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Uniform sets with few 4APs via colorings

A well-known question of Ruzsa asks if there exist Fourier-uniform sets with very few 4-term arithmetic progressions: do there exist Fourier-uniform subsets of $\mathbb{Z}/N\mathbb{Z}$ with density α and 4AP-density $\alpha^{\omega(1)}$? I will discuss a surprising connection between this problem and one in arithmetic Ramsey theory. We show that one could construct such sets given a coloring of $\{1, 2, \ldots, N\}$ with $N^{o(1)}$ colors that avoids symmetrically colored 4APs. We say that a 4AP is symmetrically colored if its first and last term receive the same color and its middle two terms receive the same color.

Based on joint work with Mingyang Deng and Yufei Zhao.