On the solutions of systems of polynomial equations

(a tale of polytopes, heights and Sherlock Holmes)

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A beautiful result by Bernstein and Kouchnirenko allows to predict the number of solutions of a system of Laurent polynomials in terms of its combinatorial properties.
When the coefficients of the system are algebraic numbers, one can also wonder about the “expected arithmetical complexity” of its solution set. In an ongoing work with Martín Sombra, we give some insights into such a question by bringing into play the Arakelov geometry of toric varieties and, unexpectedly, the most famous detective of all time.

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