

NATIONAL SCIENCE FOUNDATION

MATHEMATICAL SCIENCES

SUMMER RESEARCH SYMPOSIUM



Register now at <https://orise.orau.gov/nsf-msgi/symposium>

Thursday, August 25th

All times are in Eastern Daylight Time

Moderators:

- Yulia Gel, Project Director, National Science Foundation
- Jeremy Tyson, Project Director, National Science Foundation
- Swatee Naik, Project Director, National Science Foundation
- Jennifer Burnette, Project Manager, Oak Ridge Institute for Science and Education

Welcome and Schedule of Events

10:00AM

Welcome from the Division Director

- Dr. David Manderscheid, Division Director, Division of Mathematical Sciences, National Science Foundation

Overview of the NSF Mathematical Sciences Graduate Internship and Schedule of Events

- Jennifer Burnette, Project Manager, Oak Ridge Institute of Science and Education

Research Presentations

These sessions will feature 15-minute research-focused traditional style presentations from mathematical sciences doctoral students. Research presentations will feature the following topics: 1) Data Science and Machine Learning, 2) Fluids, Climate, and Atmospheric Science, 3) Mathematical Biology, 4) Numerical Methods, 5) Physics, 6) Quantum Computing, and 7) Stochastics and Statistics.

Numerical Methods

10:30AM

The Askey-Rahman-Suslov Nonsymmetric Poisson Kernel for Askey-Wilson Polynomials and its Special Values

- Raymond Centner, National Institute of Standards and Technology

Acceleration of Kernel Methods with Nystrom Approximation

- Zezheng Song, Lawrence Berkeley National Laboratory

Mathematical Biology	11:00AM
<i>Simulating African Swine Fever Movement with SIR Models</i>	
<ul style="list-style-type: none"> Abigail D'Ovidio Long, United States Department of Agriculture: Animal and Plant Health Inspection Service 	
<i>Topological data analysis on LiDAR scans of the forest</i>	
<ul style="list-style-type: none"> Alvis Zhao, United States Department of Agriculture Forest Service 	
Data Science and Machine Learning	11:30AM
<i>Causal inference and discovery with dynamic intervention for policy-making</i>	
<ul style="list-style-type: none"> Jimi Kim, Oak Ridge National Laboratory: Oak Ridge Leadership Computing Facility 	
<i>Geometric Scattering Priors and Differentiable Solvers for Inverse Problems</i>	
<ul style="list-style-type: none"> Oluwadamilola Fasina, Lawrence Berkeley National Laboratory 	
<i>How Robust are the Communities in Temporal Networks? A Comparative Analysis Using Community Detection Algorithms</i>	
<ul style="list-style-type: none"> Moyi Tian, Oak Ridge National Laboratory 	
<i>Generative Modeling and Parameter Identification of SDEs via Optimal Transport and Normalizing Flows</i>	
<ul style="list-style-type: none"> Jonah Botvinick-Greenhouse, Argonne National Laboratory, MCS Division 	
<i>Scalable hyperparameter optimization for neural networks</i>	
<ul style="list-style-type: none"> Madhu Gupta, Oak Ridge National Laboratory 	
<i>Variational Deep Learning for Image Segmentation</i>	
<ul style="list-style-type: none"> Liangchen Liu, National Institute of Standards and Technology 	
Stochastics and Statistics	1:00PM
<i>Techniques of Design of Experiments and Space Filling Designs</i>	
<ul style="list-style-type: none"> Manisha Garg, Argonne National Laboratory 	
<i>Predicting a continuous causal variable given ordinal outcomes and structural zeroes with application to submersed aquatic vegetation biomass</i>	
<ul style="list-style-type: none"> Julie Sherman, United States Geological Survey: Upper Midwest Environmental Sciences Center 	
<i>Stein-Variational Gradient Descent in Higher Dimensional Bayesian Inference</i>	
<ul style="list-style-type: none"> Muhammad Rao, Los Alamos National Laboratory 	
<i>Theoretical and Empirical Investigation of Gradient Estimators in Zeroth-order Optimization</i>	
<ul style="list-style-type: none"> Manushi Welandawe, Argonne National Laboratory 	
Mathematical Biology	2:00PM
<i>Decoding Animal Behaviors: Using Information Theory to Explore Behavioral Dynamics in Golden Shiners</i>	
<ul style="list-style-type: none"> Katherine Daftari, United States Army Corps of Engineers: Engineer Research and Development Center 	
<i>Inference of dynamical states in behavioral recordings of socially interacting animals</i>	
<ul style="list-style-type: none"> Wai Ho Chak, Lawrence Berkeley National Laboratory 	
Numerical Methods	2:30PM
<i>An exploration of multidimensional numerical integration techniques in PAGANI and m-CUBES</i>	
<ul style="list-style-type: none"> Madison Phelps, Fermi National Accelerator Laboratory 	

Break	2:45PM
Data Science and Machine Learning	3:00PM
<i>Transfer learning techniques for building damage assessment</i>	
<ul style="list-style-type: none"> • Yandi Wu, United States Army Corps of Engineers: Engineer Research and Development Center: Geospatial Research Laboratory 	
Fluids, Climate, and Atmospheric Science	3:15PM
<i>Pressure-dependant rheological stress model of continuum granular flows</i>	
<ul style="list-style-type: none"> • Eunji Yoo, Lawrence Berkeley National Laboratory 	
<i>Gaussian Process Emulators for Volcanic Ash Dispersion Model Tephra2</i>	
<ul style="list-style-type: none"> • Nian Liu, Los Alamos National Laboratory 	
Break	3:45 PM
Fluids, Climate, and Atmospheric Science Cont'd	4:00PM
<i>Mathematical approaches for effective meso-micro coupling</i>	
<ul style="list-style-type: none"> • Jithin George, National Renewable Energy Laboratory 	
<i>High Amplitude Acoustic Propagation in Porous Media</i>	
<ul style="list-style-type: none"> • Ryan McConnell, United States Army Corps of Engineers: Engineer Research and Development Center: Cold Regions Research and Engineering Laboratory 	
<i>Discovering reduced-order equations of motion for firebrand transport</i>	
<ul style="list-style-type: none"> • Alexander Mendez, United States Department of Agriculture Forest Service 	
Physics	4:45PM
<i>Machine Learning of Peridynamic Models</i>	
<ul style="list-style-type: none"> • Biraj Dahal, Oak Ridge National Laboratory 	
<i>Preconditioning for hyper-reduction in reduced order models</i>	
<ul style="list-style-type: none"> • Minji Kim, Lawrence Livermore National Laboratory 	
<i>A Discrete Curvature Approach to the Drill String Bending Problem</i>	
<ul style="list-style-type: none"> • Arthur Mills, National Energy Technology Laboratory 	
<i>Intragranular bubble detection in crystalline solids through image processing and graph convolutional neural networks</i>	
<ul style="list-style-type: none"> • Irving Martinez, Sandia National Laboratory 	
Closing Remarks	5:45PM

Friday, August 26th

All times are in Eastern Daylight Time

Moderators:

- Yulia Gel, Project Director, National Science Foundation
- Jeremy Tyson, Project Director, National Science Foundation
- Swatee Naik, Project Director, National Science Foundation
- Jennifer Burnette, Project Manager, Oak Ridge Institute for Science and Education

Welcome Back

Research Presentations

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Stochastics and Statistics

10:00AM

Statistical metrics for evaluating the compressibility of scientific datasets through lossy compressors

- Arkaprabha Ganguli, Argonne National Laboratory

Bayesian Nonlocal Operator Regression (BNOR): A Data-Driven Learning Framework of Nonlocal Models with Uncertainty Quantification

- Yiming Fan, Sandia National Laboratory

Statistical Emulators for Stochastic Computer Simulators

- Hwanwoo Kim, Argonne National Laboratory

Fluids, Climate and Atmospheric Science

10:50AM

Predict Soil Moisture Content Using Physics-Informed Neural Networks

- Jiajing Guan, United States Army Corps of Engineers: Cold Regions Research and Engineering Laboratory

Quantum Computing

11:05AM

A statistically-inspired method for enhancing error mitigation in quantum computing

- Wern Yeen Yeong, Fermi National Accelerator Laboratory

Fluids, Climate, and Atmospheric Science

11:20AM

A Higher Order, Stable Partitioned Scheme for Fluid-Structure Interaction Problems

- Kyle Schwiebert, Los Alamos National Laboratory

Exploring numerical errors in simulations of the wave equation with large grid spacings

- Madhumita Roy, Oak Ridge National Laboratory

Changing Space-Time Covariance of Drought Index Under Changing Climates using Gaussian Processes

- Tiffany Christian, Argonne National Laboratory

Physics

12:05PM

Building Hierarchical Graphs to Describe Neutrino Interactions

- Alaittin Kirtisoglu, Fermi National Accelerator Laboratory

Reconstruction of 4d Diffraction Patterns in Scanning Transmission Electron Microscopy via Compressed Sensing and Neural Network

- Zhaiming Shen, Oak Ridge National Laboratory

Efficient Gaussian process-based surrogate model for chance-constrained optimal power flow on the large scaled power grid

- Hanmo Li, Lawrence Livermore National Laboratory

Break

12:50PM

Panel Discussion: Preparing Students for Careers in Mathematical Sciences

1:00PM

This session will feature distinguished panelists from national laboratories and highlight the role of mathematics and statistics graduate education in preparing students for careers in science and industry, and the distinctive contribution of internship programs such as MSGI.

Moderator

- Dr. Jeremy Tyson, Program Director, Division of Mathematical Sciences, National Science Foundation

Panelists

- Dr. Aditi Krishnapriyan, Applied Mathematician, Lawrence Berkeley National Laboratory
- Dr. E. Louise Loudermilk, Research Ecologist, U.S. Department of Agriculture, Forest Service, Southern Research Station
- Dr. Gabriel Perdue, Scientist, Fermi National Accelerator Laboratory (Fermilab)
- Dr. Kevin R. Pilkievicz, Research Chemist, U.S. Army Corps of Engineers, Engineer Research and Development Center
- Dr. Stefan M. Wild, Deputy Division Director/Senior Computational Mathematician, Argonne National Laboratory

Quantum Computing

2:00PM

Simulating Quantum Circuits Using the Yang-Baxter Equation

- Andrey Khesin, Fermi National Accelerator Laboratory

Topological Quantum Error Detection/Correction

- Tushar Pandey, Oak Ridge National Laboratory

Data Science and Machine Learning

2:30PM

To Correctly Classify Imbalanced Data, Find the Best Model Data

- K Medlin, Argonne National Laboratory

An Explainable Convolutional Neural Network Model for Predicting the Southern Annular Mode

- Austin Eide, Los Alamos National Laboratory

The Constituents of Hierarchical Temporal Memory

- DJ Passey, Lawrence Berkeley National Laboratory

Learning on top of the reference dynamical system

- Tianhao Zhang, Lawrence Berkeley National Laboratory

Closing Remarks

3:25PM

For more information about this event, please visit our website:

<https://orise.orau.gov/nsf-msgi/symposium.html>



**OAK RIDGE INSTITUTE
FOR SCIENCE AND EDUCATION**

Shaping the Future of Science