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**Mauricio Velasco\***, Universidad de los Andes, Departamento de Matemáticas, Bogotá, Colombia. *Algebraic geometry through the lens of sums of squares.*

SOS optimization has a wealth of connections to pure mathematics allowing us to define new invariants of real projective varieties and to connect algebraic geometry, convexity and optimization. This lecture will illustrate these connections by focusing on a basic example: (\*) the classification of those (real, projective) varieties on which nonnegative quadratic forms and sums-of-squares of linear forms coincide.

In the first part of the lecture, we will give a self-contained introduction to projective algebraic geometry and describe the classification of "varieties of minimal degree", one of the great achievements of the Italian school of algebraic geometry in the XIX century. In the second part of the lecture we will explain why varieties of minimal degree play a central "extremal" role in the theory of SOS on varieties and are the building blocks for solving problem (\*) above. The solution of (\*) allows us to generalize and synthesize all known results of equality between nonnegative polynomials and sums of squares (by Choi-Lam-Reznick, Grone, Hilbert, Yakubovich, among others). (Received September 25, 2018)