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Non-vanishing of cubic twists of elliptic curves

We will present a proof of a quantitative non-vanishing result for cubic twists of an elliptic curve E over the field $K = Q(\sqrt{-3})$. Our proof is based on the classical approach of Iwaniec (for the case of quadratic twists of L -functions). A similar result was also obtained by Brubaker, Friedberg and Hoffstein by studying some multiple Dirichlet series. We obtain that at least $X^{2/3-\varepsilon}$ twisted L -functions do not vanish at the critical point. If one could improve the large sieve inequality of Heath-Brown for cubic characters by removing a residual term, the proportion of non-vanishing would be at least $X^{1-\varepsilon}$, which is the optimal result that can be obtained without mollifying.

Joint work with D. Milicevic and G. Ricotta.