ATELIER « LES GRAPHES ET L'ARITHMÉTIQUE »
8–12 MARS 2010

WORKSHOP ON GRAPHS AND ARITHMETIC
MARCH 8–12, 2010

Improving Roth's theorem in the primes

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Given a subset A of the primes and a positive integer N, we define the relative density $\delta_P(N)$ of the set of elements of A less than N as $\delta_P(N) = \|\{p \in A, p \leq N\}\|/\|\{p \text{ prime }, p \leq N\}\|$.

Ben Green proved that if N is large enough and if $\delta_P(N) \geq C\sqrt{\log\log\log\log\log N/\log\log\log\log N}$ where C is some absolute constant, then $A \cap [1, N]$ contains a non-trivial three-term arithmetic progression.

We improve his result by showing that assuming $\delta_P(N) \geq C'\log\log\log N/(\log\log N)^{1/3}$ is enough.

This work is a joint work with Harald Helfgott.