Mathematics, Statistics, and Computer Science **@ UIC**

Departmental Colloquium

Vanishing theorems and rational singularities

Sándor Kovács (University of Washington)

Abstract: Rational singularities play an important role in many parts of algebraic geometry. Their most significant property is that their cohomology theory works very much as if they were regular, but the class of rational singularities is much more robust than that of regular points. Traditionally, the two fundamental pillars of studying rational singularities over the complex numbers have been: (i) resolutions of singularities, and (ii) Kodaira-type vanishing theorems. In positive characteristic, however, resolutions of singularities may not exist and Kodaira-type vanishing theorems generally fail to hold. In this talk, I will describe a new approach to rational singularities which do not rely on resolutions as well as a vanishing theorem that is general enough to prove a characteristic independent version of Kempf's criterion for rational singularities. In turn, this result may be used to prove a characteristic independent version of Elkik's theorem which states that most of the singularities of the minimal model program are rational. Another application is to counting rational points on varieties defined over a finite field. In particular, I will discuss a generalization of Esnault's theorem on rational points of smooth Fano varieties to mildly singular log Fano varieties which also gives a new proof of Esnault's theorem.

Friday, April 21 at 3:00 PM in Douglas Hall 210