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Statistics for traces of cyclic trigonal curves over finite fields

We study the variation of the trace of the Frobenius endomorphism associated to a cyclic trigonal curve of genus g over \mathbb{F}_q as the curve varies in an irreducible component of the moduli space. We show that for q fixed and g increasing, the limiting distribution of the trace of Frobenius equals the sum of $q+1$ independent random variables taking the value 0 with probability $2/(q+2)$ and $1, e^{2\pi i/3}, e^{4\pi i/3}$ each with probability $q/(3(q+2))$. This extends the work of Kurlberg and Rudnick who considered the same limit for hyperelliptic curves. We also show that when both g and q go to infinity, the normalized trace has a standard complex Gaussian distribution and how to generalize these results to p -fold covers of the projective line.

This is joint work with A. Bucur, C. David, and B. Feigon.