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A Ramsey Theory Problem in Finite Fields

An open problem in arithmetic Ramsey theory asks if given a finite colouring $c : \mathbb{N} \to \{1, \ldots, r\}$ of the naturals, there exist $x, y \in \mathbb{N}$ such that $c(xy) = c(x + y)$. More generally, one could replace $x + y$ with a binary linear form and xy with a binary quadratic form. In this talk we discuss the analogous problem in a finite field $\mathbb{F}_q$. Specifically, given a linear form L and a quadratic from Q in two variables, we provide estimates on the necessary size of $A \subset \mathbb{F}_q$ to guarantee that $L(x, y)$ and $Q(x, y)$ are elements of A for some $x, y \in \mathbb{F}_q$.