FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

An FBSDE approach to the two-dimensional Abelian–Higgs model

Speaker: Zexi He (Fudan University)

Time: 2026-12-03, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Advisor: Shanjian Tang (Fudan University)

Abstract: The Abelian–Higgs model is a basic model in mathematical physics describing the interaction between an electromagnetic gauge field and a charged scalar field. A fundamental mathematical problem is to rigorously construct the continuum model—a probability measure describing the joint distribution of these fields—from discrete lattice approximations.

In this talk, we present an iterated forward–backward stochastic differential equation (FBSDE) approach to the two-dimensional infinite-volume Abelian–Higgs model in Coulomb gauge. The main result is tightness of the joint lattice gauge–Higgs laws in Besov spaces of negative regularity. We represent the lattice Abelian–Higgs measure as the joint terminal law of the FBSDEs and establish uniform moment bounds for the terminal shifts. For the Higgs field, we combine a low–high frequency decomposition with covariant energy estimates to obtain bounds with sufficiently mild dependence on the gauge shift. For the gauge field, we establish estimates for the effective force to close the coupled estimates. Our approach draws on techniques developed over the past decade in the study of singular stochastic partial differential equations (SPDEs).