Differential Geometry and Mathematical Physics
Géométrie différentielle et physique mathématique
(Org: **Eric Bahuaud** (Seattle University) and/et **Frédéric Rochon** (UQÀM))

ARAM ALYOUSEF, University of Alberta

ABDOU OUSSAMA BENABIDA, UBC

MAURICIO BUSTAMANTE, Universidad Católica de Chile
Non-nullbordant aspherical manifolds

A manifold is called aspherical if its universal cover is contractible. Examples of aspherical manifolds are tori, hyperbolic manifolds and nonpositively curved manifolds. Hence the homotopy type of aspherical manifolds is encoded in their fundamental groups. It is therefore interesting to investigate the extent to which other topological properties of these manifolds are constrained by the fundamental group. In that regard, it was conjectured that closed aspherical manifolds whose fundamental group has nontrivial center were boundaries. In my talk I will show how using *hyperbolization* – a process to turn a triangulated manifold into an aspherical manifold– one can disprove this conjecture.

FACUNDO CAMANO, Waterloo

BENJAMIN FRIEDMAN, UQÀM

CHRISTINE GUENTHER, Pacific University

ROBERT HARRIS, UQÀM

HARI KUNDURI, McMaster University

KUAN-HUI LEE, McGill University
Pluriclosed 3-folds with vanishing Bismut Ricci form

In this talk, we discuss complex 3-dimensional non-Kähler Bismut Ricci flat pluirclosed Hermitian manifolds (BHE) via their dimensional reduction to a special Kähler geometry in complex dimension 2. The reduced geometry satisfies a 6th order non-linear PDE which has infinite dimensional momentum map interpretation, similar to much-studied Kähler metrics of constant

scalar curvature (cscK). We use this to associate to the reduced manifold or orbifold Mabuchi functional, as well as to obtain obstructions for the existence of solutions in terms of the automorphism group. Furthermore, we discuss explicit solutions of the PDE on orthotoric Kähler orbifold surfaces which construct some new BHE examples.

MAXENCE MAYRAND, University of Sherbrooke

RUXANDRA MORARU, University of Waterloo

TRISTAN OZUCH, MIT

Positive Einstein metrics on infinitely many 4-manifolds

We construct Einstein metrics with positive scalar curvature on two infinite families of 4-manifolds. Via Wick rotation, we obtain static axisymmetric Lorentzian spacetimes with positive cosmological constant and arbitrarily many horizons of equal surface gravity. As the topology increases, the metrics collapse to an explicit 2-disk while bubbling off periodic gravitational instantons with Kasner asymptotics, one of which is new.

CRISTINA STOICA, Wilfred Laurier University

ERIC WOOLGAR, University of Alberta

Spacetime conformal boundary causal rigidity

A well-known boundary rigidity problem for Riemannian geometry asks whether a manifold-with-boundary, such that all geodesic chords have the same length, is necessarily a round hemisphere. It is, and therefore any chord leaving a given boundary point passes through that point's antipode. For Lorentzian geometry, we pose the following conformal boundary rigidity problem. If all light rays leaving a point p in the distant past (Penrose's conformal infinity) refocus at the same point q in the distant future, and if the same is true for all such p, is the spacetime conformal to a maximally symmetric spacetime? For example, if the spacetime is also asymptotically anti-de Sitter, is it actually anti-de Sitter (up to conformal transformations that preserve the asymptotics)? I will answer this question, assuming that the spacetime is also stationary, based on joint work with Gabriel Paternain. Time permitting, I will discuss joint work with Alex Sandhu and Giulio Sanzeni on the positive cosmological constant version of this problem.

XUWEN ZHU, Northeastern University