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Diophantine tuples over integers and finite fields

A set $\{a_1, a_2, \ldots, a_m\}$ of distinct positive integers is a Diophantine m-tuple if the product of any two distinct elements in the set is one less than a square. There is a long history and extensive literature on the study of Diophantine tuples and their generalizations in various settings. In this talk, we focus on the following generalization: for each $n \geq 1$ and $k \geq 2$, we call a set of positive integers a Diophantine tuple with property $D_k(n)$ if the product of any two distinct elements is n less than a k-th power, and we denote $M_k(n)$ be the largest size of a Diophantine tuple with property $D_k(n)$. Using various tools from number theory, we show that there is $k = k(n)$ such that $k, n \to \infty$ and $M_k(n) = o(\log n)$, breaking the $\log n$ barrier. A key ingredient is to study the finite field model of the same problem. Joint work with Seoyoung Kim and Semin Yoo.