

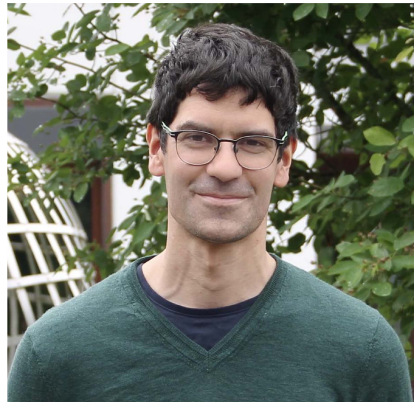
The University of Chicago
Departments of Statistics and Mathematics
are proud to present the

Billingsley Lectures on Probability
in honor of Patrick Billingsley

Continuous Symmetry and Phase Transitions in Lattice Spin Systems

Thursday, February 26, 2026, at 5:00 PM, in Kent 120, 1020 E 58th St.

Reception immediately following the lecture at 6:10 pm, in Jones 111, 5747 S Ellis Ave.



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Abstract

A central problem in statistical physics is to understand how spins placed on the lattice \mathbb{Z}^d interact and collectively organize at different temperatures. When the spins take values in a discrete set — for instance in the celebrated Ising model, where $\sigma_x \in \{-1, +1\}$ — the mechanisms governing phase transitions are by now relatively well understood.

The situation changes dramatically when the spins take values in a continuous space, such as the unit circle S^1 in the XY model or the unit sphere S^2 in the classical Heisenberg model. In this setting, new phenomena appear, and the behavior depends strongly on whether the underlying symmetry is Abelian or non-Abelian. In particular, the non-Abelian case remains far more mysterious.

In this talk, I will introduce the mathematics of spin systems with continuous symmetry, emphasizing their deep connections with analysis, including harmonic functions, harmonic maps, and geometric analysis. I will also describe some recent results and open problems in the area.

No prior background in statistical physics or probability will be assumed. Based on joint works with J. Aru, D. van Engelenburg, P. Dario, N. de Montgolfier, A. Sepúlveda and T. Spencer.

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