兩岸清華數學研討會

2012年10月3日(星期三)

時間	Algebra and Geometry 地點: 綜合三館 R734	Analysis and Differential Equations 地點: 綜合三館 R723
10:00am -10:10am	Opening - chair: 蔡孟傑	Opening - chair: 陳國璋
10:10am -11:00am	李海中 (Haizhong Li) Title: Self-Shrinkers of the Mean Curvature Flow in Euclidean Space with Arbitrary Codimension	步尙全 (Shangquan Bu) Title: Mild well-posedness of vector-valued boundary problems
11:00am -11:10am	Tea Time - 綜合三館 R728 (學生交誼室)	
11:10am - 12:00pm	卓士堯 (Shin-Yao Jow) Effective cone of the space of maps from P^1 to a Grassmannian	許世壁 (Sze-Bi Hsu) Title: Competition between microorganism for a single limiting resource with cell quota structure and spatial variation
12:00pm - 2:00pm	Lunch	
2:00pm - 2:50pm	周堅 (Jian Zhou) Title: Curve counting in toric Calabi-Yau 3-folds	鄒文明 (Wenming Zou) Title: Some results on elliptic equations with critical Sobolev exponents
2:50pm - 3:10pm	Tea Time - 綜合三館 R728 (學生交誼室)	
3:10pm - 4:00pm	蔡東和 (Dong-Ho Tsai) Title: Remarks on Some Isoperimetric Properties of the k -1 Flow	江金城 (Jin-Cheng Jiang) Title: Collision operator of the Boltzmann equation
4:00pm - 4:10pm	Tea Time - 綜合三館 R728 (學生交誼室)	
4:10pm - 5:00pm	張賀春 (Hechun Zhang) Title: Quantum invariant theory	朱家杰 (Chia-Chieh Jay Chu) Title: Multiscale methods for high contrast elliptic equations

Algebra and Geometry

- Speaker: Haizhong Li 李海中 (Tsinghua-Beijing)
- Title: Self-Shrinkers of the Mean Curvature Flow in Euclidean Space with Arbitrary Codimension
- Abstract: In this talk, we will report our recent research results about self-shrinkers of the mean crvature flow in Euclidean space with arbitrary codimension, which include: lower volume growth estimates for selfshrinkers; classification and rigidity of self-shrinkers; the diameter estimate of compact shrinkers; gap theorems of self-shrinkers and \$F\$-stability for self-shrinkers.
- **Speaker:** Shin-Yao Jow 卓士堯
- Title: Effective cone of the space of maps from P^1 to a Grassmannian
- Abstract: We will describe the effective cone of the Quot scheme which compactifies
 the space of maps from P^1 to a Grassmannian. This space has seen some applications in
 enumerative geometry and mathematical physics, and determining its effective cone is a
 first step in understanding its birational geometry.
- Speaker: Jian Zhou 周坚 (Tsinghua-Beijing)
- Title: Curve counting in toric Calabi-Yau 3-folds
- Abstract: We will report on our recent joint work with Shui Guo on computations of Gopakumar-Vafa
 invariants of canonical line bundles of toric Fano surfaces. We will compare our results with Gottsche-YauZaslow formula.
- Speaker: Dong-Ho Tsai 蔡東和
- Title: Remarks on Some Isoperimetric Properties of the k 1 Flow
- Abstract: ;

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We consider the evolution of a convex closed plane curve γ_0 along its inward normal direction with speed k-1, where k is the curvature. This flow has the feature that it is the gradient flow of the (length-area) functional and has been previously studied by Chou-Zhu and Yagisita. Here we revisit the flow again and point out some interesting isoperimetric properties not discussed before.

We first prove that if the curve γ_t converges to the unit circle S^1 (without rescaling), then its length L(t) and area A(t) must satisfy certain monotonicity properties and inequalities.

On the other hand, if the curve γ_t (assume γ_0 is not a circle) expands to infinity as $t \to \infty$ and we interpret Yagisita's result in the right way, then the isoperimetric difference $L^2(t) - 4\pi A(t)$ of γ_t will decrease to a **positive** constant as $t \to \infty$. Hence, without rescaling, the expanding curve γ_t will not become circular. It is asymptotically close to some expanding curve C_t , where C_0 is not a circle and each C_t is parallel to C_0 . The asymptotic speed of C_t is given by the constant 1.

- Title: Quantum invariant theory
- Abstract: My talk is based on a joint work with G. Lehrer and R. B. Zhang from University of Sydney.We establish a noncommutative analogue of the first fundamental theorem of classical invariant theory. For each quantum group associated with a classical Lie algebra, we construct a noncommutative associative algebra whose underlying vector space forms a module for the quantum group and whose algebraic structure is preserved by the quantum group action. The subspace of invariants is shown to form a subalgebra, which is finitely generated. We determine generators of this subalgebra of invariants and determine their commutation relations. In each case considered, the noncommutative modules we construct are flat deformations of their classical commutative analogues. Thus by taking the limit as \$q\rightarrow 1\$, our results imply the first fundamental theorem of classical invariant theory, and therefore generalise them to the noncommutative case.

Analysis and Differential Equations

<u>Speaker: Sze-Bi Hsu 許世壁</u>

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Title: Competition between microorganism for a single limiting resource with cell quota structure and spatial variation

Abstract : Microbial populations compete for nutrient resources, and the simplest mathematical models of competition neglect differences in the nutrient content of individuals. The simplest models also assume a spatially uniform habitat. Here both of these assumptions are relaxed. Nutrient content of individuals is assumed proportional to cell size, which varies for populations that reproduce by division, and the habitat is taken to be an unstirred chemostat where organisms and nutrients move by simple diffusion. In a spatially uniform habitat, the size-structured model predicts competitive exclusion, such that only the species with lowest break-even concentration persists. In the unstirred chemostat, coexistence of two competitors is possible, if one has a lower break-even concentration and the other can grow more rapidly. In all habitats, the calculation of competitive outcomes depends on aprincipal eigenvalue that summarizes relationships among cell growth, cell division, and cell size.

Speaker: Shangquan Bu 步尙全 (Tsinghua-Beijing)

Title: Mild well-posedness of vector-valued boundary problems

Abstract: In this talk, we will give some results on the well-posedness of vector-valued boundary problems, we will also give some characterizations of the mild well-posedness of vector-valued boundary problems.

Speaker: Wenming Zou 鄒文明 (Tsinghua-Beijing)

- Title: Some results on elliptic equations with critical Sobolev exponents
- Abstract: In this survey talk, I am going to talk about
- 1. A Berestycki-Lions theorem revisited;
 - 2. Singularly perturbed critical Dirichlet problems
 - 3. Standing Waves for critical Schrodinger Equations
 - 4. High-dim Bose-Einstein condensates type equations
 - 5. Doubly critical elliptic systems in \$\R^N\$ with indefinite weight
- 6. Critical systems with Linear perturbation
- 7. Optimal Constants for Bose-Einstein condensates
- Speaker: Jin-Cheng Jiang 江金城
- Title: Collision operator of the Boltzmann equation
- Abstract: It is known that the properties of solutions for the Boltzmann equation are determined by the assumptions on collision operator. However even the models used widely are not understood completely. We will introduce our results on this aspect.

Speaker: Chia-Chieh Jay Chu 朱家杰

Title: Multiscale methods for high contrast elliptic equations

Abstract: In this talk, I will introduce multiscale numerical methods for the elliptic equations arising in interface and two-phase flow problems. The model problems we consider are motivated by the multiscale computations of flow and transport of two-phase flow in strongly heterogeneous porous media. Although the analysis is carried out for simplified model problems, it does provide valuable insight in designing accurate multiscale methods for more realistic applications. The method is able to accurately capture solutions of elliptic interface problems with high contrast coefficients by using only coarse quasi-uniform meshes, and without resolving the interfaces. The method has an optimal convergence rate and the hidden constants in these estimates are independent of the ``contrast" of the PDE's coefficients. I conduct some numerical experiments to confirm the optimal rate of convergence of the proposed method and its independence from the aspect ratio of the coefficients.