

Colloquium

University of Notre Dame
Department of Mathematics

Speaker: Roland Roeder

Indiana University/Purdue University



Will give a lecture entitled

The Ising Model for magnets and the mysterious Lee-Yang zeros

Date: Wednesday, April 18, 2018

Time: 4:00 PM

Location: 129 Hayes-Healy Hall

Departmental Tea: Tea in Room 257 (lounge in Hurley Hall) at 3:30 p.m.

Abstract:

The Ising Model was developed by Lenz and Ising in the 1920s to describe magnetic materials. It is the most fundamental model of such materials, but there are still many open questions about it that continue to challenge present day physicists and mathematicians. In suitable variables, the Ising model can be described by a single polynomial $Z(z, t)$ of two variables z and t that is called the "partition function". Lee and Yang proved in 1952 that if $t \in [0, 1]$, then the zeros of the partition function lie on the unit circle $|z| = 1$. Most of the physical properties of the magnet are determined by the location of these "Lee-Yang zeros". In this talk, I will explain the Ising model, the Lee-Yang Theorem, and describe several interesting results and open questions about the locations of the Lee-Yang zeros for the classical square lattice \mathbb{Z}^2 . I will conclude by describing two hierarchical lattices (the Cayley Tree and the Diamond Hierarchical Lattice) for which dynamical systems techniques allow us to say considerably more about the limiting distribution of Lee-Yang zeros. In the case of the Cayley Tree, this is joint work with Ivan Chio, Anthony Ji, and Caleb He and in the case of the Diamond Hierarchical Lattice it is joint work with Pavel Bleher and Mikhail Lyubich.