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Circle squaring with algebraic irrationals and few pieces

We show that a closed disk and square with the same area in the plane are equidecomposible using translations whose coordinates are linear combinations of algebraic irrationals. This solves a question of Laczkovich from 1990. Our proof uses a new method for bounding the discrepancy of product sets in the k-torus using the Erdos-Turan inequality. As an application of our work, we obtain an improved upper bound on the number of pieces required to square the circle. For this we fix certain algebraic irrationals and make use of: (1) effective constants in Roth's theorem on diophantine approximation, (2) an idea of Frank Calegari for bounding sums of products of fractional parts of those numbers and (3) computer assistance. This is joint work with Andrew Marks.