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Summary: In the finite field setting, we show that the restriction conjecture associated to any one of a large family of $d = 2n + 1$ dimensional quadratic surfaces implies the $n + 1$-dimensional Kakeya conjecture (Dvir’s theorem). This includes the case of the paraboloid over finite fields in which $-1$ is a square. We are able to partially reverse this implication using the sharp Kakeya maximal operator estimates of J. S. Ellenberg et al. [Mathematika 56, No. 1, 1–25 (2010; Zbl 1189.42010)] to establish the first finite field restriction estimates beyond the Stein-Tomas exponent in this setting.

MSC:
42B10 Fourier and Fourier-Stieltjes transforms and other transforms of Fourier type
42B25 Maximal functions, Littlewood-Paley theory
14G15 Finite ground fields in algebraic geometry
52C17 Packing and covering in $n$ dimensions (aspects of discrete geometry)
11T24 Other character sums and Gauss sums

Keywords:
Fourier transform; restriction conjecture; Kakeya conjecture; finite fields

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References:
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