Talks:

Paolo Cascini
Title: Minimal model program for foliations.

Abstract: Building on the work of Brunella, McQuillan has recently obtained some strong results on the Minimal Model Program for algebraic foliations on algebraic surfaces, generalising most of the important results of the Castelnuovo-Enrique-Severi school to the study of foliations. In the case of foliations, the Abundance Conjecture fails already in dimension two because of the existence of a foliation with negative Kodaira dimension but positive numerical dimension.On the other hand, it is possible to characterise those foliations for which Abundance fails.

I will survey some recent results on the Minimal Model Program for foliations on algebraic surfaces and in higher dimension.

Zhi Jiang
Title: Multiplier ideals and applications

Abstract: The multiplier ideal of an effective Q-divisor D relects the singularities of D and it has many interesting properties.

We will talk about the definition and some geometric properties of multiplier ideal sheaves and focus on

the log-canonical thresholds, the subadditivity theorem and the Nadel vanishing theorem.

We will also see some examples and basic applications of the multiplier ideal sheaves.

Chi Li
Title: K-stability, Ding-stability and normalized volume

Abstract: Topics in each talk:

Talk 1: We will discuss the notion of Ding-stability of Q-Fano varieties and show the equivalence between K-stability and Ding-stability, based on the work of Berman-Boucksom-Jonsson and Fujita.

Talk 2: We will introduce the normalized volume functional on the space of real valuations at Klt singularities. We will then discuss its minimization problem by illustrative examples including the case of T-varieties originally studied in Sasaki geometry. Basic estimates including Izumi-type estimate will be proved and the existence of minimizers will be discussed.

Talk 3: We will prove the equivalence of K-semistability/Ding-semistability of any Q-Fano variety and the condition that the canonical divisorial valuation on the affine cone being the minimizer. Finally we will discuss the model approach and apply MMP to study minimizers of normalized volume functional. As an application the uniqueness of minimizers among Kollar components can be proved.

Mircea Mustata
Title: Some invariants of singularities in birational geometry

Abstract: In birational geometry, a typical way to measure singularities is via divisorial valuations, by comparing the order of vanishing to an invariant of the corresponding valuation, its log discrepancy. Invariants obtained in this way are, for example, the log canonical threshold and the multiplier ideals.

In the first two lectures I will discuss an asymptotic version of such invariants, that plays an important role when dealing with situations that are typically non-finitely generated (for example, the ideals attached to an arbitrary valuation, or the ideals defining the base loci of the multiplies of a given line bundle). I will give an introduction to the study of such invariants, and explain some basic results and some intriguing open problems. One of the main tools in this study will be provided by the asymptotic multiplier ideals.

In the third lecture I will discuss a somewhat different circle of ideas, involving invariants of singularities that come out of Saito's theory of Mixed Hodge Modules. More precisely, to any reduced divisor one can associate a sequence of ideals, the first ideal in this sequence being the multiplier ideal of (a small perturbation) of the divisor. I will discuss the main properties of these ideals and some applications.

Xiaowei Wang

Title: Introduction to K-stability and Fano manifolds.

Abstract: In this preliminary lecture series, we will give an introduction to the theory of GIT-, K-, and KSBA stability of polarized varieties. It serves as a preparation to other more advanced topic. In particular, we will focus more the application of K-stability for the study of Fano vareities.

Chenyang Xu

Title: Minimal model program and its applications in higher dimensional geometry

Abstract:

In Lecture 1, I plan to survey the basic notion about minimal model programs, and one of its most important application: constructing KSBA compactifaction of the moduli space of polarized varieties.

In Lecture 2, I plan to discuss the technique of cutting log canonical centers, especially the application to obtain results on Fujita's conjecture by Angehrn and Siu.

In Lecture 3, I will talk about the boundedness results on general type varieties and the pair version.