40. Süddeutsches Kolloquium über Differentialgeometrie

June 29–30, 2018

Titles and Abstracts

Friday June 29, Morning

- 9:15 - 10:05

  Speaker: Judit Abardia-Evéquoz

  Title: Flag area measures

  Abstract: A flag area measure on a finite-dimensional euclidean vector space is a continuous translation invariant valuation with values in the space of signed measures on the flag manifold consisting of a unit vector and a $(p+1)$-dimensional linear subspace containing the vector, with $0 = p = n - 1$. Flag area measures play an important role in convex and integral geometry.

  In this talk, we will present a general construction of $SO(n)$-covariant flag area measures, which generalizes an already known formula for flag area measures evaluated on polytopes. The construction involves elementary symmetric polynomials in the squared cosines of the principal angles between two subspaces. We will also show that the described flag area measures are all the $SO(n)$-covariant ones, which satisfy additionally a natural notion of smoothness: we show that every smooth $SO(n)$-covariant flag area measure is a linear combination of the constructed ones.

  This is joint work with Andreas Bernig and Susanna Dann.

- 10:35 - 11:25

  Speaker: Gabriele Benedetti

  Title: On the curvature of magnetic flows

  Abstract: In this talk, which report on joint work with Jungsoo Kang (SNU) and Luca Asselle (Uni Giessen), we discuss the role of curvature in the study of magnetic flows on surfaces. In particular,

we analyse its relation with integrable flows, Zoll flows and systolic inequalities in this category.

- 11:35 - 12:25

  Speaker: Armando Cabrera Pacheco

  Title: Extensions of Riemannian manifolds and the Bartnik mass in mathematical relativity

  Abstract: In the context of mathematical relativity, asymptotically flat Riemannian manifolds with non-negative scalar curvature represent time-symmetric initial data sets (satisfying the dominant energy condition) for the Einstein Equations. The Bartnik mass is an important notion of local mass, although it has the drawback of being difficult to compute. Recently, C. Mantoulidis and R. Schoen constructed asymptotically flat extensions of Bartnik data $(S, g, H = 0)$ allowing them to compute their Bartnik mass. In this talk we will describe how to adapt the ideas of Mantoulidis and Schoen to obtain estimates for the Bartnik mass of Bartnik data (S, g, H), where H is positive constant. In addition, we will discuss a Bartnik mass analogue in the context of asymptotically hyperbolic manifolds and the corresponding estimates. This talk is based in joint projects with C. Cederbaum, S. McCormick and P. Miao.

Friday June 29, Afternoon

- 14:15 - 15:05

  Speaker: Sebastian Hensel

  Title: Connectivity of the set of uniquely ergodic laminations

  Abstract: The sphere of projective measured laminations can be identified with a boundary of Teichmüller space, and dynamic properties of laminations can then often be related to properties of Teichmüller geodesic rays. In this talk, we will consider the subsets of cobounded and uniquely ergodic laminations, and discuss a result (joint with Jon Chaika) that shows that both of them are path-connected. One motivation for studying these sets ultimately came from questions on negatively curved Riemannian metrics on surface bundles, and we will highlight this connection as well.

- 15:15 - 16:05

  Speaker: Raphael Zentner

  Title: Irreducible $SL(2, C)$-representations of integer homology 3-spheres

  Abstract: We prove that the splicing of any two non-trivial knots in the 3-sphere admits an irreducible $SU(2)$-representation of its fundamental group. This uses instanton gauge theory, and in particular

a non-vanishing result of Kronheimer-Mrowka and some new results that we establish for holonomy perturbations of the ASD equation. Using a result of Boileau, Rubinstein and Wang (which builds on the geometrization theorem of 3-manifolds), it follows that the fundamental group of any integer homology 3-sphere different from the 3-sphere admits irreducible representations of its fundamental group in $SL(2,C)$.

- 16:35 - 17:25

  Speaker: Manuel Amann

  Title: Orbifolds with all geodesics closed

  Abstract: The concept of a Riemannian orbifold generalises the one of a Riemannian manifold by permitting certain singularities. In particular, one is able to speak about several concepts known from classical Riemannian geometry including geodesics. Whenever all geodesics can be extended for infinite time and are all periodic, the orbifold is called a Besse orbifold — in analogy to Besse manifolds. A classical result in the simply-connected manifold case states that in odd dimensions only spheres may arise as examples of Besse manifolds. In this talk we shall illustrate that the same holds for Besse orbifolds, namely that they are actually already manifolds whence they are spheres. The talk is based on joint work in progress with Christian Lange and Marco Radeschi.

Saturday June 30, Morning

- 9:15 - 10:05

  Speaker: Esther Cabezas-Rivas

  Title: Brownian motion on Perelman's almost Ricci-flat manifold

  Abstract: We study Brownian motion and stochastic parallel transport on Perelman's almost Ricci flat manifold, whose dimension depends on a parameter N unbounded from above. By taking suitable projections we construct sequences of space-time Brownian motion and stochastic parallel transport whose limit as $N \to \infty$ are the corresponding objects for the Ricci flow. In order to make precise this process of passing to the limit, we study the martingale problems for the Laplace operator on Perelmans manifold and for the horizontal Laplacian on the corresponding orthonormal frame bundle.

  As an application, we see how the characterizations of two-sided bounds on the Ricci curvature established by A. Naber applied to Perelman's manifold lead to the inequalities that characterize solutions of the Ricci flow discovered by Naber and Haslhofer.

  This is joint work with Robert Haslhofer.

- 10:15 - 11:05

  Speaker: Andrew Sanders

  Title: Parameterizing generalized opers

  Abstract: An oper is a flat holomorphic vector bundle of rank n over a Riemann Surface equipped with a complete filtration by sub-bundles satisfying a certain compatibility condition with respect to the flat connection. It is a remarkable fact that the moduli space of opers admits a parameterization via an n-tuple of pluri-canonical sections on the Riemann surface. In this talk, we will introduce the notion of a generalized oper by relaxing the condition that the filtration by sub-bundles is complete. Lie theoretically, this corresponds to replacing a Borel subgroup by an arbitrary parabolic subgroup. Then, we will present a parameterization of the moduli space of generalized opers. Time permitting, we will discuss the relationship between generalized opers and certain connected components of surface group representations. This is joint work with Brian Collier.

- 11:35 - 12:25

  Speaker: Julian Scheuer

  Title: Harnack inequalities for evolving hypersurfaces

  Abstract: We introduce a new method to obtain Harnack inequalities for extrinsic curvature flows such as the mean curvature flow and more general fully nonlinear flows. For example, this method allows us to deduce Harnack inequalities for the mean curvature flow in locally symmetric (Riemannian or Lorentzian) Einstein spaces, for flows with convex speeds in the De Sitter space and for the Gauss curvature flow in Minkowski space. (joint work with Paul Bryan and Mohammad Ivaki)