
Week 1, July 5-9, 2027

Introduction to machine learning theory & methods

Roger Melko

The learning problem; data, machine and loss. Foundational connections between machine learning and condensed matter physics.

Yasaman Bahri

Large-width neural networks, mean-field limits. Statistical mechanics, correlations, fluctuations, and criticality.

Bernd Rosenow

Statistical mechanics and machine learning. Ensembles, random matrices, generalization, phase transitions.

Ying Wai Li

Monte Carlo, sampling, optimization. Spin models, thermodynamics, phase transitions, materials simulation.

Week 2, July 12-16, 2027

Data-driven learning in classical and quantum systems

Yi-Zhuang You

Quantum data, measurements, and models. Entanglement, quantum phases, measurement-induced phenomena, quantum processors.

Ehsan Khatami

Learning and strongly correlated electrons. Hubbard models, quantum Monte Carlo, magnetism, competing phases.

Timothy Hsieh

Markov length, CMI and phases of matter. Mixed states, decoherence, correlation length, phase stability.

Kipton Barros

Markov length, CMI and phases of matter. Mixed states, decoherence, correlation length, phase stability.

Week 3, July 19-23, 2027

Neural quantum states

Christopher Roth

NQS for interacting fermions. Hubbard models, superconductivity, frustration, quantum spin liquids.

Annabelle Bohrdt

Hubbard models and more. Mott physics, magnetic polarons, quantum gas microscopy.

Juan Carrasquilla

Hamiltonian-driven variational learning. Variational Monte Carlo, many-body wavefunctions, entanglement, quantum spin systems.

Week 4, July 26-30, 2027

Frontiers in physics and artificial intelligence

Agnes Valenti

Generalization, double descent. Neural quantum states, variational Monte Carlo, frustrated quantum matter.

Zohar Ringel

RG, neural scaling laws, complexity. Relevance, universality, scale dependence, power-law learning curves.

Miles Stoudenmire

Tensor networks & neural networks. Entanglement, MPS, high-dimensional representations, tensor cross interpolation.

Andrey Gromov

Grokking, emergence and scaling laws. Phase transitions, criticality, and scale dependence.