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The stochastic heat equation: Feynman-Kac formula and intermittence. (English)

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Summary: We study, in one space dimension, the heat equation with a random potential that is a white noise in space and time. This equation is a linearized model for the evolution of a scalar field in a space-time-dependent random medium. It has also been related to the distribution of two-dimensional directed polymers in a random environment, to the KPZ model of growing interfaces, and to the Burgers equation with conservative noise. We show how the solution can be expressed via a generalized Feynman-Kac formula. We then investigate the statistical properties: the two-point correlation function is explicitly computed and the intermittence of the solution is proven. This analysis is carried out showing how the statistical moments can be expressed through local times of independent Brownian motions.

MSC:

60H15 Stochastic partial differential equations (aspects of stochastic analysis)
60J50 Boundary theory for Markov processes
82C31 Stochastic methods (Fokker-Planck, Langevin, etc.) applied to problems in time-dependent statistical mechanics

Cited in **2** Reviews
Cited in **78** Documents

Keywords:

stochastic partial differential equations; random media; moment Lyapunov exponents; local times

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References:

[1] P. H. Baxendale and B. L. Rozowskii, Kinematic dynamo and intermittence in a turbulent flow, CAMS preprint \#92-2 (1992).

[2] L. Bertini, N. Cancrini, and G. Jona-Lasinio, The stochastic Burgers equation,Commun. Math. Phys. 165:211–232 (1994). · Zbl 0807.60062 · doi:10.1007/BF02099769

[3] L. Bertini, N. Cancrini, and G. Jona-Lasinio, Burgers equation forced by conservative or nonconservative noise,Proceedings of the NATO-ASI School "Stochastic Analysis and Applications in Physics" (Madeira, August 1993), to appear.

[4] L. V. Bogachev, The moment approach to intermittence of random media. The model of a mean-field diffusion, Preprint Nr. 116, Institut für Mathematik Ruhr-Universität-Bochum (1991).

[5] N. Cancrini, Soluzione del problema di Cauchy per l'equazione di Burgers stocastica in una dimensione spaziale, Ph.D. dissertation, Dipartimento di Fisica, Università di Roma "La Sapienza" (1993) [in Italian].

[6] G. Da Prato, A. Debussche, and R. Temam, Stochastic Burger equation, Preprint di Matematica n. 27, Scuola Normale Superiore, Pisa (1993).

[7] I. I. Gikhman and A. V. Skorohod,Stochastic Differential Equations (Springer-Verlag, Berlin, 1972). · Zbl 0242.60003

[8] H. Holden, T. Lindstrøm, B. Øksendal, J. Ubøe, and T.-S. Zhang, The Burgers equation with a noisy force and the stochastic heat equation,Commun. Partial Differential Equations 19:119–141 (1994). · Zbl 0804.35158 · doi:10.1080/03605309408821011

[9] M. Kardar, Replica Bethe ansatz studies of two-dimensional interfaces with quenched random impurities,Nucl. Phys. B 290:582–602 (1987). · doi:10.1016/0550-3213(87)90203-3

[10] M. Kardar, G. Parisi, and Y.-C. Zhang, Dynamical scaling of growing interfaces,Phys. Rev. Lett. 56:889–892 (1986). · Zbl 1101.82329 · doi:10.1103/PhysRevLett.56.889

[11] M. Kardar and Y.-C. Zhang, Scaling of directed polymers in random media,Phys. Rev. Lett. 58:2087–2090 (1987). · doi:10.1103/PhysRevLett.58.208

[12] J. Krug and H. Spohn, Kinetic roughening of growing surfaces, inSolids far from equilibrium: Growth, Morphology and Defects, C. Godrèche, ed. (Cambridge University Press, Cambridge, 1991).

[13] S. A. Molchanov, Ideas in theory of random media,Acta Appl. Math. 22:139–282 (1991), and references therein. · Zbl 0728.73011 · doi:10.1007/BF00580850

[14] C. Mueller, On the support of solutions to the heat equation with noise,Stochastics Stochastics Rep. 37:225–245 (1991). · Zbl 0749.60057

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[15] J. M. Noble, Evolution equation with Gaussian potential, Preprint (1993). · Zbl 0861.35149

[16] L. Pastur, Large time behaviour of moments of solution of parabolic differential equations with random coefficients, Séminaire 1991/92 Centre de Mathematiques, Ecole Polytechnique, Palaiseau, France.

[17] D. Revuz and M. Yor,Continuous Martingales and Brownian Motion (Springer-Verlag, Berlin, 1991). · Zbl 0731.60002

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