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Section:

3. Number Theory and Arithmetic Algebraic Geometry

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On the density of elliptic curves

We show that 17.9% of all elliptic curves over $\mathbb{Q}$, ordered by their exponential height, are semistable, and that there is a positive density subset of elliptic curves for which the root numbers are uniformly distributed. Moreover, for any $\alpha > 1/6$ (resp. $\alpha > 1/12$) the set of Frey curves (resp. semistable curves) for which the generalized Szpiro conjecture $|\Delta(E)| \ll_\alpha N_E^{12\alpha}$ is false has density zero. These results remain true if we use the logarithmic or the Faltings height. The proofs make use of the fibering argument in the square-free sieve of Gouvêa-Mazur. We also obtain conditional as well as unconditional lower bounds for the number of curves with Mordell-Weil rank 0 and ≥ 2, respectively.