Titles and Abstracts

1. Meng Chen, Fudan University
   Title: On effective method in calculating birational invariants of smooth projective 3-folds of general type
   Abstract: We explain an effective method in computing all birational invariants of nonsingular projective 3-folds by investigating the set of weighted baskets of terminal orbifolds.

2. Yonggao Chen, Nanjing Normal University
   Title: A generalization of the classical circle problem
   Abstract: The classical circle problem is to study the number of representations of n as a sum of squares of two integers. In this talk, we will talk about the number of representations of n as a sum of two terms of a given sequence A.

3. Chuangxun Cheng, Nanjing Normal University, China
   Title: From formal groups to displays
   Abstract: In this talk, we describe formal groups as certain functors with special properties. In this way, we explain the relation between formal groups and Cartier modules and the relation between p-divisible formal groups and Dieudonn\'e modules. In the end, we introduce the theory of displays and explain several applications.

4. Rong Du, East China Normal University
   Title: on the Canonical Degrees of Gorenstein Three Folds of General Type
   Abstract: Let X be a Gorenstein minimal projective 3-fold of general type with at worst locally factorial terminal singularities. I will talk about the canonial map of X and some examples of canonical degrees by using the method of abelian covers over P3. It is a joint work with Yun Gao.

5. Xiaoshan Gao, Academy of Mathematics and Systems Science, Chinese Academy of Sciences
   Title: Binomial Difference Ideal and Toric Difference Variety
   Abstract: We will present our recent work on binomial difference ideals and toric difference varieties. First, we consider Laurent binomial difference ideals and their canonical representations using the reduced Groebner basis of Z[x] lattices and regular and coherent difference ascending chains, respectively. Second, we give criteria for a Laurent binomial difference ideal to be reflexive, prime, perfect, well-mixed, and toric in terms of their support lattices which are Z[x] lattices. Third, four equivalent definitions for toric difference varieties are presented. Finally, algorithms are given to check whether a given Laurent binomial difference ideal I is reflexive, prime, perfect, or toric, and in the negative case, to compute the reflexive and perfect closures of I.

6. Yasuhiro Goto, Hokkaido University of Education , Japan
Title: Formal groups of Calabi-Yau varieties in positive characteristic
Abstract: Calabi-Yau varieties in positive characteristic are associated with one-dimensional formal groups via deformation theory. Such formal groups are determined by the height. For $K3$ surfaces, the height is known to be bounded, but for higher dimensional Calabi-Yau varieties, no such bound has been known yet. In this talk, we consider various Calabi-Yau varieties and try to evaluate the height of their formal groups.

7. Jerome William Hoffman, Louisiana State University, USA
Title: Genus 3 Curves with Nontrivial Multiplications: Questions
Abstract: Let X be a projective smooth algebraic curve of genus g defined over a field k. The Jacobian variety Jac(X) is a principally polarized abelian variety of dimension g. The set of endomorphisms End(Jac(X)) is an order in a finite-dimensional semisimple algebra over Q. In this talk, we will be mainly concerned with the case char(k) = 0, in which case, the general curve X has End(Jac(X)) = Z. We say that a curve X has nontrivial multiplications if End(Jac(X) ⊗Q is larger than Q. We are interested in constructing families of curves with nontrivial multiplications.
After describing the known results in case g = 2, we will focus on the much less understood case g = 3. Some recent work with collaborators Dun Liang, Zhibin Liang, Ryotaro Okazaki, Yukiko Sakai, and Haohao Wang will be described.

8. Dun Liang, Louisiana State University, USA
Title: Explicit Equations of Genus 3 Curves with Real Multiplication by $\mathbb{Q}(\zeta_7 + \zeta_7^{-1})$
Abstract: Fix the cubic totally real field $F = \mathbb{Q}(\zeta_7 + \zeta_7^{-1})$. The genus 3 curves with real multiplication by F are parametrized by a Hilbert modular threefold. In this talk, I will discuss methods of constructing explicit equations of genus 3 curves with real multiplication by F both for hyperelliptic curves as in [1] and for non-hyperelliptic curves as in [2], [3]. For hyperelliptic genus 3 curves, [1] uses a Poncelet 7-gon to construct the curves; this is based on the ideas in [4]. For non-hyperelliptic curves, we extend the methods of [5]. We are able to construct families of curves of maximal modular dimension, namely 3.

9. Benjamin Linowitz, Yau Mathematical Science Center, Tsinghua University, China
Title: The Classification of Fake Quadrics
Abstract: A fake quadric is a smooth projective surface that has the same rational cohomology as a smooth quadric surface but is not biholomorphic to one. In this talk I will describe the classiffication of all irreducible fake quadrics according to the commensurability class of their fundamental group. This is joint work with Matthew Stover and John Voight.

10. Atsuhira Nagano, Waseda University, Japan
    Title: Hilbert modular functions via K3 surfaces and applications in number theory
    Abstract: K3 surfaces are compact complex surfaces whose canonical bundles are trivial. We can regard K3 surfaces as 2-dimensional analogy of elliptic curves. In this talk, the speaker will present a result of Hilbert modular functions coming from the moduli of lattice polarized K3 surfaces. This result has applications in number theory. The period mappings for K3 surfaces allow us to obtain new explicit models of Shimura curves and a simple construction of class fields over quartic CM fields.

11. Ryotaro Okazaki, Chuo University, Japan
    Title: Constructing Algebraic Curves by Hermite Interpolation
    Abstract: In this talk, we discuss a project of a group lead by Professor Hoffman. The project aims to construct certain moduli spaces concretely.
    We use Ellenberg's method for constructing a family of curves with some endomorphism ring larger than the ring of rational integers. Let Y be a Galois covering of the rational curve. By dividing Y with a subgroup H of the Galois group G of Y, Ellenberg obtains a curve X, which admits an action by "Hecke" ring generated by double cosets of G by H. The genus of X is controlled by the genus and ramification of Y, in addition to the structure of G and H.
    Our project is to write out a parametric equation for X. If we know the function field of Y concretely, we can find an equation for X by a technique in Galois theory. Thus, our task is to find the function field of Y, or equivalently, to write a parametric equation for Y.
    We will discuss cases in which our Galois groups is non-abelian group of order 6 or 21, where endomorphism ring of X contains some order of the imaginary quadratic field of discriminant -3 or -7.
    We find Hermite Interpolation from Numeric Analysis is useful for achieving this task.

12. Shengli Tan, East China Normal University, Shanghai, China
    Title: Foliated algebraic surfaces and Diophantine geometry
    Abstract: Arakelov geometry is the geometric approach to Diophantine equations by generalizing the methods and results in the theory of fibred algebraic surfaces. The main unsolved problem is that we can not define horizontal differentials in the arithmetic case. In order to overcome this difficulty, one may replace the fibred surfaces by foliated surfaces which involve no horizontal differentials.
    A holomorphic foliation F on a compact complex surface X can be viewed as a global differential equation of the first order. A family of algebraic curves on X is the solution of some differential equation. Poincaré proposed a problem to bound the height of a family of curves by using the information of the corresponding differential equation. Poincaré suggested also to generalize some topological properties of families of algebraic curves to arbitrary differential equations. For example, the genus g of the generic curves in the family is a topological invariants, Painlevé proposed the following problem: can we recognize the genus g from the

differential equation? Unfortunately, Lins Neto constructed some counterexamples to Painlev´e's Problem. So the genus is not an invariant of the differential equations. Namely, we can not define the genus for an arbitrary differential equation.

Our purpose of this talk is to prove that the modular Chern numbers of a family of algebraic curves are invariants of the corresponding differential equation. Therefore, we can define the Chern numbers for any differential equations. More precisely, for any holomorphic foliation F on *X*, we introduce the Chern numbers $c_1^2(\mathcal{F})$, $c_2(\mathcal{F})$ and χ(F), which are nonnegative rational numbers satisfying Noether's equality $c_1^2(\mathcal{F}) + c_2(\mathcal{F}) = 12\chi(\mathcal{F})$. These Chern numbers are birational invariants, and $c_1^2(\mathcal{F}) = 0$ iff $\mathcal{F}$ is not of general type. If the foliation F is algebraically integrable, then these invariants are exactly the modular Chern numbers of the family of curves defined by the rational first integral.

The birational classification of holomorphic foliations is almost completed by using the Kodaira dimensions. The Chern numbers can be used to get the biregular classification. As an application, we will give positive answers to the problems of Poincar´e and Painlev´e on the algebraic integrability of foliations with $c_1^2(\mathcal{F}) < 4\chi(\mathcal{F})$. We will also discuss the effective behavior of the pluricanonical systems of foliations of general type.

13. Peng Tian, East China University of Science and Technology
    Title: Non-vanishing Fourier coefficients of level one modular forms
    Abstract: In this talk, we describe a method to compute a bound B of n such that $a_n(f)$ 6= 0 for all $n < B$. In fact, this is a generalization of Lehmer's conjecture for Ramanujan's tau function. As examples, we achieve the explicit bounds B_k for the unique cusp form Δ_k of level one and weight k with k = 16,18,20,22,26 such that $a_n(\Delta_k)$ 6= 0 for all $n < B_k$.

14. Yifan Yang, National Chiao Tung University and National Center for Theoretical Sciences, Taiwan
    Title: Quaternionic Loci in Siegel's Modular Threefold
    Abstract: Let Q_D denote the set of moduli points in Siegel's modular threefold that have quaternionic multiplication by a maximal order in an indefinite quaternion algebra of discriminent D over Q. In this talk, we first determine the number of irreducible component in Q_D. Then for each component of Q_D, we describe a method to determine the parameterization of the component in terms of modular functions on Shimura curves.

15. Pingzhi Yuan, East China University of Science and Technology

    Title: The Global ß-Forms

    Abstract: Global ß−forms were first introduced by H. Dobbertin in 2001 with q = 2 to study for certain type of permutation polynomials of F_{2^m}; global ß−forms with q = p for an arbitrary prime p were considered by W. More in 2005. In this talk, we talk about some recent results on global ß−forms obtained by Xiang-dong Hou. We

discuss some fundamental questions about global ß −forms, some of which are answered and some others remain open.

16. Zhongfeng Zhang, Zhaoqing University, China
Title: The solutions of some Diophantine equations
Abstract: In this talk, we introduce the modular method and its application in the higher degree Diophantine equations.

17. Lihong Zhi, Chinese Academy of Sciences, Beijing
Title: A certificate for semidefinite relaxations in computing positive-dimensional real radical ideals
Abstract: For an ideal $ I$ with a positive-dimensional real variety $V_R(I)$, based on moment relaxations, we study how to compute a Pommaret basis which is simultaneously a Gr\"{o}bner basis of an ideal J generated by the kernel of a truncated moment matrix and satisfying $I \subseteq J \subseteq I(V_{R}(I)), V_R(I)=V_C(J) \cap R^n$. We provide a certificate consisting of a condition on coranks of moment matrices for terminating the algorithm. For a generic δ-regular coordinate system, we prove that the condition is satisfiable in a large enough order of moment relaxations.