

DEPARTMENT  
COLLOQUIUM

*A relative Szemerédi theorem*

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**Abstract:** The celebrated Green-Tao theorem states that there are arbitrarily long arithmetic progressions in the primes. The proof has two parts. The first part is a relative Szemerédi theorem which says that any subset of a pseudorandom set of integers of positive relative density contains long arithmetic progressions, where a set is pseudorandom if it satisfies two conditions, the linear forms condition and the correlation condition. The second part is in finding a pseudorandom set in which the primes have positive relative density.

In this talk, we will discuss a simple proof for a strengthening of the relative Szemerédi theorem, showing that a weak linear forms condition is sufficient for the theorem to hold. By removing the correlation condition, our strengthened version can be applied to give a relative Szemerédi theorem for  $k$ -term arithmetic progressions in pseudorandom subsets of  $\mathbb{Z}_N$  of density  $N^{-c_k}$ . It also simplifies the deduction of the Green-Tao theorem by removing the need for certain number theoretic estimates in the second part of their proof.

Joint work with Jacob Fox and Yufei Zhao.

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