International research in smooth ergodic theory is increasingly focusing on the mixing properties of continuous time dynamical systems, that is flows $\varphi_t : M \to M$ preserving a probability measure μ. This includes traditional examples such as geodesic flows on manifolds of negative curvature, horocycle flows, singular hyperbolic (Lorenz-like) flows, billiard flows (such as Lorentz gases or other models describing the behaviour of moving and bouncing particles in some environment) and systems arising from a variety of mechanical models.

The basic question is how fast initial information, measured by observables $v, w : M \to \mathbb{R}$, disperses over time, in particular at which rate $\int_M v \circ \varphi_t \, w \, d\mu$ converges to $\int_M v \, d\mu \int_M w \, d\mu$. This rate of decay of correlations has important implications for numerous statistical properties of the flow as well as for the study of averaging and homogenization in multiscale systems. Mixing is a delicate phenomenon for flows. For example, it is still an open question whether a dense set of Anosov flows in dimension greater than three have exponential decay of correlations.

There have been a number of recent advances in this and associated areas: examples from the last year or so include (i) exponential decay of correlations for finite horizon planar periodic Lorentz gases, singular hyperbolic attractors, open and dense sets of three-dimensional volume preserving Anosov flows, open sets of Axiom A attractors; (ii) decay of correlations for slowly mixing Weil-Petersson flows; (iii) results on averaging and homogenization for large classes of multiscale systems beyond the uniformly hyperbolic setting; (iv) mixing results for infinite measure preserving flows.

The central aim of the semester is to build on this recent momentum and to explore ramifications for related questions such as sharp mixing rates for finite and infinite measure geodesic and billiard flows, anomalous diffusion, convergence rates in statistical limit laws and in averaging/homogenization, thermodynamic formalism and phase transitions.