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Secondary terms in counting functions for cubic fields

We will discuss our proof of secondary terms of order $X^{5/6}$ in the Davenport-Heilbronn theorems on cubic fields and 3-torsion in class groups of quadratic fields. For cubic fields this confirms a conjecture of Datskovsky-Wright and Roberts. We also will describe some generalizations, in particular to arithmetic progressions, where we discover a curious bias in the secondary term.

Roberts' conjecture has also been proved independently by Bhargava, Shankar, and Tsimerman. Their proof uses the geometry of numbers, while our proof uses the analytic theory of Shintani zeta functions. We will also discuss a combined approach which yields further improved error terms.

This is joint work with Takashi Taniguchi.