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One-level density in one-parameter families of elliptic curves with non-zero average root number

(joint work with Sandro Bettin and Christophe Delaunay)

We present in this talk a (conjectural) formula for the one-level density of general one-parameter families of elliptic curves, in term of \( n \), the rank of \( E \) over \( Q(t) \) and the average root number \( W_E \) over the family. In the general case, \( W_E \) is zero, and the one-level density is given by orthogonal symmetries as predicted by the conjectures of Katz and Sarnak. In the exceptional cases where \( W_E \neq 0 \), we find that the statistics are given by a weighted sum of even orthogonal and odd orthogonal symmetries. The most dramatic and counter-intuitive cases occur when \( W_E = \pm 1 \). In that case, the one-level density exhibits even orthogonal symmetries when \( (-1)^n W_E = 1 \) and odd orthogonal symmetries when \( (-1)^n W_E = -1 \), and there is a shift of the symmetries (between orthogonal odd and orthogonal even) when \( n \) is odd.