

PQM DISCUSSION GROUP

Tuesday 6 February 2024

At 2pm in Pears Seminar Room 4 (PSR4) and online

Joseph Chapman (Kent) - Curious correlations in the Toblerone model

Abstract:

The 1D Ising model is perhaps the most widely studied model in statistical physics. It is well known that this model is exactly solvable and does not undergo a phase transition at finite temperature.

Recent studies of certain 1D Ising models, with strongly competing interactions, have presented a peak in the specific heat capacity, which is reminiscent of a divergence as expected in a thermodynamic phase transition. These recent results will be discussed. We first show that the width and location of the peak are controlled by two independent sets of model parameters; the peak is not narrow just because it occurs at low temperature. One model in particular, with a strong resemblance to Swiss chocolate, has been the focus of our recent work. This model is a two-leg ladder with triangular rungs, and it is these rungs that can be used to understand the physics of the model.

Despite the previous focus on the thermodynamics in the literature, we present a curious phenomenon arising in the *correlation lengths* of this model: a mathematically rigorous phase transition. We will show that there are two distinct phases in the correlation length of this model. One phase is described by a single correlation length, as is typical. However, at a well-defined "critical temperature", a separation in the correlation length occurs, resulting in two distinguishable length scales in the model. We will explain how this "non-thermodynamic" phase transition occurs and present the phase diagram.