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On the vanishing of twisted L-functions of elliptic curves

(joint work with J. Fearnley and H. Kisilevsky)

Let E be an elliptic curve over the rationals with L-function $L_E(s)$. Let χ be a Dirichlet character, and let $L_E(s, \chi)$ be the L-function of E twisted by the character χ. For quadratic characters χ, $L_E(1, \chi)$ vanishes for at least half of the characters (where the sign of the functional equation is -1), and Goldfeld conjectured that the density of vanishing is exactly $1/2$ in this case. For higher order characters, the functional equation now relates $L_E(1, \chi)$ and $L_E(1, \bar{\chi})$, and there is no reason to predict a positive density of vanishing. We present in this talk some evidence for the case of twists by cubic character χ, based on empirical computations and random matric theory.