

# **31<sup>st</sup> ANNUAL GEOMETRY FESTIVAL: ABSTRACTS.**

April 8-10, 2016

PRINCETON UNIVERSITY: A01 McDonnell Hall

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Speaker: **Ian Agol** (*University of California, Berkeley & the Institute for Advanced Study*)

Talk title: *"Pseudo-Anosov stretch factors and homology of mapping tori"*

**Abstract:**

(Joint work with Chris Leininger and Dan Margalit.)

We consider the pseudo-Anosov elements of the mapping class group of a surface of genus  $g$  that fix a rank  $k$  subgroup of the first homology of the surface. We show that the smallest entropy among these is comparable to  $(k+1)/g$ . This interpolates between results of Penner and Farb and the second and third authors, who treated the cases of  $k=0$  and  $k=2g$ , respectively, and answers a question of Ellenberg.

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Speaker: **Fengbo Hang** (*Courant Institute, New York University*)

Talk title: *"Fourth order Paneitz operator and Q curvature equation"*

**Abstract:**

Paneitz operator and Q curvature were discovered in searching for higher order analogue of the Laplacian operator in dimension two and the conformal Laplacian operator in dimension at least three. The work of Chang-Gursky-Yang since late 90's demonstrates the analytic and geometric value of this algebraically built operator in dimension four. We will discuss some recent progress in the analysis of this operator and Q curvature equation in dimensions other than four, based on many people's effort.

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Speaker: **Nancy Hingston** (*The College of New Jersey*)

Talk title: *"Loop Products, Index Growth, and Dynamics"*

**Abstract:**

A metric on a compact manifold  $M$  gives rise to a length function on the free loop space  $LM$  whose critical points are the closed geodesics on  $M$  in the given metric. Morse theory gives a link between Hamiltonian dynamics and the topology of loop spaces, between iteration of closed geodesics and the algebraic structure given by the Chas-Sullivan product on the homology of  $LM$ . Poincaré Duality reveals the existence of a related product on the cohomology of  $LM$ .

A number of known results on the existence of closed geodesics are naturally expressed in terms of nilpotence of products. We use products to prove a resonance result for the loop homology of spheres. There are interesting consequences for the length spectrum, and related results in Floer and contact theory.

Mark Goresky, Alexandru Oancea, Hans-Bert Rademacher, and Nathalie Wahl are collaborators.

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Speaker: **Jen Hom** (*Georgia Tech & the Institute for Advanced Study*)

Talk title: *"Symplectic four-manifolds and Heegaard Floer homology"*

**Abstract:**

We give new constraints on the topology of symplectic four-manifolds using invariants from Heegaard Floer homology. In particular, we will prove that certain simply-connected four-manifolds with positive-definite intersection forms cannot admit symplectic structures. This is joint work with Tye Lidman.

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Speaker: **Claude LeBrun** (*SUNY at Stony Brook*)

Talk title: *"Mass in Kähler Geometry"*

**Abstract:**

Given a complete Riemannian manifold that looks enough like Euclidean space at infinity, physicists have defined a quantity called the "mass" which measures the asymptotic deviation of the geometry from the Euclidean model. In this lecture, I will explain a simple formula, discovered in joint work with Hajo Hein, for the mass of any asymptotically locally Euclidean (ALE) Kähler manifold. For ALE scalar-flat Kähler manifolds, the mass turns out to be a topological invariant, depending only on the underlying smooth manifold, the first Chern class of the complex structure, and the Kähler class of the metric. When the metric is actually AE (asymptotically Euclidean), our formula not only implies a positive mass theorem for Kähler metrics, but also yields a Penrose-type inequality for the mass.

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Speaker: **Davi Maximo** (*Stanford University*)

Talk title: *"Minimal surfaces with bounded index"*

**Abstract:**

We prove a structural theorem that provides a precise local picture of how a sequence of closed embedded minimal surfaces with bounded index on a given three-manifold might degenerate. We then discuss several applications, including some compactness results. Time permitting, we discuss how our strategy can be extended to ambient dimensions 4, 5, 6 and 7. (This is joint work with O. Chodosh and D. Ketover)

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Speaker: **Jake Solomon** (*Hebrew University*)

Talk title: *"The space of positive Lagrangians"*

**Abstract:**

A Lagrangian submanifold of a Calabi-Yau manifold is positive if the real part of the holomorphic volume form restricts on it to a positive form. A Hamiltonian isotopy class of positive Lagrangians admits a Riemannian metric of non-positive sectional curvature and a convex functional which has critical points at special Lagrangians. Geodesics are equivalent to solutions of the degenerate special Lagrangian equation. Existence of geodesics would imply uniqueness of special Lagrangians as well as a version of the strong Arnold conjecture. Weak geodesics are known to exist between positive graph Lagrangians in Euclidean space. Smooth geodesics can be constructed in Milnor fibers and toric Calabi-Yau manifolds using symmetry techniques. This talk is based partially on joint work with Y. Rubinstein and A. Yuval.

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