THE UNIVERSITY   OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

WORKSHOP ON GEOMETRIC ANALYSIS

8 - 9 January, 2015
Room 210, Run Run Shaw Building, HKU

THURSDAY, 8 JANUARY

10:00 – 11:00   **Weiping Zhang** (Chern Institute of Mathematics)

Dirac operators on foliations

Tea / Coffee Break

11:20 – 12:20   **Ping Xu** (Pennsylvania State University)

Rozansky–Witten-type invariants from symplectic Lie pairs

Lunch Break

15:00 – 16:00   **Bai-Ling Wang** (Australian National University)

Orbifold K-theory for ineffective orbifolds

Tea / Coffee Break

16:20 – 17:20   **Man Ho Ho** (Hong Kong Baptist University)

Characteristic classes in differential cohomology

Workshop Dinner

FRIDAY, 9 JANUARY

10:00 – 11:00   **Huitao Feng** (Chern Institute of Mathematics)

Some simple observations on Finsler geometry

Tea / Coffee Break

11:20 – 12:20   **Jiazu Zhou** (Southwest University, Chongqing)

On isoperimetric inequalities

Organizer: Siye Wu

All are welcome

Abstracts

Huitao Feng (Chern Institute of Mathematics)
Some simple observations on Finsler geometry
Abstract: In this talk, I will introduce our two simple observations on Finsler geometry. One is that the Chern connection in real Finsler geometry is in fact the Bott connection associated to a foliation, the other is a Gauss-Bonnet-Chern-type formula for almost complex Finsler manifolds.

Man Ho Ho (Hong Kong Baptist University)
Characteristic classes in differential cohomology
Abstract: This talk is about characteristic classes in differential cohomology, also called differential characteristic classes in literatures. Differential characteristic classes are finer geometric invariants of principal G-bundles with connections, and it take values in Cheeger-Simons differential characters, the differential extension of ordinary cohomology theory. In this talk we will talk about defining characteristic classes without using universal bundles and universal connections, thus answering a question raised by Jeff Cheeger in the 70s. We will also give explicit formulae for differential characteristic classes, for example differential Chern classes. From the explicit formula we determine which model of differential K-theory is suitable for the differential Chern class to be a natural transformation. If time permits we will talk about the representation of differential characters by differential forms with singularities and discuss how to define differential Stiefel-Whitney classes.

Bai-Ling Wang (Australian National University)
Orbifold K-theory for ineffective orbifolds
Abstract: In recent joint work with Tang Xiang, Tseng Hsian-Hua and Wang Hang, we show that for any orbifold X, the category of orbifold vector bundles over X is weakly equivalence to the category of finitely generated projective modules of the associated C^*-algebra $C^*(X)$. In particular, for any orbifold, the orbifold K-theory agrees with the K-theory of the C^*-algebras, hence enjoys the Mayer-Vietoris sequence property. The proof utilises the non-abelian grebe and some interesting isomorphisms for cross-product C^*-algebras.

Ping Xu (Pennsylvania State University)
Rozansky–Witten-type invariants from symplectic Lie pairs
Abstract: In 1997, Rozansky and Witten built new finite-type invariants of 3-manifolds from hyper-Kähler manifolds. It was later shown by Kontsevich and Kapranov that those invariants only depend on the holomorphic symplectic structure of the hyper-Kähler manifolds. Indeed Kapranov proved that these invariants may be considered as an analogue of Chern-Simons type invariants, where the Atiyah class of the underlying complex manifold plays the role of Lie bracket. In this talk, we introduce symplectic structures on "Lie pairs" of (real or complex) algebroids, encompassing homogeneous symplectic spaces, symplectic manifolds with a $\mathfrak{g}$-action and holomorphic symplectic manifolds. We show that to each such symplectic Lie pair are associated Rozansky-Witten-type invariants of three-manifolds. This is a joint work with Yannick Voglaire.

Weiping Zhang (Chern Institute of Mathematics)
Dirac operators on foliations
Abstract: We construct Dirac operators on foliations by applying the Bismut-Lebeau analytic localization technique to the Connes fibration over a foliation. The Laplacian of the resulting Dirac operators has better lower bound than that obtained by using the usual adiabatic limit arguments on the original foliation. As a consequence, we prove an extension of the Lichnerowicz-Hitchin vanishing theorem to the case of foliations.

Jiazu Zhou (Southwest University, Chongqing)
On isoperimetric inequalities
Abstract: In this talk, we will address the classical isoperimetric problem. The isoperimetric inequality, Minkowski inequality, Brunn-Minkowski inequality, L_p Minkowski inequality for geo-minimal surface areas, L_p Minkowski inequality for mixed volumes, Bonnesen-style inequalities and more generalized isoperimetric inequalities will be introduced.