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Anomalous Diffusivity and Regularity for Random Incompressible Flows

mardi 13 janvier 2026 14:00 (1 heure)

I will present work on the long-time behavior of Brownian motion in a stationary, incompressible random drift field with slowly decaying correlations. In this setting one expects the variance of the displacement to grow faster than linearly in time, with an exponent determined by the correlation structure of the drift (as predicted by Bouchaud-Georges in 1990). We view the problem through the associated divergence-form drift-diffusion operator and apply a scale-by-scale coarse-graining scheme to its coefficients. This produces, at each scale, an effective Laplacian whose diffusivity depends on the scale, together with quantitative control of the error of this approximation. This can be seen as a rigorous version of the perturbative renormalization group heuristics proposed by Bouchaud-Georges. A crucial role is played by anomalous regularization, that is, elliptic estimates that are independent of the bare molecular diffusivity. This work I describe is joint with A. Bou-Rabee and T. Kuusi.

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