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A joint distribution theorem with applications to extremal primes for elliptic curves

An extremal prime p for an elliptic curve E is one for which $|a_p(E)| = [2\sqrt{p}]$ i.e., $a_p(E)$ is maximal or minimal in view of the Hasse bound. Although an asymptotic for the number of extremal primes up to x for a fixed non-CM elliptic curve seems out of reach, upper bounds have been proved recently. In this talk, assuming GRH, we present a joint distribution result involving the Chebotarev density theorem. As a consequence, we obtain an upper bound for the number of primes satisfying $a_p(E) = [2\sqrt{p}]$ $\mathrm{mod}\ \ell$ for a sufficiently large prime ℓ. This is joint work with Amita Malik.