Title: Automorphy of Calabi-Yau varieties over $\mathbf{Q}$ of dimension ≤ 3

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Abstract: Let X be a Calabi-Yau variety of dimension d. We will focus on the cases where $d \leq 3$. Calabi–Yau varieties of dimension $1, 2$ are elliptic curves and K3 surfaces, respectively. The dimension 3 Calabi–Yau varieties are Calabi–Yau threefolds where one can observe, among other things, mirror symmetry in full force. I will consider Calabi–Yau varieties defined over $\mathbf{Q}$ of dimension $d \leq 3$. Our goal is to discuss the modularity/automorphy of the (ℓ-adic) Galois representations associated to the d-th étale cohomology groups of these Calabi–Yau varieties. At my last visit to LSU in 2011, I presented the modularity results for elliptic curves, (the transcendental part of) singular (extremal) K3 surfaces, and rigid Calabi–Yau threefolds, all defined over $\mathbf{Q}$, and whose Galois representations are two-dimensional.

In this talk, I will discuss the modularity/automorphy of higher dimensional Galois representations (e.g., of dimension > 2). I will present some examples in support of the modularity/automorphy focusing on the two (or three) situations:

(1) when X is equipped with a large automorphism group, and the Galois representation of X splits into smaller dimensional pieces,

(2) when X is of CM type,

and

(3) the intersection of (1) and (2).