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One-Level density for cubic characters over the Eisenstein field

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Katz and Sarnak conjectured that statistics on zeroes of a family of L-functions on the critical line should match statistics on eigenvalues of characteristic polynomials of a group of random matrices, where the group is chosen according to the properties of the family. For example, the family of L-functions attached to quadratic Dirichlet characters corresponds to symplectic matrices, and evidence for the conjecture of Katz and Sarnak was obtained by proving that the one-level density of zeroes of quadratic Dirichlet L-functions matches the one-level density for eigenvalues of characteristic polynomials of symplectic matrices,
for special test functions (with limited support of the Fourier transform) by Ozluk and Snyder in 1999. Since the support of the Fourier transform of the test function is large enough, they can deduce that more than 93.75% of the L-functions attached to quadratic Dirichlet characters are such that $L(1/2, \chi) \neq 0$, giving evidence for a well-known conjecture of Chowla. The full conjecture of Katz-Sarnak
(without any restrictions on the support of the Fourier transform) implies that 100% of the L-functions attached to quadratic Dirichlet characters are such that $L(1/2, \chi) \neq 0$.

We will review those results and consider the case of L-functions attached to cubic Dirichlet characters. We prove the first result towards the Katz and Sarnak conjecture for test functions with support of the Fourier transform large enough to obtain a positive proportion of L-functions attached to cubic Dirichlet characters such that $L(1/2, \chi) \neq 0$.

Joint work with Ahmet M. Guloglu.

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