Configurations of points with many collinear triples: going beyond Sylvester-Gallai

Date Tuesday, January 29

Time 3 pm

Location 303 Mudd

Abstract: The Sylvester-Gallai theorem states that a configuration of points in R^n in which every pair is in some collinear triple, has to lie on a single line. I will discuss some recent results that go beyond this theorem, dealing with more robust scenarios. The first type of results deal with configurations in which *many* pairs are in collinear triples. For example: If a constant fraction of the pairs are in a collinear triple then there is a constant fraction of the points that lie in a subspace of constant dimension. Another type of results deal with configurations in which there are many *almost*, or epsilon-collinear triples (that is, points that are epsilon-close to being on a line). We will see that, under some uniformity conditions on the distances between points, one can find a subspace of low dimension that approximates all (or most) of the points. All of these results, which deal with points in complex space, are obtained by understanding the rank (or, more generally, the number of small singular values) of sparse complex matrices with specific patterns of zeros/non-zeros.

Based on joint works with Albert Ai, Boaz Barak, Subhangi Saraf, Avi Wigderson and Amir Yehudayoff.