1117-14-270 **Jesus A. De Loera**, **Sonja Petrović*** (sonja.petrovic@iit.edu) and **Despina Stasi**.

Random Sampling in Computational Algebra: Helly Numbers and Violator Spaces.

Solving systems of polynomial equations is a cornerstone of computational algebra today, but it is well-known that many algorithms have high worst-case complexity. In this talk, I will describe a new randomized algorithm for computing solutions of (large) systems of polynomial equations that has expected runtime linear in the number of input polynomials.

In particular, our work transfers a randomized algorithm, originally used in geometric optimization, to computational problems in commutative algebra. We show that Clarkson's sampling algorithm can be applied to two problems in computational algebra: solving large-scale polynomial systems and finding small generating sets of graded ideals. The cornerstone of our work is showing that the theory of violator spaces of Gärtner et al. applies to polynomial ideal problems. To show this, one utilizes a Helly-type result for algebraic varieties. The resulting algorithms have expected runtime linear in the number of input polynomials, making the ideas interesting for handling systems with very large numbers of polynomials, but whose rank in the vector space of polynomials is small (e.g., when the number of variables and degree is constant). (Received January 15, 2016)