The Riemann Hypothesis and Stein's Method

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Abstract: The Rieman hypothesis is a well-known open question and there are many equivalent statements. One equivalent conjecture is that the moment generating function of a special probability density function, say Ψ, has pure imaginary zeros. So the conjecture is reduced to find a sequence of random variables whose moment generating functions have pure imaginary zeros and their limiting probability density function is Ψ. It was proved by Lee-Yang (1952) that the moment generating function of Ising models has pure imaginary zeros. Therefore, if one can find a sequence of Ising models so that the limiting probability density function is Ψ, then the Riemann Hypothesis holds. In this talk we shall use Stein's method to give a concrete approach to identify the limiting distribution for any given sequence of Ising models. The problem can be reduced to calculate conditional expectations and conditional variances.