

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Fluctuation Effects in the Pair Annihilation Process with Levy Dynamics¹ INGO HOMRIGHAUSEN, Georg-August-Universität Göttingen, ANTON WINKLER, ERWIN FREY, Ludwig-Maximilians-Universität München — Reaction diffusion models provide a plethora of intensively studied classical nonequilibrium many body systems. One example is the diffusion limited pair annihilation process $A + A \rightarrow 0$, where the reactants diffuse in space and annihilate on contact. Inspired by the fact that many phenomena observed in nature exhibit superdiffusive behavior, we investigate the pair annihilation process in the case where the particles perform superdiffusion, realized by Levy flights. As a consequence, the critical dimension depends continuously on the control parameter of the Levy flight distribution. This instance is used to study the density decay in the pair annihilation process close to the critical dimension by means of the non-perturbative renormalization group theory. Close to the critical dimension, long-range fluctuations cause the law of mass action to break down. One crucial consequence of these fluctuations is that the law of mass action is complemented by additional non-analytic correction terms above the critical dimension. An increasing number of those corrections accumulate and give an essential contribution as the critical dimension is approached.

¹Financial support of Deutsche Forschungsgemeinschaft through the German Excellence Initiative via the program ‘Nanosystems Initiative Munich’ (NIM) and through the SFB TR12 ‘Symmetries and Universalities in Mesoscopic Systems’ is gratefully acknowledged.

Ingo Homrighausen
Georg-August-Universität Göttingen

Date submitted: 26 Nov 2012

Electronic form version 1.4