NYU SHANGHAI | NYU-ECNU Institute of Mathematical Sciences at NYU Shanghai

Statistical Mechanics and the Riemann Hypothesis

13:30-15:30, Tuesdays
February 23 to March 22, 2016

Room 264, Geography Building
Zhongbei Campus, ECNU

ABSTRACT

We review a number of old results concerning certain statistical mechanics models and their possible connections to the Riemann Hypothesis.

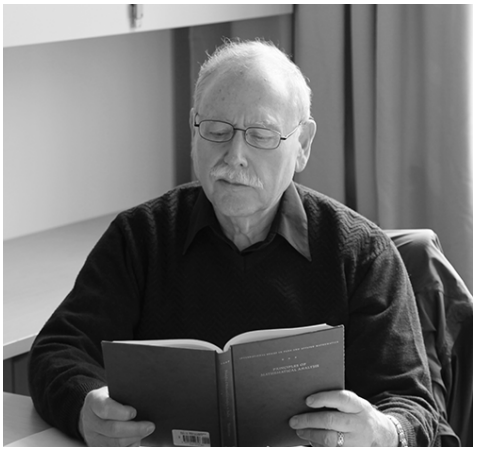
A standard reformulation of the Riemann Hypothesis (RH) is: The (two-sided) Laplace transform of a certain specific function Ψ on the real line is automatically an entire function on the complex plane; the RH is equivalent to this transform having only pure imaginary zeros. Also Ψ is a positive integrable function, so (modulo a multiplicative constant C) is a probability density function.

A (finite) Ising model is a specific type of probability measure P on the points $S=(S_1,\ldots,S_N)$ with each $S_j = +1$ or -1. The Lee-Yang theorem (of T. D. Lee and C. N. Yang) implies that for non-negative $a_1, \ldots, a_N$, the Laplace transform of the induced probability distribution of $a_1 S_1 + \ldots + a_N S_N$ has only pure imaginary zeros. There are also other models, where the variables are real-valued or vector-valued, which have moment generating functions with only pure imaginary zeros.

An intriguing question is whether it is possible to find a sequence in N of models and generating functions so that the limit as $N \to \infty$ of such distributions has density exactly $C\Psi$. We'll discuss some of the cases where one can study the limiting distribution and some hints as to how one might try to find the "right" choice.

BIOGRAPHY

Charles M. Newman, Silver Professor of Mathematics at the Courant Institute and Global Network Professor at NYU-New York and NYU-Shanghai, received B.S. degrees in Mathematics and in Physics from MIT and M.S. and Ph.D. degrees in Physics from Princeton. With 200+ published papers, mainly in probability and statistical physics, he has been a Sloan and Guggenheim fellow and is a member of the U.S. National Academy of Sciences, the American Academy of Arts and Sciences and the Brazilian Academy of Sciences.



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