Cohomology of uniform lattices in real semi simple Lie groups

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Abstract: Let G be a real semi simple linear Lie group with finitely many components and let K be a maximal compact subgroup. Let L be a torsion-free lattice in G. The cohomology of the the double coset space $X_L = L\backslash G/K$, which is an Eilenberg-MacLane space $K(L,1)$, is an important object of investigation. We shall outline a construction of Millson and Raghunathan (around 1987) which leads to submanifolds of complementary dimensions, called, geometric cycles. Under certain additional hypotheses, the geometric cycle represent non-zero real cohomology classes which cannot be represented by G-invariant forms. We shall highlight some recent developments in the study of geometric cycles in X_L.