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Title: Improved bounds for the Kakeya conjecture using semialgebraic geometry

ABSTRACT. The Kakeya problem considers thin tubes which point in different directions and how much they can be made to overlap by positioning them strategically. On the one hand, we will see that the tubes cannot be compressed too much if they are positioned in an algebraic way. The proof employs the Tarski-Seidenberg projection theorem and the Gromov-Yomdin algebraic lemma. On the other hand, polynomial partitioning can be used to show that the expected bound holds in the absence of any algebraic structure. Balancing between the two extremes yields improved bounds for the Kakeya maximal operator in higher dimensions. This is joint work with J. Hickman, N.H. Katz and R. Zhang.