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The Elekes-Szabó Problem and the Uniformity Conjecture

The Elekes-Szabó problem is to find an upper bound for $|Z(F) \cap (A \times B \times C)|$ for a 'non-degenerate' trivariate polynomial $F \in \mathbb{R}[x, y, z]$. Here, $Z(F)$ is the zero set of F. If we assume the Uniformity Conjecture, then we show how to obtain stronger bounds for a special family of polynomials in $\mathbb{Q}[x, y, z]$. Our conditional results are quantitatively stronger than the unconditional results of Raz, Sharir and de Zeeuw. In this talk, I will give several applications to additive combinatorics and discrete geometry. For example, to expanders, additive energy bounds, and pinned distances. This is joint work with M. Makhul, O. Roche-Newton and A. Warren.