Title

*Generalized arithmetic progressions and diophantine approximation by polynomials*

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**Abstract:** We discuss two related notions of “approximate subgroups” inside finite sets of integers: Bohr sets, which capture simultaneous Diophantine approximation, and symmetric generalized arithmetic progressions (GAPs). For example, fix natural numbers $N$ and $d$ and consider the following pair of questions:

(1) For fixed $\alpha_1, \ldots, \alpha_d \in \mathbb{R}$, how close to an integer can we simultaneously make $n^2\alpha_1, \ldots, n^2\alpha_d$ for some $1 \leq n \leq N$?

(2) How large can a set of the form $\{x_1\ell_1 + \cdots + x_d\ell_d : |\ell_i| \leq L_i \} \subseteq [-N, N]$ be before it is guaranteed to contain a perfect square?

Our discussions range from classical facts like the Kronecker approximation theorem and Linnik’s theorem, to a recent breakthrough result of Maynard and its potential future applications. In between we survey results including previous joint work with Neil Lyall and Ernie Croot.