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On the proper reconstruction of complex dynamical systems spoilt by strong measurement noise

F. Boettcher (1), **J. Peinke** (1), D, Kleinhans (2), R. Friedrich (2), P.G. Lind (3) and M. Haase (3)

(1) Institute of Physics, University of Oldenburg, D-26111 Oldenburg, German, (2)Institute of Theoretical Physics, University of Münster, D-48149 Münster, Germany, (3) University of Stuttgart, Pfaffenwaldring 27, D-70569 Stuttgart, Germany

This article reports on a new approach to properly analyze time series of dynamical systems which are spoilt by the simultaneous presence of dynamical noise and measurement noise. It is shown that even strong external measurement noise as well as dynamical noise which is an intrinsic part of the dynamical process can be quantified correctly, solely on the basis of measured times series and proper data analysis. Finally real world data sets are presented pointing out the relevance of the new approach.

First we present analytic results a fixed point dynamics (Ornstein-Uhlenbeck process) driven by Langevin and spoint by measurement noise. Next we show that this method is also able to extract from given data the underlying equations of a nonlinear dynamical system. The work has been published as Phys. Rev. **97**,090603 (2006)