

Deterministic chaos, fractals and diffusion: From simple models towards experiments

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Abstract

About a century ago Einstein developed a theory of diffusion which is based on the assumption of *stochasticity* for a Brownian particle. On a microscopic level, however, diffusion is generated by Newton's *deterministic* equations of motion, which typically are highly nonlinear. In my talk I will discuss a theoretical approach to understand diffusion on the basis of *microscopic deterministic chaos*. Simple models ranging from deterministic versions of a random walk on the line to Knudsen diffusion through arrays of hard scatterers will be studied analytically and by means of computer simulations. Surprisingly, the diffusion coefficients of these models turn out to be highly irregular, fractal functions of control parameters while simple random walk theory predicts monotonicity. I will argue that such properties might be seen in experiments like molecular diffusion in zeolite nanopores.

[1] R.Klages, *Microscopic Chaos, Fractals and Transport in Nonequilibrium Statistical Mechanics* (World Scientific, Singapore, 2007)