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Joint Equidistribution of Approximates

The distribution of integer points on varieties has occupied mathematicians for centuries. In the 1950's Linnik used an “ergodic method” to prove the equidistribution of integer points on large spheres under a congruence condition. As shown by Maaß, this problem is closely related to modular forms. Subsequently, there were spectacular developments both from the analytic as well as ergodic side. I will discuss a more refined problem, namely the joint distribution of lattice points in conjunction with other arithmetic data. An example of such data is the “shape” of an associated lattice, or in number theoretic language, a Heegner point. In a completely different direction, a “Poincaré section” is a classical and useful tool in ergodic theory and dynamical systems. Recently, Shapira and Weiss, constructed a Poincaré section for the geodesic flow on the moduli space of lattices to study joint equidistribution properties. Their work in fact is very general but crucially uses the fact that the acting group has rank one. In joint work with Anish Ghosh, we develop a new method to deal with actions of higher rank groups. I will explain this and, if time permits, some corollaries in Diophantine analysis.