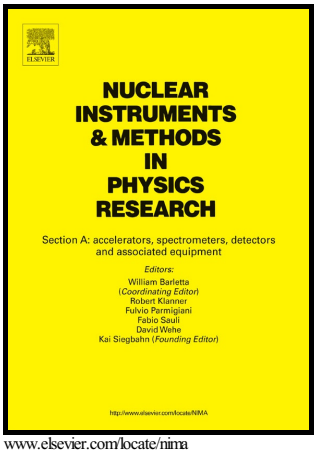
On the maximum entropy distributions of inherently positive nuclear data

A. Taavitsainen, R. Vanhanen



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On the maximum entropy distributions of inherently positive nuclear data

A. Taavitsainen[a,*], R. Vanhanen[a]

[a] *Aalto University School of Science, P.O. Box 14100, FI-00076 AALTO, Finland*

Abstract

The multivariate log-normal distribution is used by many authors and statistical uncertainty propagation programs for inherently positive quantities. Sometimes it is claimed that the log-normal distribution results from the maximum entropy principle, if only means, covariances and inherent positiveness of quantities are known or assumed to be known. In this article we show that this is not true. Assuming a constant prior distribution, the maximum entropy distribution is in fact a truncated multivariate normal distribution – whenever it exists. However, its practical application to multidimensional cases is hindered by a lack of method to compute its location and scale parameters from means and covariances. Therefore, regardless of its theoretical disadvantage, use of other distributions seems to be a practical necessity.

Keywords: maximum entropy principle, normal multivariate distribution, log-normal multivariate distribution, truncated multivariate normal distribution, uncertainty propagation, nuclear data

1. Introduction

Nuclear data are used to make predictions about behaviour of nuclear reactors. The nuclear data are imperfectly known, i.e., uncertain. Assessing the amount of confidence one can have in the predictions made using the imperfectly known nuclear data is the task of uncertainty analysis. An important part of the analysis is the quantification of uncertainties in the nuclear data, that is, quantitatively expressing how well the nuclear data are known.

*Corresponding author
Email address: aapo.taavitsainen@aalto.fi (A. Taavitsainen)
Present address: aapo.taavitsainen@gmail.com