

## Sampling, Inference, and Data-Driven Physical Modeling in Scientific Machine Learning

**January 13 - 17, 2025**

### Scientific Overview

In recent years, the synergy between data-driven modeling and artificial intelligence, particularly generative modeling, has become an indispensable avenue in scientific discovery. Advances in machine learning have led to novel techniques addressing inverse and forward problems in traditional modeling, such as those involving partial differential equations and dynamical systems. Concurrently, scientific computing concepts can enhance the performance of data-driven methods, like generative modeling. Recent progress has highlighted profound synergy within these methods, underpinned by shared mathematical foundations. A crucial motivation for this workshop is to discuss advances in neural network-based approaches and high-dimensional approximations for parameterizing solution operators or formulating the structure of the underlying mathematical model. The computational and applied mathematics community is increasingly applying these techniques to dynamical systems and nonlinear phenomena. We will bring together leading researchers from various fields to capitalize on this synergy, seeking a unified understanding of hidden mathematical and data-informed structures in sampling, inference, and data-driven modeling in scientific machine learning. Through vigorous discussions and presentations, the initiative aims to address real-world data challenges and pave the way for future explorations.

### Participation

Additional information about this workshop including links to register and to apply for funding, can be found on the webpage listed below. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission, and we welcome their applications.



### Organizers

Rolando de Santiago (CSU Long Beach)  
Ben Hayes (University of Virginia)  
Srivatsav Kunnawalkam Elayavalli (UCSD)  
Brent Nelson (Michigan State University)  
Nikhil Srivastava (UC Berkeley)

### Speakers

Anima Anankumar (California Institute of Technology)  
David Bortz (University of Colorado Boulder)  
Nisha Chandramoorthy (Georgia Institute of Technology)  
Alex Cloninger (University of California, San Diego)  
Nestor Guillen (Texas State University - San Marcos)  
Fuqun Han (University of California, Los Angeles)  
Markos Katsoulakis (University of Massachusetts Amherst)  
Rongjie Lai (Purdue University) Lina Li (Harvard University)  
Wuchen Li (University of South Carolina)  
Wenjing Liao (Georgia Institute of Technology)  
Guang Lin (Purdue University)  
Siting Liu (University of California, Los Angeles)  
Hannah Lu (Massachusetts Institute of Technology)  
Jianfeng Lu (Duke University)  
Mauro Maggioni (Johns Hopkins University)  
Youssef Marzouk (Massachusetts Institute of Technology)  
Scott McCalla (Montana State University - Bozeman)  
Tingwei Meng (University of California, Los Angeles)  
Stanley Osher (University of California, Los Angeles)  
Elizabeth Qian (Georgia Institute of Technology)  
Lars Ruthotto (MLPRC2)  
Hayden Schaeffer (University of California, Los Angeles)  
Carola Schönlieb (University of Cambridge)  
Giang Tran (University of Waterloo)  
Nathaniel Trask (University of Pennsylvania)  
Eric Vanden-Eijnden (New York University)  
Li Wang (University of Minnesota, Twin Cities)  
Rachel Ward (University of Texas at Austin)  
Rebecca Willett (University of Chicago)  
Yunan Yang (Cornell University)  
Benjamin Zhang (University of Massachusetts Amherst)  
Zecheng Zhang (Florida State University)  
Haomin Zhou (Georgia Institute of Technology)  
Wei Zhu (University of Massachusetts Amherst)



For more information, visit the program webpage:  
[www.ipam.ucla.edu/SID2025](http://www.ipam.ucla.edu/SID2025)