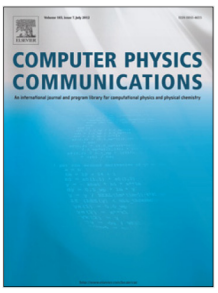
Accepted Manuscript



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PII: S0010-4655(17)30079-6
DOI: http://dx.doi.org/10.1016/j.cpc.2017.03.003
Reference: COMPHY 6175

To appear in: *Computer Physics Communications*

Received date : 26 August 2016
Revised date : 22 February 2017
Accepted date : 8 March 2017

Please cite this article as: B.V. Costa, et al., Energy probability distribution zeros: A route to study phase transitions, *Computer Physics Communications* (2017), http://dx.doi.org/10.1016/j.cpc.2017.03.003

Energy Probability Distribution Zeros: A Route to Study Phase Transitions

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Abstract

In the study of phase transitions a very few models are accessible to exact solution. In the most cases analytical simplifications have to be done or some numerical technique has to be used to get insight about their critical properties. Numerically, the most common approaches are those based in Monte Carlo simulations together finite size scaling analysis. The use of Monte Carlo techniques requires the estimate of quantities like the specific heat or susceptibilities in a wide range of temperature or the construction of the density of states in large intervals of energy. Although many of these techniques are well developed they may be very time consuming when the system size becomes large enough. It should be suitable to have a method that could surpass those difficulties. In this work we present an iterative method to study the critical behavior of a system based on the partial knowledge of the complex Fisher zeros set of the partition function. The method is general with advantages over most conventional techniques since it does not need to identify any order parameter *a priori*. The critical temperature and exponents can be obtained with great precision even in the most unamenable cases like the two dimensional XY model. To test the method and to show how it works we applied it to some selected models where the transitions are well known: The 2D Ising, Potts and XY models and to a

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