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Nonlinear evolution equations with anomalous diffusion

Nonlinear and nonlocal evolution equations of the form $u_t = -\mathcal{L}u + f(u, \nabla u)$, where $\mathcal{L}$ is a pseudodifferential operator representing the infinitesimal generator of a Lévy stochastic process and f is a smooth nonlinearity of polynomial growth, have been derived, for example, as models for growing interfaces in the case when the continuous Brownian diffusion surface transport is augmented by a random hopping mechanism.

The goal of the lectures (based on the publications listed below) is to present recent results on properties of solutions to this equation resulting from the interplay between the strengths of the "diffusive" linear and "hyperbolic" nonlinear terms, posed in the whole space $\mathbf{R}^n$, and supplemented with suitable initial conditions.

References

[1] P. Biler, G. Karch, and W.A. Woyczyński, *Multifractal and Levy conservation laws*, C. R. Acad. Sci. Paris, **330**, Serie I, (2000) 343–348,

[2] 2 P. Biler, G. Karch, and W.A. Woyczyński, *Asymptotics for conservation laws involving Levy diffusion generators*, Studia Math. **148** (2001), 171–192.

[3] P. Biler, G. Karch, and W.A. Woyczyński, *Critical nonlinearity exponent and self-similar asymptotics for Levy conservation laws* , Ann. I.H. Poincaré - Analyse non linéare **18**, (2001), 613-637.

[4] G. Karch and W.A. Woyczyński, *Fractal Hamilton-Jacobi-KPZ equations*, to appear in Trans. A.M.S.

[5] G. Karch, Changxing Miao, and Xiaojing Xu, *On convergence of solutions of fractal Burgers equation toward rarefaction waves*, to appear in SIAM J. Math. Anal.

All paper are available on the webpage: `http://www.math.uni.wroc.pl/∼karch`