraic K-theory introduced by Goodwillie 25 years ago and almost forgotten by now. I will describe it and try to convince the audience that it is actually a very useful gadget -- in particular, it can be effectively computed for algebraic varieties over a finite field.

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12) Ljudmila Kamenova (SUNY Stony Brook, USA), **Recent developments in hyper-Kahler geometry.**

In this talk we are going to survey some of the results in hyper-Kahler geometry from the last few years regarding finiteness results, special classes of hyper-Kahler manifolds and Abelian fibrations.

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13) Ludmil Katzarkov (University of Miami, USA & University, of Vienna, Austria), **Wallcrossings and generations.**

We will consider some categorical invariants and their connections to some geometric applications.

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14) Alexei Kovalev (University of Cambridge, UK), **New examples of compact and asymptotically cylindrical G_2 manifolds.** Joint work with Johannes Nordstrom and with Nam-Hoon Lee.

I'll explain a construction of asymptotically cylindrical 7-manifolds with holonomy exactly G_2. To my knowledge, these are first such examples. These will be applied to identify a compact 7-manifold where the G_2 metrics constructed by Joyce, by resolution of singularities of a compact orbifold, can be smoothly deformed to the G_2 metrics constructed as `twisted' connected sums, for a pair of asymptotically cylindrical Calabi-Yau 3-folds. The latter 3-folds are obtained using a particular class of algebraic K3 surfaces studied by Nikulin.The `geography' of Betti numbers of known compact irreducible G_2 manifolds will be briefly discussed.

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15) George Papadopoulos (King's College London, UK), **String special geometry.**

The classification of near horizon geometries of supergravity black holes leads to the understanding of certain differential systems on Riemannian manifolds. I shall explain that the investigation of heterotic black holes lead to Calabi type of systems on Kaehler with torsion manifolds while IIB black holes are associated with astheno-Kaehler or 2SKT manfolds, and 11-dimensional black holes are related to a differential system on Kaehler manifolds. I shall give examples of all such manifolds and raise the question on whether there is a general theory for proving the existence of solutions in all these differential systems.

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16) Tony Pantev (University of Pennsylvania, USA), **Constructions of generalized monopoles.**

Higher dimensional generalizations of magnetic monopoles arise naturally in GUT model building in string theory. The existence problem for such monopoles is hard to tackle due the non-linear nature of the extended Bogomolny equations. I will describe an algebraic geometric technique for obtaining explicit monopole solutions on Seifert fibrations. The technique utilizes a twisted form of T-duality to convert the question to a construction problem in complex geometry and yields directly existence results. It also allows us to study the moduli of solutions and to carry out computations of the gauge theory matter content. This is a joint work with Martijn Wijnholt.

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17) *Yat-Sun Poon (University of California – Riverside, USA)***, Deformation of Generalized Complex Manifolds.**

The differential Gerstenhaber algebra (DGA) of a complex structure controls its extended deformation theory. As a complex structure deforms, its associated DGA follows. In this lecture, we study the issue of when DGA will remain unchanged when a complex structure deforms along the directions of generalized complex structures. Our focus is on deformation of holomorphic Poisson structures.

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18) Victor Przyjalkowski (Steklov Math Institute, Moscow, Russia), **Laurent Polynomials in Mirror Symmetry.**

We discuss quantitative properties of Mirror Symmetry correspondence for Fano varieties. Laurent polynomials naturally appear in this picture. They describe (the essential part of) dual Landau--Ginzburg models for Fanos. They are related to toric degenerations of the initial Fano varieties. Their relative compactifications are candidates for Landau—Ginzburg models from the Homological Mirror Simmetry point of view. On a threefold example we discuss why Landau--Ginzburg model (for given Fano variety) represented by Laurent polynomial is unique and why it is not unique.

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19) Jeff Streets (University of California - Irvine, USA), **Geometric Flows in Complex Geometry.**

I will introduce a new geometric flow of Hermitian, possibly non-Kahler metrics. I will show some regularity results for this flow, and an interesting connection to the renormalization group flow of the nonlinear sigma model with B-field. Finally I will describe an optimal regularity conjecture for this flow and describe how it is related to the long standing problem of understanding the topology of non-Kahler complex surfaces.

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20) Valentino Tosatti, (Columbia University, USA), **Collapsing of abelian fibred Calabi-Yaus and hyperkahler mirror symmetry.** Joint work with Mark Gross and Yuguang Zhang.

We will address the problem of understanding the collapsing of Ricci-flat Kahler metric on abelian fibred projective Calabi-Yau manifolds. We will then explain an application of these results to the Strominger-Yau-Zaslow picture of mirror symmetry for some hyperkahler manifolds.

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21) Stefan Vandoren (University of Utrecht, Netherlands), **Quaternionic geometries from the variations of CY-Hodge structures.**

We present a construction of quaternion-Kahler manifolds, starting from the variations of Hodge structures of Calabi-Yau (CY) type. This construction is inspired by the so-called c-map in the physics community, but now presented in purely mathematical terms. Important ingredients that are used are special Kahler geometry, hyperbolic spaces and Heisenberg groups, and Weil intermediate Jacobians of CY-threefolds.

22) Luis Ugarte (University of Zaragoza, Spain), **Balanced Hermitian geometry on nilmanifolds.**

In this talk we describe the invariant balanced Hermitian geometry of nilmanifolds of dimension 6. It turns out that the holonomy of the associated Bismut connection reduces to a proper subgroup of SU(3) if and only if the underlying complex structure J is abelian. As an application several solutions of the Strominger system with constant dilaton can be obtained satisfying the anomaly cancellation condition with respect to the Bismut connection as well as with respect to the Chern connection in the case J is a non-nilpotent complex structure.

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23) Misha Verbitsky (ITEP, Moscow, Russia), ***Formally Kaehler structure on the space of knots in a G_2-manifold.***

A knot space in a manifold M is a space of oriented immersions from a circle S^1 to M up to $Diff(S^1)$. Brylinski has shown that a knot space of a Riemannian threefold is formally Kahler. An elementary construction allows one to construct a Hermitian almost complex structure on the space of knots inside a 7-manifold M if its structure group is reduced to G_2. I prove that this Hermitian structure is formally Kaehler if M has holonomy G_2, and the formal integrability is equivalent to the holonomy condition.

TALKS

1) Adrian Andrada (Universidad Nacional de Cordoba, Argentina), **Flat complex connections with torsion of type (1,1).** Joint work with M.L. Barberis and I. Dotti.

In this talk we exhibit some results regarding complex connections on complex manifolds with trivial holonomy and such that the corresponding torsion is of type (1,1) with respect to the complex structure. Such connections arise naturally when considering Lie groups, and its quotients by discrete subgroups, equipped with abelian complex structures. In particular, we study the first canonical Hermitian connection ∇^1associated to a left-invariant Hermitian structure (J, g) on a Lie group G. We prove that (i) if ∇^1 coincides with the (-)-connection, or (ii) if J is abelian and $\nabla^1$is flat, then G is abelian.

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2) Florin Belgun (University of Hamburg, Germany), **A generalization of Gallot's theorem.**

Gallot's theorem states that a Riemannian cone over a complete manifold is either irreducible or flat. On the other hand, a cone over a compact manifold admits discrete compact quotients by pure homotheties. We call a space with this latter property a {\em cone-like} space and we show that it can be completed as a metric space by adding just one point. If a cone-like space is addditionally {\em tame} (the length of incomplete geodesics starting from one point is controlled), then we show that it is either irreducible or flat. This generalizes Gallot's theorem to cone-like deformations (of a given radius in the C^1 topology) of Riemannian cones, since we show that the {\em tame} condition is implied by a differential inequality. This joint work with Andrei Moroianu is motivated by the question of finding the possible holonomy grups of Weyl connections, cone-like manifolds being equivalent to compact conformal manifolds with a closed, non-exact, Weyl structure.

3) Christofer Braun (University of Leicester, UK), **Quantum homotopy algebras**.

Quantum homotopy algebras are `higher genus' generalisations of homotopy algebras arising as solutions to the quantum master equation, for example just as (cyclic) A--∞ algebras give rise to classes in the moduli space of curves, quantum A--∞ algebras give rise to classes in a certain compactification of the moduli space of curves. I will approach homotopyalgebras and quantum/semi-quantum homotopy algebras from the generality of modular operads and as an example consider how the problem of lifting an A--∞ algebra to a quantum A--∞ algebra corresponds to a problem of lifting L--∞ matrix algebras by application of the Loday--Quillen--Tsygan theorem. I will also consider how Chern--Simons invariants can be understood from this more general perspective.

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4) Letizia Brunetti (University of Bari, Italy), **A new Osserman condition in Lorentz S-manifolds**.

The Osserman conjecture, introduced by R.\ Osserman for Riemannian manifolds, relates the properties of the Riemannian curvature to the spectral behaviour of the Jacobi operator. The Ossermann problem has been partially solved in the Riemannian case and, while it still remains open in the semi-Riemannian context, a complete solution has been reached in the Lorentzian case. As a consequence, Garc\'ia-R\'io, Kupeli and V\'azquez-Abal defined a different type of Osserman conditions: the \emph{null Osserman conditions} with respect to a unit timelike vector tangent to a Lorentzian manifold. It is natural to study the null Osserman conditions in a Lorentz almost contact manifold and, more generally, in a Lorentz $g.f.f$-manifold, where one finds that none of the above types of Osserman conditions can be satisfied.

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5)** Johann Davidov (IMI BAS and Higher School of Civil Engineering, Bulgaria),* ***Para hyperhermitian structures on complex surfaces. Joint with Gueo Grantcharov, Oleg Mushkarov, Miroslav Yotov

Hypercomplex and hyperkähler structures have been studied for a long time and many interesting results and relations with other fields have been established. Recently there is a growing interest in their pseudo-Riemannian counterparts partially due to the fact that important geometry models of string theory carry such structures. The para-hyperhermitian structures arise as a pseudo-Riemannian analog of the hyperhermitian structures and it is well known that in four dimensions they lead to self-dual metrics of neutral (split) signature. There are many other similarities between these two structures, but there are also significant differences. For example, the para-hypercomplex structures, the neutral analog of hypercomplex structures, exist in any even dimension (not only in that divisible by 4) and, in contrast to the latter, they may not have compatible metrics.
In this talk we shall discuss the problems of existence of a metric compatible with a given (almost) para-hypercomplex structure on a four-manifold and the existence of para-hyperhermitian and para-hyperkähler structures on compact complex surfaces.

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6) Isabel Dotti (Universidad Nacional de Cordoba, Argentina), **The Killing Yano equation on Lie groups.** Joint with M.L. Barberis and O. Santillán

An (l +1)-form ω is called a Killing-Yano tensor if it satisfies the Killing- Yano equation, that is, $d\omega = (l + 2)\nabla \omega$ (see K.Yano, Ann. Math 55(1952) 328). In this talk we will present results concerning Killing Yano tensors on Lie groups, with special emphasis on the nilpotent case.

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7) *Ignacio Lujan Fernandez*, (Universidad Complutense de Madrid)**Reduction of Homogeneous strusture**

We study Riemannian homogeneous structure tensors and its classes within the framework of reduction under a group of isometries. Some classical examples illustrate the theory. Finally, the reduction procedure is applied to Sasakian homogeneous structures providing Kähler homogeneous structure tensors in the quotient manifold.

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8) *Moritz Hoegner (University of Cambridge, UK),* **Octonionic Instantons.**

The Yang-Mills equations are second-order differential equations in the gauge potential, in general they are not integrable. All known solutions in four dimensions come from the Anti-Self-Duality Equations, which imply the Yang-Mills equations and are fully integrable. What about higher dimensions? We explain algebraic conditions one can impose on the curvature tensor that also imply Yang-Mills. Particularly interesting is such an example of extended anti-self-duality to eight-manifolds with holonomy Spin(7). We proceed to introduce the Octonionic Instanton Equation and explore symmetry reductions and the relation to the Seiberg-Witten equations. Finally we present explicit examples of anti-self-dual gauge fields with gauge group SU(2) on certain Spin(7)-manifolds.

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9) *Mancho Manev (Plovdiv University, Bulgaria),* **Natural connection with totally skew-symmetric torsion on almost contact manifolds with B-metric**.

A natural connection with totally skew-symmetric torsion on almost contact manifolds with B-metric is constructed. The class of these manifolds, where the considered connection exists, is determined. Some curvature properties for this connection, when the corresponding curvature tensor has the properties of the curvature tensor for the Levi-Civita connection and the torsion tensor is parallel, are obtained.

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10) *Velichka Milousheva ((IMI BAS and Higher School of Civil Engineering, Bulgaria),* **An invariant theory of marginally trapped surfaces in the four-dimensional Minkowski space.**

A marginally trapped surface in the four-dimensional Minkowski space is a spacelike surface whose mean curvature vector is lightlike at each point. We associate a geometrically determined moving frame field to such a surface and using the derivative formulas for this frame field we obtain seven invariant functions. Our main theorem states that these seven invariants determine the surface up to a motion in Minkowski space. We introduce meridian surfaces as one-parameter systems of meridians of a rotational hypersurface in the four-dimensional Minkowski space. We find all marginally trapped meridian surfaces.

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11) *Marian Ioan Munteanu (Al.I.Cuza University of Iasi, Romania),* **On the geometry of PR-warped products in para-Kaehler manifolds** . Joint work with Bang-Yen Chen.

We initiate the study of PR-warped products in para-Kaehler manifolds and prove some fundamental results on such submanifolds. In particular, we establish a general optimal inequality for PR-warped products in para-Kaehler manifolds involving only the warping function and the second fundamental form. Moreover, we completely classify PR-warped products in the flat para-Kaehler manifold with least codimension which satisfy the qualitycase of the inequality.

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12) *Kristof Schoels (Katholieke Universiteit Leuven, Belgium),* **Minimal Lagrangian submanifolds of complex space forms having a rotational symmetry in the fundamental cubic.**

We study minimal 4-dimensional Lagrangian submanifolds in complex space forms, on which we impose a fundamental cubic pointwise invariant under a non-trivial subgroup of the rotational group SO_4. Marianty Ionel has made an algebraic classification of all traceless fundamental cubics which are invariant under these subgroups and made a classification of all minimal Lagrangian submanifolds in $\mathbb{C}^4$ having these fundamental cubics. In recent work, we've completed the classification of the minimal Lagrangian submanifolds in $\mathbb{C}^4$, whose fundamental cubic has the local symmetry $S_3\ltimes SO_2$, and classified all the minimal Lagrangian submanifolds having this symmetry in the complex projective space $\mathbb{C}P^4$ and the complex hyperbolic space $\mathbb{C}H^4$.

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13) Vasil Tsanov (Sofia University, Bulgaria), **Homogeneous Hypercomplex Varieties**.

We present a complete classification of hypercomplex manifolds with a compact transitive group of automorphisms. We discuss some partial results and examples for homoheneous hypercomplrx and related structures, when the automorphism group has no compact transitive subgroup.

POSTERS

1) Angelo Vincenzo Caldarella (University of Bari, Italy), **Remarks concerning the φ-null Osserman conditions on Lorentzian *S*-manifolds.**

We expound some results about the eigenvalues of the Jacobi operator with respect suitable null vectors tangent to a Lorentzian $\mathcal{S}$-manifold, related with the φ-null Osserman conditions, which have recently been defined for Lorentzian $g.g.f$-manifolds.

Moreover, we examinate the possibility of projection of such conditions via semi-Riemannian submersions between a Lorentzian $\mathcal{S}$-manifold and either a Lorentzian Sasakian manifold or a Kähler manifold.

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2) Daniel Clarke (University of Bath, UK), **Integrability in submanifold geometry .**

Isothermic surfaces, i.e. those admitting curvature line co-ordinates are a special case of Omega surfaces: those that envelope a sphere congruence which is in itself isothermic. Omega surfaces possess a transformation theory analogous to that of constant Gauss curvature surfaces. It has been shown that the transformation theory for isothermic surfaces may be formulated in the setting of generalised flag manifolds (a manifold of the form G/P where P is a parabolic subgroup); all that is needed is an algebraic condition on P -- the Lie algebra $\mathfrak{p}$ should have abelian nilradical. However this does not cover Omega surfaces since the condition on P is not then satisfied. I give a Lie theoretic description of the transformations which works in any generalised flag manifold.

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3)** Giulia Dileo (University of Bari, Italy),** **Generalized pseudohermitian manifolds.**

We define a generalized pseudohermitian structure on an almost CR manifold *(M,HM,J)* as a pair *(h,P)*, where h is a positive definite fiber metric on HM compatible with J, and $P: TM \to TM$ is a smooth projector such that $Im(P) = HM$. Generalized pseudohermitian structures are classified into sixteen classes, making use of a basic differential operator invariant under equivalence, that we call the Koszul operator.To each generalized pseudohermitian structure one can associate a canonical linear connection on the holomorphic bundle HM which is invariant under equivalence. By using this connection, the equivalence problem is solved under the assumption that the distribution HM has kind 2. This is a generalization of a classical result of Webster for pseudohermitian manifolds, in which case the canonical connection is the Tanaka-Webster connection. We study the curvature of the canonical connection, especially for the classes of standard homogeneous CR manifolds and 3-Sasakian manifolds. The basic formulas for isopseudohermitian immersions are also presented in the attempt to enlarge the theory of pseudohermitian immersions between strongly pseudoconvex pseudohermitian manifolds of hypersurface type.

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4) Ana Ferreira (University of Minho, Portugal), **Einstein four-manifolds with skew torsion**.

We develop a notion of Einstein manifolds with skew torsion on compact, orientable Riemannian manifolds of dimension four. We prove an analogue of the Hitchin-Thorpe inequality and study the case of equality. We use the link with self-duality to study the moduli space of 1-instantons on the four-sphere for a family of metrics defined by Bonneau.
arxiv:1106.4947

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5) Milen Hristov (Veliko Tarnovo University, Bulgaria), **Baezier type almost complex structures on quaternion Kähler manifold.**

The sphere ($\mathbb S^2$) image of a B\'ezier curve with respect to a basic triangle $A_1A_2A_3$ generates over quaternion Kähler manifold $M^{4n}(g, \mathbb Q=\{ J_1,J_2,J_3 \})$ an one-parameter family of almost complex structures. We call these structures B\'ezier type almost complex structures. The topological conditions for the existence and basic properties of compatible such structures (smooth sections over the twistor space) will be discussed.

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6)** Gueorqui Mihaylov (Politecnico di Torino, Italy), Geometry of Intrinsic Torsion Varieties**.

We introduce the problem of determining the ITV's of reduced Riemannian structures on a parallelizable manifold. A classification of G-structures is based on criteria whereby their intrinsic torsion belongs to a proper subset of irreducible components of a specific G-module. Reductions to a G-structure of a given geometrical structure on a parallelizable manifold are parametrized by a standard parameter space. The ITV's are the subsets of this space whose points correspond to reducions of the same class. We consider for example the reductions of a fixed Riemannian structure determined by stabilizing a differential 2-form. These are parametrized by the coadjoint orbits of $SO(N)$ and the canonical symplectic structure on those spaces (and the corresponding moment map) are involved in the description of the ITV's. We describe the ITV's of almost-Hermitian and almost-product sructures over the Iwasawa manifold.

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7)** Ana Irina Nistor (Katholieke Universiteit Leuven, Belgium), Constant Angle Surfaces in Solvable Lie Groups**. Joint work with M.I. Munteanu.

We classify all surfaces in a 3-dimensional solvable Lie group $G(\mu_1, \mu_2)$ whose normals make constant angle with a left invariant vector field. The 2-parameter solvable Lie group $G(\mu_1, \mu_2)$ may be represented by ${\mathbb{R}}^3$ equipped with the left-invariant metric $\tilde{g}[\mu_1, \mu_2]=e^{-2 \mu_1 z}dx^2+e^{-2\mu_2 z}dy^2+dz^2,$ where (x,y,z) are canonical coordinates of ${\mathbb{R}}^3$. This group includes some classical examples for different parameters μ_1 and μ_2, as $\mathbb{E}^3$ for $\mu_1=\mu_2=0$, $\mathbb{H}^3(-c^2)$ for $\mu_1=\mu_2=c$, $c>0$, the product space $\mathbb{H}^2(-c^2)\times\mathbb{R}$ for $\mu_1=0$ and $\mu_2 = c$, $c>0$ or the Sol_3 group when $\mu_1=-1$ and $\mu_2=1$. Since the classification of constant angle surfaces in these ambient spaces is known, we provide a general classification on $G(\mu_1, \mu_2)$.

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8) Mihaela Pilca (University Regensburg, Germany), **Limiting Kähler Manifolds of the refined Kirchberg's Inequality.**

Friedrich's estimate for the smallest eigenvalue of the Dirac operator on compact spin manifolds was improved by Kirchberg for the class of Kähler spin manifolds. The corresponding limiting manifolds were geometrically described by A. Moroianu. Considering the splitting of the spinor bundle into eigenspaces of the Kähler form leads to refined Kirchbergs inequalities. We give the complete description of the limiting manifolds for these refined lower bounds of the spectrum of the Dirac operator restricted to sections of the eigenbundles. Moreover, we show their relation to the existence of the so called Kählerian twistor spinors, which are a natural analogue of twistor spinors on Riemannian spin manifolds. They are defined as sections in the kernel of a first order differential operator adapted to the Kähler structure, called the Kählerian twistor (Penrose) operator.

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9) Frank Reidegeld (TU Dortmund, Germany), **G_2-manifolds from K3-surfaces with nonsymplectic automorphisms.**

This is joint work with Max Pumperla. We show that K3-surfaces with nonsymplectic automorphisms of prime order can be used to construct new compact irreducible G2-manifolds. This technique was carried out in detail by Kovalev and Lee for nonsymplectic involutions. We use Chen-Ruan orbifold cohomology to determine the Hodge diamonds of certain complex threefolds, which are the building blocks for this approach.

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10) Joeri Van der Veken (Katholieke Universiteit Leuven, Belgium), **Classification of marginally trapped surfaces**.

The concept of a trapped surface is considered as a cornerstone for the achievement of the singularity theorems, the analysis of gravitational collapse and the understanding of cosmic black holes. One can roughly say that a surface is trapped if outgoing light rays are also converging, due to a massive source inside; so nothing can escape from the surface, not even light. The boundary separating trapped surfaces from untrapped ones is known as a arginally trapped surface, although differentiability of this boundary is an issue which is not yet settled. In this work we study marginally trapped surfaces from a purely differential geometric point of view: they are surfaces in a space-time for which the mean curvature vector is light-like at every point. It is natural to look for classifications of these surfaces in a certain space-time under one or more extra conditions. In particular, this gives concrete examples of marginally trapped surfaces. Examples of additional assumptions that we have considered are having positive relative nullity and parallelism of the mean curvature vector.

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11) Rodica-Cristina Voicu (University of Bucharest, Romania), **Submersions and harmonic maps on remarkable manifolds "**

We study properties of a particular cohomology class and different curvature properties of a conformal submersion and harmonic maps on Riemannian manifolds and several remarkable manifolds as almost contact manifolds.