Abstract

Let G be a locally compact group (usually a reductive algebraic group over an algebraic number field F). The main aim of the theory of Automorphic Forms is to understand the right regular representation of the group G on the space $L^2(\Gamma \backslash G)$ for certain "nice" closed subgroups Γ. Usually, Γ is taken to be a lattice or even an arithmetic subgroup.

In the case of uniform lattices, the space $L^2(\Gamma \backslash G)$ decomposes into a direct sum of irreducible unitary representations of the group G with each such representation π occurring with a *finite* multiplicity $m(\Gamma, \pi)$. It seems quite difficult to obtain an explicit formula for this multiplicity; however, the limiting behaviour of these numbers in case of certain "nice" sequences of subgroups $(\Gamma_n)_n$ seems more tractable.

We study this problem in the global set-up where G is the group of adelic points of a reductive group defined over the field of rational numbers and the relevant subgroups are the maximal compact open subgroups of G. As is natural and traditional, we use the Arthur trace formula to analyse the multiplicities. In particular, we expand the geometric side to obtain the information about the spectral side—which is made up from the multiplicities $m(\Gamma, \pi)$.

The geometric side has a contributions from various conjugacy classes, most notably from the unipotent conjugacy class. It is this *unipotent* contribution that is the subject of Part III of this thesis. We estimate the contribution in terms of level of the maximal compact open subgroup and make conclusions about the limiting behaviour.

Part IV is then concerned with the spectral side of the trace formula where we show (under certain conditions) that the trace of the discrete part of the regular representation is the only term that survives in the limit.