Experimental Indications of Three-dimensional Galois Representations from the Cohomology of $\mathrm{SL}(3, \mathrm{Z})$

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Abstract

Conjecturally, any "algebraic" automorphic representation on $mathrmGL(n)$ should have an n-dimensional Galois representation attached. Many examples of algebraic automorphic representations come from the cohomology over $\mathbf{C}$ of congruence subgroups of $mathrmGL(n, \mathbf{Z})$. On the other hand, the first author has conjectured that for any Hecke eigenclass in the mod p cohomology of a congruence subgroup of $mathrmGL(n, \mathbb{Z})$ there should be an attached n-dimensional Galois representation.

By computer, we found Hecke eigenclasses in the mod p cohomology of certain congruence subgroups of $mathrmSL(3, \mathbf{Z})$. In a range of examples, we then found a Galois representation (uniquely determined up to isomorphism by our data) that seemed to be attached to the Hecke eigenclass.