

Mixing properties of a stochastic flow describing inertial particles

Leonid Piterbarg, USC

The following stochastic flow

$$dr = vdt, \quad dv = -(v/\tau)dt + dw(t, r) \tag{1}$$

is considered which is used to describe tracer particles in turbulent flows, drifters in the upper ocean, cloud formation, ultrasonic aggregation of aerosols, mammal migration, iterating functions, and other phenomena. Here r, v are interpreted as the position and velocity of a particle with arbitrary initial conditions, τ is the Lagrangian correlation time, and $w(t, r)$ is a Brownian motion in a Hilbert space. An exact expression for the top Lyapunov exponent of the flow is derived in the 1D case and some asymptotics are obtained in 2D. The phase transition is described from mixing to coalescence in terms of the Stokes number. In the 2D case the relative dispersion for flow (1) is investigated as well.