Abstracts

Valery Alexeev, University of Georgia, Athens, USA

On compactifications of moduli spaces of K3 surfaces

I will consider the problem of constructing a geometrically meaningful compactification of the moduli space of polarized K3 surfaces. A general method for constructing such compactifications is provided by the Minimal Model Program, and the case of abelian varieties serves as the primary example. I will discuss how much of the theory can be extended to the K3 surface case, and will compute the compactifications is several special cases.

Yik-Man Chiang, University of Science & Technology, Hong Kong

Nevanlinna theory based on Askey-Wilson divided difference operator

The idea is to re-write the classical Nevanlinna theory in terms of a divided difference operator due to Askey and Wilson (1985) from special function theory. The Askey-Wilson operator is a q-operator that is more complicated than other q-operators, such as the q-Hahn operator. The operator has close relationship with the Jacobi theta functions. It allows us to derive previously unknown properties for meromorphic functions that have very slow growth in the complex plane. This is a joint work with Shaoji Feng.

Lawrence Ein, University of Illinois, Chicago, USA

Pseudoeffective and nef classes of higher codimension cylces

This is a joint work with Debarre, Lazarsfeld and Voisin. We study the pseudoeffective and nef cones of higher codimenion cycles. We investigate various criteria to determine whether a class is in the interior of the pseduoeffective cone. We discuss the following example. If X is the self product of an ellipitc curve with complex multiplications n times ($n > 3$). Then $Nef^k(X)$ is strictly larger than $psef^k(X)$ for 1, $k < n - 1$.

Jaehyun Hong, Seoul National University, Korea

Classification of smooth Schubert varieties in a rational homogeneous manifold of Picard number one

A Schubert variety of a rational homogeneous manifold G/P is the closure of an orbit of a Borel subgroup of G. By the Bruhat decomposition the homology classes of Schubert varieties generate the homology space of G/P. Schubert varieties are generally singular and an explicit determination of the singular locus of a Schubert variety is still an open question.

A normal variety with an action of a reductive group is said to be horospherical if it has an open dense orbit which is a torus bundle over a rational homogenous manifold. Up to now all known examples of smooth Schubert varieties are horospherical. In this talk, we show that a smooth Schubert variety of a rational homogeneous manifold of Picard number one is horospherical and determine all smooth Schubert varieties of rational homogeneous manifolds of Picard number one.

Ngaiming Mok, HKU, Hong Kong

Boundary behavior of holomorphic maps into bounded symmetric domains and applications to geometric problems

Let $\Omega \Subset \mathbb{C}^n$ be a bounded symmetric domain in its Harish-Chandra realization and equipped with the Bergman metric ds^2_Ω. Let $b \in \partial\Omega$ a boundary point and S a germ of complex submanifold of $\mathbb{C}^n$ at b. We are interested to study the boundary behavior of $(S \cap \Omega, ds^2_\Omega|_{S\cap\Omega})$ near b as a Kähler submanifold of (Ω, ds^2_Ω). By way of examples we will illustrate in special cases how the knowledge of such boundary behavior implies solutions to geometric problems.
We will illustrate this with two examples. The first example is the case where Ω is the complex unit ball. In this case, slightly perturbing the base point $b \in S \cap \partial B^n$ if necessary, as is well-known S is of asymptotically constant holomorphic sectional curvature $-\frac{2}{n+1}$. This implies the following geometric statement. Given a finite-volume quotient $X = B^n/\Gamma$ and a germ of complex geodesic submanifold $E \subset X$ at some point $x \in X$, the Zariski closure of E in X is totally geodesic. In particular, it implies that the Gauss map on any irreducible subvariety $Z \subset X$ (with respect to the projective structure on X inherited from B^n) is generically finite, a result first established by Jun-Muk Hwang. The second example is the case where Ω is an irreducible bounded symmetric domain, $b \in \partial\Omega$ is a smooth point of $\partial\Omega$, and S is a germ of holomorphic curve at b. In this case we show that, slightly perturbing the base point b if necessary, the second fundamental form is asymptotically zero when one approaches $\partial S \cap \mathrm{Reg}(\partial\Omega)$. (A precise rate of decay of the second fundamental form is also obtained.) The asymptotic behavior gives an alternative proof of the characterization of measure-preserving holomorphic maps for Ω other than the unit disk granted the algebraic extendibility of such maps (as established by Mok-Ng). Both examples are prototypes of much more general phenomena with interesting geometric consequences.

Sui-Chung Ng, HKU, Hong Kong

Proper holomorphic maps on bounded symmetric domains of rank at least 2 and characteristic symmetric subspaces

In an early work of Mok and Tsai in 1992 regarding the rigidity of convex realizations of bounded symmetric domains, it has been shown that proper holomorphic maps between bounded symmetric domains of rank at least 2 preserve certain symmetric subspaces, known as characteristic symmetric subspaces. This property has then been further exploited by Tsai and Tu in their studies of proper holomorphic maps between bounded symmetric domains. In this talk, we will first briefly introduce the related notions and then we will discuss a recent joint work with Mok and Tu regarding arbitrary proper holomorphic maps defined on an irreducible bounded symmetric domain (with rank ≥ 2) and a simple proof of Tsai's theorem on proper holomorphic maps between domains of equal rank.

Tuen-Wai Ng, HKU, Hong Kong

Two-variable Wiman-Valiron theory and its applications to PDEs

The classical Wiman-Valiron theory is an important tool for the study of entire solutions of ODEs in the complex plane. A two variable version of Wiman-Valiron theory was developed by Peter Fenton in 1995 and it has been applied to study the entire solutions of some PDEs by Peter Fenton and John Rossi very recently. In this talk, we shall explain how their techniques can be used to show that certain PDEs cannot have transcendental entire solutions.

Yum-Tong Siu, Harvard University, USA

Appications of curvature properties of direct images of relative pluricanonical bundles

Will discuss the historic background of curvature properties of direct images of relative pluricanonical bundles and their applications to algebraic and complex geometry such as the hyperbolicity of moduli spaces and the abundance conjecture.

Xiaotao Sun, Chinese Academy of Sciences, Beijing, China

Frobenius morphism and vector bundles

Let X be a smooth projective variety over an algebraically closed field of positive characteristic. Let F be the relative Frobenius morphism of X. In this talk, I will discuss the behaviour of semistable bundles under the operations F^* and F_*. The stability of sheaves of locally closed forms and exact forms will also be discussed.

Wing-Keung To, National University of Singapore

Finsler metrics, Kobayashi hyperbolicity and moduli spaces of canonically polarized manifolds

In this talk, I will report on a recent joint work with Sai-Kee Yeung on the study of hyperbolicity properties on moduli spaces of canonically polarized manifolds via the construction of Finsler metrics of negative curvature.

Jonathan Tsai, Polytechnic University, Hong Kong

The scaling limit of 2-d myopic random walk

Consider the hexagonal or square lattice in the two-dimensional upper half-plane. Myopic random walk is the following walk on the lattice from 0 to infinity: Starting from the origin, it moves to adjacent points chosen uniformly amongst the neighbouring points that do not lead to the walk getting trapped.

It has been conjectured (by W. Werner and others) that the scaling limit (i.e. as the mesh size of the lattice tends to 0) of myopic random walk is SLE(6). In thehexagonal lattice, this is already known (Smirnov, Camia and Newman) due to its relation with percolation. We will present a proof of the convergence of myopic random walk to SLE(6) that does not require percolation. This is joint work with Phillip Yam.

Julie Tzu-Yueh Wang, Academia Sinica, Taipei, Taiwan

p-adic hyperbolicity and Z-integral points on varieties

Similar to the correspondence between classical Nevanlinna theory and Diophantine approximation, we discuss a correspondence between p-adic analytic maps and Z-integral points on varieties. This is a joint work with Ta Thi Hoai An and Aaron Levin.

Lin Weng, University of Kyushu, Fukuoka, Japan

Relative Bott-Chern secondary characteristic classes

For smooth fibrations of compact Kaehler manifolds, the index theorem says that de Rham cohomology classes of the so-called index form is equal to the associated L^2-form. However as differential forms, these two are very different. To measure their differences, we introduced relative Bott-Chern secondary characteristic classes. In this talk, we will explain our axiomatic approach to such classes, offer some details on their constructions and point out difficulties involved if time is allowed.

Sai-Kee Yeung, Purdue University, USA

Infinitesimal deformation, local deformation, and rigidity of tangent bundle of complex two ball quotients

In this talk, we study the problem of deformation rigidity of the holomorphic tangent bundle of a compact complex two ball quotient. This is in turn used to study a problem of Kodaira and Morrow about the distinction between infinitesimal and local deformation.

Wanke Yin, Wuhan University, Wuhan, China

Equivalence problems for Bishop surfaces

Bishop surfaces are generically embedded surfaces in the complex Euclidean space of dimension two. The surfaces have been playing important roles in the study of several complex variables. In this talk, I will focus on the equivalence problem for such surfaces, as well as its connection with classical dynamics and hyperbolic geometry.