Frobenius distributions on K3 surfaces

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Let S be a K3 surface over $\mathbb{Q}$. The zeta function of the reduction of S over $\mathbb{F}_p$ takes the form

$$\frac{1}{(1-T)(1-pT)(1-p^2T)p^{-1}L(pT)}$$

where $L(T) \in \mathbb{Z}[T]$ is of degree 21, with $L(0) = p$ and all roots on the unit circle. The polynomial $L(T)$ factors as

$$L(T) = L_{\mathrm{alg}}(T)L_{\mathrm{trc}}(T)$$

into the algebraic and transcendental parts, where the roots of former are roots of unity. The polynomial $L(T)$ carries the information of the image of Frobenius in the Sato-Tate group associated to S. We describe the characterization of this Galois representation associated to S, in terms of character theory of orthogonal groups.

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