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Arithmetic progressions in sumsets

We are concerned with quantitative statements about the additive structure of the set kA of sums of k elements of a subset A of $\{1, \ldots, N\}$. For $k = 2$, a result of Bourgain (1999) in this direction states that, provided A has density α at least $(\log N)^{-1/3+\varepsilon}$, the sumset $2A$ always contains a long arithmetic progression, of length $e^{c(\log N)^c}$. A recent result of Croot, Laba and Sisask (2011) shows that this result holds in the longer range $\alpha \geq (\log N)^{-1+\varepsilon}$. In this talk we discuss the analogue problem for $k = 3$, in which case we expect the sumset $3A$ to possess more structure. Specifically, we show how methods developed by Sanders (2011) in the context of Roth's theorem may be applied to obtain an arithmetic progression of similar length in $3A$, in the longer range $\alpha \geq (\log N)^{-2+\varepsilon}$.