

MANFRED EINSIEDLER  
HOMOGENEOUS DYNAMICS AND APPLICATIONS IN NUMBER  
THEORY

Week 2: 4 July - 8 July, 5 double lectures (each lecture is 45-50 minutes).

In this course we will discuss homogeneous dynamics and how dynamical theorems can be of use in number theoretical questions:

- 1) The geodesic and horocycle flow on finite volume quotients of  $SL(2, \mathbb{R})$ , up to a proof of the theorem of Dani and Smillie that there are only two types of horocycle orbits – periodic orbits and equidistributing orbits.
- 2) Discussion of how the above setting generalizes to other semi-simple groups. Some of the generalizations are easy, but the finer questions are only answered by Ratner's theorems which we will discuss but not prove.
- 3) The Margulis theorem on Oppenheim's conjecture is one of the earliest successes of homogeneous dynamics. The Eskin-McMullen approach to the counting theorems of Duke-Runick-Sarnak is another. We will discuss both of them.
- 4) A proof of a special case of Ratner's measure classification theorem (with semisimple acting group).