Great Lakes Geometry 2014
Schedule

Saturday April 26 - Morning

9:00 – 10:00 Coffee / breakfast / registration

10:00 – 11:00 **Mohammed Abouzaid** – Family Floer Cohomology

11:30 – 12:30 **Tim Perutz** – Generating Fukaya Categories in Homological Mirror Symmetry

12:30 – 14:00 Lunch

Saturday April 26 - Afternoon

14:00 – 15:00 **Matt Hedden** – Obstructing the Existence of Algebraic Curves with Prescribed Singularities

15:30 – 16:30 **Natasa Sesum** – TBA

18:30 – 20:30 Banquet in the Oak Room - South Dining Hall

Sunday April 27 - Morning

8:00 – 9:00 Coffee / refreshments

9:00 – 10:00 **Aaron Naber** – Characterizations of Bounded Ricci Curvature on Smooth and Nonsmooth Spaces

10:15 – 11:15 **László Lempert** – Representing Analytic Cohomology Groups of Complex Manifolds

All the talks are in **127 Hayes-Healy**. The coffee breaks in the mornings and between talks will be in the lounge, **257 Hurley**.

Abstracts

Mohammed Abouzaid – Family Floer Cohomology

Fukaya categories have recently emerged as a powerful tool to study symplectic topology, but they are difficult to describe outside a small class of examples. By focusing on the case of symplectic manifolds admitting Lagrangian fibrations, I will explain how the study of Family floer cohomology can shed some light on these categories, and hence on some questions in symplectic topology. Time permitting, I will explain some difficulties that arise when attempting to go beyond this case.

Matt Hedden – Obstructing the Existence of Algebraic Curves with Prescribed Singularities

A non-singular algebraic curve in the complex projective plane of degree d has topological genus $(d-1)(d-2)/2$. If the curve has singularities, yet topologically is still an embedded surface, then the genus will be lower. Heuristically, some of the topology gets pushed into the singularities. This talk will examine the question of which configurations of singularities can arise in algebraic curves of degree d that have some fixed topological genus. I will discuss new obstructions that imply the non-existence of algebraic curves with certain configurations of singularities. The obstructions come from Heegaard Floer homology. This is joint work with Maciej Borodzik and Charles Livingston.

László Lempert – Representing Analytic Cohomology Groups of Complex Manifolds

The cohomology groups $H^q(X, \mathcal{O})$ of a complex manifold are often represented in terms of open covers $\mathfrak{U} = \{U_a \colon a \in A\}$ of X and the associated Čech complex $C^\bullet(\mathfrak{U}, \mathcal{O})$, whose elements are collections $(f_{a_0 \dots a_q})_{a_j \in A}$, with each $f_{a_0 \dots a_q} \in \mathcal{O}(\bigcap_{j=0}^q U_{a_j})$. If each U_a is Stein, $H^q(X, \mathcal{O}) \approx H^q(C^\bullet(\mathfrak{U}, \mathcal{O}))$.

The notion of Čech cochains $(f_{a_0 \dots a_q})$ is natural if the cover $\mathfrak{U}$ is indexed by a set A without any structure. However, if A has some structure, then it makes sense to consider cochains that, in their dependence on a_j, reflect this structure. In the talk we will consider an A that itself is a complex manifold, and the subspace $C^\bullet_{\text{hol}}(\mathfrak{U}, \mathcal{O})$ of cochains $(f_{a_0 \dots a_q})$ that depend holomorphically on $a_0, \dots, a_q$ as well. We will discuss when the holomorphic Čech complex $C^\bullet_{\text{hol}}(\mathfrak{U}, \mathcal{O})$ can be used to compute $H^q(X, \mathcal{O})$, and will give an application to group actions.

Aaron Naber – Characterizations of Bounded Ricci Curvature on Smooth and Nonsmooth Spaces

In this talk we discuss several new estimates on manifold with bounded Ricci curvature, and in particular Einstein manifolds. In fact, the estimates are not only implied by bounded Ricci curvature, but turn out to be equivalent to bounded Ricci curvature. We will see that bounded Ricci curvature controls analysis on the path space P(M) of a manifold in much the same way that lower Ricci curvature controls analysis on M. There are three distinct such characterizations given. The first is a gradient estimate that acts as an infinite dimensional analogue of the Bakry-Emery gradient estimate. The second is a $C^{1/2}$-Holder estimate on the time regularity of the martingale decomposition of functions on path space. For the third we consider the Ornstein-Uhlenbeck operator, a form of infinite dimensional laplace operator, and show that bounded Ricci curvature is equivalent to an appropriate spectral gap. One can use these notions to make sense of bounded Ricci curvature on abstract metric-measure spaces.

Tim Perutz – Generating Fukaya Categories in Homological Mirror Symmetry

This talk is about joint work with Nick Sheridan about mirror symmetry for Calabi-Yau (CY) manifolds. Homological mirror symmetry (HMS) claims that the Fukaya category of one CY (viewed as a symplectic manifold) is equivalent to the derived category of its mirror (viewed as an algebraic variety). I aim to outline enough of the ideas and terminology of the field to discuss the following theorem: Suppose that one has a full subcategory A of the Fukaya category; a full subcategory B of the derived category of the mirror, which generates it under taking mapping cones and idempotents; and an equivalence of A with B. Then A generates the Fukaya category, HMS holds, and the small quantum cohomology of the symplectic manifold is isomorphic to the ”tangential cohomology” of its mirror.