Quasi-Modularity of Hodge Cycles

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Given an integral lattice L of signature (2p,n), one can build a non-compact locally symmetric space M as a double quotient of the orthogonal group O(2p,n). This space is closely related to the periods of smooth projective varieties. The lattice L provides a collection of totally geodesic submanifolds Cn inside M, Hodge cycles, whose dual classes in the cohomology of M are the coefficients of modular form. Since most complete families of projective varieties contain singular members, there has been much work recently on compactifying period maps. I will present a web of conjectures and results around the philosophy that the closures of the Cn are quasi-modular or mock modular, and then give some applications to classical algebraic geometry.