

Living on the edge of the moduli space

Workshop on limits of canonical metrics

Titles & Abstracts

*Department of Mathematics
Aarhus University · 18–22 May 2026*

Monday 18 May

Claude LeBrun

Stony Brook University, USA

09:30–10:20

Desingularizations of Conformally Kaehler, Einstein Orbifolds

In this talk, I will discuss the following result, which was proved in joint work with Tristan Ozuch.

Suppose we are given a sequence of smooth compact oriented Einstein 4-manifolds with fixed positive Einstein constant that Gromov-Hausdorff converges to a 4-dimensional Einstein orbifold. Suppose, moreover, that the limit metric is Hermitian with respect to some integrable complex structure on the limit orbifold, and that this orbifold has at least one singular point. Finally, suppose that every gravitational instanton that bubbles off from the sequence is anti-self-dual. Then, far out in the sequence, all the given Einstein manifolds are actually Kaehler-Einstein. As a consequence, the limit orbifold is also Kaehler-Einstein, and must in fact be one of the orbifold limits classified by Odaka, Spotti, and Sun.

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Shih-Kai Chiu

UC Irvine, USA

11:00–11:50

Special Lagrangian submanifolds in K3-fibered Calabi–Yau 3-folds

Partly inspired by the tropical-to-holomorphic correspondence in mirror symmetry, Donaldson-Scaduto proposed a program to find and count associative submanifolds in G_2 manifolds admitting a Kovalev-Lefschetz fibration, where the torsion-free G_2 structure is near an adiabatic limit. As the G_2 manifold collapses, these associative submanifolds are expected to converge to certain one-dimensional objects in the base, called gradient cycles. In this talk, I will discuss joint work with Yu-Shen Lin on a Calabi-Yau analogue of the Donaldson-Scaduto program. More precisely, we construct examples of special Lagrangian spheres and trivial mapping tori in Calabi-Yau 3-folds equipped with a Lefschetz K3-fibration. I will also discuss some potential applications of this construction.

Martin de Borbon

Loughborough University, UK

13:30–14:20

A Miyaoka-Yau inequality for hyperplane arrangements in $\mathbb{C}P^n$

The talk is based on joint work with Dmitri Panov. Given a hyperplane arrangement in complex projective space, we associate to it a quadratic form (that we call the Hirzebruch quadratic form). We show that this form is semi-negative (under certain stability assumptions) and it vanishes precisely when there is a polyhedral Kähler metric with cone singularities along the hyperplane arrangement. I will also fit this result into a broader context of Kähler-Einstein metrics and the Miyaoka-Yau inequality for log pairs, where many questions remain to be answered, based on previous work with Cristiano Spotti.

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Max Hallgren

Rutgers University, USA

15:00–15:50

Expanding soliton models for Kähler-Ricci flow near conical singularities

Hamilton proved that every compact Riemannian manifold admits a unique short-time solution to the Ricci flow. Since then, much work has been devoted to extending this theory to singular initial data and to understanding the geometry of the resulting flow near singular points. In this talk, I will discuss recent joint work with Longeng Chen and Lucas Lavoyer on Ricci flows whose initial data is a Kähler space with isolated conical singularities. I will explain how expanding solitons arise as models for the flow near the singular set, and I will also discuss the relationship between our solutions and those constructed by Song and Tian.

Tuesday 19 May

Shouhei Honda

University of Tokyo, Japan

09:30–10:20

Gel'fand inverse problem under Ricci curvature

The classical Gel'fand's inverse problem asks whether a Riemannian manifold is uniquely determined by the knowledge of the heat kernel on any open subset of the manifold. We study this inverse problem in the non-smooth setting in the framework of $\text{RCD}(\mathbf{K}, \mathbf{N})$ spaces, namely, metric-measure spaces with synthetic Riemannian Ricci curvature bounded below by \mathbf{K} and dimension bounded above by \mathbf{N} . We establish the unique solvability of Gel'fand's inverse problem for the class of compact $\text{RCD}(\mathbf{K}, \mathbf{N})$ spaces whose regular set admits C^1 -Riemannian structure. As an application, we obtain the stability of Gel'fand's inverse problem in the class of closed Riemannian manifolds with bounded Ricci curvature, diameter and volume bounded from below. We note that the results are new even for Einstein orbifolds and (weighted) Riemannian manifolds with non-smooth boundary. This is a joint work with Jinpeng Lu (University of Helsinki), based on arXiv:2602.14527.

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Daheng Min

University of Münster, Germany

11:00–11:50

Construction of higher dimensional ALF Calabi-Yau metrics

Roughly speaking, an ALF metric of real dimension $2n$ should be a complete metric such that its asymptotic cone is of dimension $2n - 1$, the volume growth of this metric is of the order of $2n - 1$, and its sectional curvature tends towards 0 near infinity. I will give examples of ALF Calabi-Yau metrics of real dimension greater than 4. Our first example is that the Taub-NUT deformation of a hyperkählerian cone with respect to a locally free circle action is hyperkählerian ALF. The second example is that a special class of complete Calabi-Yau metrics on \mathbb{C}^n , constructed by Apostolov and Cifarelli, is ALF. Based on these examples, I will explain how to produce more ALF Calabi-Yau metrics on some resolutions of known examples modeled on them. In particular, there exist ALF Calabi-Yau metrics on the canonical bundles of classical homogeneous Fano contact manifolds.

Itsuki Tazoe

Kyoto University, Japan

13:30–14:20

Multi-scale K-moduli problem of non-collapsing polarized K3 surfaces.

Over the past decade, it has become increasingly clear that the Gromov-Hausdorff limits of Kähler manifolds, particularly in the non-collapsing case, possess deep connections with algebraic geometry. In the context of moduli theory, M. de Borbon and C. Spotti have proposed the "multiscale K-moduli problem" as an algebro-geometric framework to describe algebro-geometric aspects of "bubbling limits" of Kähler-Einstein metrics. In this talk, after providing an overview of general results regarding the limits of polarized Kähler-Einstein manifolds, I will discuss the multi-scale K-moduli problem specifically for the case of non-collapsing polarized K3 surfaces.

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Lorenzo Foscolo

Sapienza, Italy

15:00–15:50

Special Hermitian metrics on non-compact Calabi–Yau 3-folds.

We present the construction of infinitely many examples of distinguished non-Kähler Hermitian metrics on non-compact Calabi-Yau 3-folds. These metrics solve a system of equations known as the IIB system, which arises in theoretical physics and is related to recent attempts to define notions of "canonical" metrics on non-Kähler Calabi-Yau manifolds. The examples we construct include infinitely many complete metrics obtained by deforming an asymptotically conical Kähler Ricci-flat metric in the direction of a non-trivial \ddot{A} class and families of solutions on the ordinary double point and its smoothing that enjoy a cohomogeneity one symmetry (i.e. there is a symmetry group that acts with 1-dimensional orbit space). The talk is based on joint work with Mario Garcia-Fernandez.

Wednesday 20 May

Ilaria Mondello

Paris-Est Créteil, France

09:30–10:20

Limits of manifolds and codimension 4 singularities

In 1989, M. Anderson conjectured that the Gromov-Hausdorff limit of a sequence of complete manifolds with bounded Ricci curvature has only singularities of codimension larger than four. This was proven in 2015 by J. Cheeger and A. Naber. In this talk, I will present a joint work with G. Carron and D. Tewodrose in which we prove an analogue result under a Kato condition on the Ricci curvature.

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Zakarias Sjöström Dyrefelt

Aarhus University, Denmark

11:00–11:50

Effective criteria for generalized Monge–Ampère equation

Generalised Monge–Ampère equations, introduced by Pingali, include several well-known PDE on compact Kähler manifolds, such as the J-equation, inverse Hessian equations, and certain deformed Hermitian–Yang–Mills equations. By results of Datar–Pingali and Fang–Ma, extending work of Gao Chen, Song, and others, solvability is equivalent to a Demailly–Păun type positivity condition tested on all irreducible analytic subvarieties; I will discuss when this infinite collection of tests can be reduced to a finite set of distinguished subvarieties, yielding effective criteria for solvability in several settings. The main results discussed are based on joint work with Sohaib Khalid, with recent ongoing developments joint with Sivaram Petchimuthu on optimal destabilising subvarieties and singularity formation of the J-flow on threefolds.

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Frédéric Rochon

UQAM, Canada

12:00–12:50

New examples of affine Calabi–Yau 3-folds of maximal volume growth

We will explain how to construct new examples of affine Calabi–Yau 3-folds by smoothing Calabi–Yau cones that are not the product of lower dimensional Calabi–Yau cones and have orbifold singularities away from the vertex. This is a joint work with Shih-Kai Chiu and Ronan J. Conlon.

Thursday 21 May

Robert Berman

Chalmers University, Sweden

09:30–10:20

Polystability thresholds vs log canonical thresholds on Fano manifolds

In this talk, I will introduce a new algebraic invariant of a Fano manifold X - the Gibbs polystability threshold of X . It is conjecturally equal to a previously studied analytic polystability threshold, which quantifies the coercivity of the Mabuchi functional modulo the action of the automorphism group of X . The invariant leads to an effective sufficient criterion for the existence of a Kähler–Einstein metric on X , reducing the problem to the computation of finitely many log canonical thresholds; the criterion is also necessary if the conjectural equality holds. The motivation comes from the probabilistic approach to constructing Kähler–Einstein metrics. This is joint work with Rolf Andreasson and Ludvig Svensson.

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Andres Gomez

Aarhus University, Denmark

11:00–11:50

Modular interpretation of the Weil-Petersson metric asymptotics for abelian varieties

As a first step towards a refined description of the asymptotic of the Weil-Petersson metric on the moduli space of polarized Calabi-Yau manifolds, we investigate the concrete case of abelian varieties by linking such asymptotic with the multi-scale collapsing limits of the parametrized flat tori, as explicitly classified by Odaka. This is a joint work with Yanbo Fang.

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Charles Cifarelli

Stony Brook University, USA

13:30–14:20

K-polystability of asymptotically conical Kähler-Ricci shrinkers

Shrinking gradient Kähler-Ricci solitons (Kähler-Ricci shrinkers) are fundamental objects in the study of the Kähler-Ricci flow, characterizing much of the behavior of finite-time singularities. Recently, Sun-Zhang have developed an algebraic theory for Kähler-Ricci shrinkers, which in particular implies that such spaces are naturally quasiprojective varieties. Moreover, they propose a YTD correspondence

between the existence of such a metric and an algebro-geometric notion of \mathbf{K} -stability, analogous to and in fact extending the well-known situations for Fano manifolds and Kähler cones. In this talk, I will discuss the proof of one direction of the correspondence, namely that the existence of a Kähler-Ricci shrinker metric implies \mathbf{K} -polystability, in the case that the Ricci curvature decays at infinity.

This is joint work with Carlos Esparza.

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Mingyang Li

Simons Center, Stony Brook University, USA

15:00–15:50

Gravitational instantons and harmonic map

It is known from general relativity that axisymmetric stationary black holes can be reduced to axisymmetric harmonic maps into the hyperbolic plane \mathbb{H}^2 , while in the Riemannian setting, 4d Ricci-flat metrics with torus symmetry can also be locally reduced to such harmonic maps satisfying a tameness condition. We study such harmonic maps and application includes a construction of infinitely many new complete, asymptotically flat, Ricci-flat 4-manifolds with arbitrarily large second Betti number b_2 . Joint work with Song Sun.

Friday 22 May

Hartmut Weiss

Kiel University, Germany

09:30–10:20

Gravitational instantons and Hitchin moduli spaces

Gravitational instantons are complete 4-dimensional hyperkähler manifolds with square-integrable curvature tensor. I will address the question whether all gravitational instantons (of type ALG) can be obtained as Hitchin moduli spaces. In particular, I will explain how to compute the (hyperkähler) Torelli map for (weakly) parabolic Higgs bundles on the 4-punctured sphere. This is based on recent joint work with Fredrickson, Mazzeo and Swoboda.

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Tristan Ozuch

MIT, USA

11:00–11:50

Regularity of Einstein 5-manifolds via 4-dimensional gap theorems

(Joint work with Yiqi Huang). We refine the regularity of non-collapsed limits of Einstein 5-manifolds. In particular, we show uniqueness of tangent cones on the full top stratum, show that the structure of the singular set lies in countable unions of Lipschitz curves and points. We finally prove real-analytic orbifold regularity along curves of singularities, which are also proven to be geodesics, and establish uniqueness of tangent cone at infinity under Euclidean volume growth with a line split. The proofs rely on new 4-dimensional gap/isolation theorems for spherical and hyperbolic Einstein orbifolds.