Irrational periods of Hilbert Eisenstein series via toroidal compactification

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Abstract

We show that the periods of the holomorphic Eisenstein series of level 1, parallel weight 2, on a Hilbert modular surface are not rational, even up to scaling. This is deduced from a study of the mixed Hodge structure on the cohomology of the Hilbert modular surface, where we find extension classes related to the units of the real quadratic field. We prove similar results for Hilbert modular varieties of all dimensions, and produce extensions of Galois representations in étale cohomology. The key point is to study the restriction of the canonical extension of the Hodge bundle to the boundary of a smooth toroidal compactification.