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Bounding 2-torsion in Class group

(joint with Bhargava, Shankar, Taniguchi, Thorne, and Zhao) Zhang's conjecture asserts that for fixed positive integers m, n , the size of the m -torsion in the class group of a degree n number field is smaller than any power of the discriminant. In all but a handful of cases, the best known result towards this conjecture is the "convex" bound given by the Brauer-Siegel Theorem.

We make progress on this conjecture by giving a "subconvex" bound on the size of the 2-torsion of the class group of a number field in terms of its discriminant, for any value of n . The proof is surprisingly elementary, and we give several applications of this result stemming from the case of cubic fields, including improved bounds on the number of A4 fields, and on the number of integer points an elliptic curve can have.

Along the way, we prove a surprising result on the shape of the lattice of the ring of integers of a number field. Namely, we show that such a lattice is very limited in how 'skew' it can be.