Phase transition in a stochastic geometry model with applications to statistical mechanics

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Abstract

We study the connected components of the stochastic geometry model on Poisson points which is obtained by connecting points with a probability that depends on their relative position. Equivalently, we investigate the random clusters of the ran- dom connection model defined on the points of a Poisson process in d-dimensional space where the links are added with a particular probability function. We use the thermodynamicrelationsbetweenfreeenergy,entropyandinternalenergytofindthe functions of the cluster size distribution in the statistical mechanics of extensive and non-extensive. By comparing these obtained functions with the probability function predicted by Penrose, we provide a suitable approximate probability function. More- over, we relate this stochastic geometry model to the physics literature by showing how the fluctuations of the thermodynamic quantities of this model correspond to other models when a phase transition (10.1002/mma.6965, 2020) occurs. Also, we obtain the critical point using a new analytical method.

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