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Self-similar asymptotics for linear and nonlinear diffusion equations. (English) Zbl 1001.35056

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Summary: The long-time asymptotic solutions of initial value problems for the heat equation and the nonlinear porous medium equation are self-similar spreading solutions. The symmetries of the governing equations yield three-parameter families of these solutions given in terms of their mass, center of mass, and variance. Unlike the mass and center of mass, the variance, or “time-shift,” of a solution is not a conserved quantity for the nonlinear problem. We derive an optimal linear estimate of the long-time variance. Newman’s Lyapunov functional is used to produce a maximum entropy time-shift estimate. Results are applied to nonlinear merging and time-dependent, inhomogeneously forced diffusion problems.

MSC:

[35K55](#) Nonlinear parabolic equations
[35B40](#) Asymptotic behavior of solutions to PDEs
[76R50](#) Diffusion
[76S05](#) Flows in porous media; filtration; seepage

Cited in **31** Documents

Keywords:

[optimal linear estimate](#); [Newman’s Lyapunov functional](#); [maximum entropy time-shift estimate](#)

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