

2nd Annual AI in Science Symposium UC Irvine

Friday, January 29, 2027

CALIT2 Auditorium



AGENDA AT-A-GLANCE

Time	Speaker / Activity	Title
9:30 - 10:00	Coffee	
10:00 - 10:15	Pierre Baldi	Introductions
10:15 - 11:00	Daniel Whiteson University of California, Irvine	Will AI Solve Physics?
11:00 - 11:45	David Miller University of Chicago	From Fast Inference to Intelligent Instruments: AI Across the Life-Cycle of Scientific Instrumentation
11:45 - 1:00	Lunch Break	
1:00 - 1:45	David Shih Rutgers University	New Tools for Old Problems: Generative AI for Discovery in Fundamental Physics
1:45 - 2:30	Tilman Plehn Heidelberg University	Better Theoretical Particle Physics with ML and Now Also AI
2:30 - 3:00	Coffee Break	
3:00 - 3:45	Jonathan Chen Stanford University	AI in Medicine—Real Magic or Technological Illusions?
3:45 - 4:30	C. Lee Giles Pennsylvania State University	Web Crawlers: A Foundational Species
4:30 - 5:15	Andrew Barto University of Massachusetts, Amherst	Rediscovering Reinforcement Learning
5:15 - 6:30	Wine and Cheese Reception	

ABSTRACTS

Talk #1

Will AI Solve Physics?

Daniel Whiteson, University of California, Irvine

Why does physics need AI? I will examine the role of AI and ML in particle physics and speculate about how it will continue to transform the way research is done and the questions we can ask.

Talk #2

From Fast Inference to Intelligent Instruments: AI Across the Life-Cycle of Scientific Instrumentation

David Miller, University of Chicago

The last several years have seen an explosion of capabilities related to machine learning and artificial intelligence. One area that has received a lot of attention is the deployment of real-time AI tools and fast machine learning at the edge of the sensors that we use to learn about the physical universe.

This talk will discuss a simple question: what might our scientific instrumentation tell us now that we know that it can do so fast? I will propose three elements of the answer to this question for what I have started calling intelligent scientific instrumentation: an instrument that knows about the system that it is measuring in its architecture, that optimizes itself against the science we use it to study, and that adapts to what it is seeing while it is seeing it.

Talk #3

New Tools for Old Problems: Generative AI for Discovery in Fundamental Physics

David Shih, Rutgers University

Generative AI — a class of algorithms that learn complex probability distributions from data — is opening new avenues for discovery across fundamental physics. In this talk, I will highlight several recent applications. At the LHC, we are ushering in a new paradigm of model-agnostic searches for new physics, developing powerful anomaly detection methods using generative AI techniques such as normalizing flows. These same methods, applied to astronomical data, have enabled discovery of stellar streams and ultra-faint dwarf galaxies. Generative models can also be used to accelerate simulations across many domains, such as detector simulations at the LHC. When combined with physics-informed neural networks, generative AI enables an entirely new model-free measurement of the dark matter density in the local Galactic neighborhood. Finally, I will discuss how generative AI in the form of agentic LLMs is creating new modes of human-AI collaboration that promise to further accelerate research. Taken together, these advances signal that we have entered a new and exciting era — one where the oldest questions about our universe may very well be answered with the help of the newest AI tools.

Talk #4

Better Theoretical Particle Physics with ML and Now Also AI

Tilman Plehn, Heidelberg University

Particle physics, specifically physics at the Large Hadron Collider (LHC), provides a perfect use case for modern machine learning. The experimental detector output is complex and comes at Petabytes per second. In theoretical physics we simulate this data from first principles, where a small number of parameters describes the interactions of all particles. The corresponding simulations are a critical ingredient to the successful precision-LHC program.

Modern machine learning is transforming these theory predictions rapidly. I will show how surrogates and generative networks allow us to simulate LHC collisions with unprecedented speed and precision. This requires accurate and uncertainty-aware setups and naturally leads us to representation learning and symmetry-aware architectures. Finally, I will show how agentic systems accelerate particle physics workflows and enhance the impact of outstanding young scientists.

Talk #5

AI in Medicine—Real Magic or Technological Illusions?

Jonathan Chen, Stanford University

Pandora's box has opened in the form of publicly accessible generative AI systems, now applied to every imaginable—and many unintended—purpose. These emerging technologies challenge the fundamental theorem of informatics: that the combination of human and machine outperforms either alone. When AI alone can match or surpass human-computer teams in complex medical reasoning, we are forced to reconsider the foundations of relevant clinical expertise. With a global shortage of medical professionals and an overwhelming demand for healthcare, AI's potential to democratize knowledge, expand access, and restore efficiency is simultaneously awe-inspiring, urgently needed, and yet fraught with risks. These advances compel us to ask: What makes a doctor a doctor—or any professional truly human—in this new era? Confronting these existential questions will have profound implications for practice, pedagogy, and policy.

Talk #7

Rediscovering Reinforcement Learning

Andrew Barto, University of Massachusetts, Amherst

Reinforcement Learning (RL) is the old and commonsense idea that learning involves adjusting behavior in order to gain rewards and avoid penalties. Why is it interesting now, and why is it playing so many roles in today's AI systems? I first recount how I became involved in what was (and still is) a highly unorthodox and speculative hypothesis about animal intelligence: that intelligence arises from networks of interacting neurons that are themselves RL agents. This is an instructive case study of how institutional and financial support, a stream of very talented students, together with sheer persistence can enable unfashionable ideas to develop into an influential subject area. RL also exposes safety concerns raised by the deployment of self-improving AI systems. I discuss these concerns in terms of the long history of the use of optimization methods in engineering and architecture. Lessons learned over these years are highly relevant to the challenges raised by the use of RL in agentic AI.

SPEAKER BIOS



Andrew Barto

University of Massachusetts, Amherst

Andrew Gehret Barto is an American computer scientist and Professor Emeritus of Computer Science at the University of Massachusetts Amherst, widely celebrated for developing the conceptual and algorithmic foundations of modern computational reinforcement learning. He earned his B.S. with distinction in mathematics in 1970 and a Ph.D. in computer science in 1975, both from the University of Michigan. Professor Barto joined UMass Amherst in 1977, eventually serving as the Department Chair of Computer Science from 2007 to 2011 and co-directing the Autonomous Learning Laboratory until his retirement in 2012. Alongside his former doctoral student Richard S. Sutton, he co-authored the definitive, field-defining textbook *Reinforcement Learning: An Introduction*. His pioneering work bridging computer science, psychology, and neuroscience earned him numerous high-level accolades, culminating in the 2024 ACM A.M. Turing Award.



Jonathan Chen

Stanford University

Jonathan H. Chen MD, PhD leads a clinical informatics research group to empower individuals with the collective experience of the many, combining human and artificial intelligence to deliver better care than either alone. Dr. Chen founded a company to translate his Computer Science graduate work into AI systems used by people around the world. Dr. Chen continues to practice medicine for the concrete rewards of caring for real people and to inspire his work to advance not just the science and technology, but to redefine how we train (and retrain) an entire generation of the healthcare workforce to safely and effectively integrate intelligent systems to reach all patients in need. His expertise is featured in the popular press with over 150 research publications and awards from the NIH, ARPA-H, American Medical Informatics Association, International Brotherhood of Magicians and more.



C. Lee Giles

Pennsylvania State University

Dr. C. Lee Giles is the Emeritus David Reese Professor in Information Sciences and Technology and graduate college professor of Computer Science and Engineering at the Pennsylvania State University. He was a co-creator of the digital library search engine, CiteSeer. He is a Fellow of the ACM, IEEE, and International Neural Network Society (INNS) and the recipient of the INNS Gabor prize, IEEE CIS Neural Networks Pioneer Award, and twice IBM Distinguished Faculty Award. He has published over 600 conference papers and journal articles with collaborators and students. His Google Scholar page has over 66,000 citations and an h-index of 122.



David Miller

University of Chicago

Prof. David Miller is an experimental particle physicist and a Professor of Physics at the University of Chicago, affiliated with the Enrico Fermi Institute. He's an expert in high-speed electronics, fast triggering systems, and modern artificial intelligence—incorporating deep learning and reinforcement learning to process complex detector data in real time. In his spare time, he searches for milli-charged particles and axions.



Tilman Plehn

Heidelberg University

Prof Tilman Plehn is a theoretical particle physicist and Professor at the Institute for Theoretical Physics at Heidelberg University. He previously worked at CERN and the University of Edinburgh. He's widely recognized as a trailblazer in integrating deep learning into high-energy physics. His group pioneers generative modeling, normalizing flows, equivariant neural networks, and agentic AI simulations for fast Monte Carlo generation, event classification, and parameter inference. He's also famous for his amazing sense of fashion and his knack for asking controversial questions.



David Shih

Rutgers University

David Shih is a Professor at the Perimeter Institute for Theoretical Physics who works broadly at the interface of AI/ML and fundamental physics. Educated at Harvard University (AB), University of Cambridge (M.Phil.), and Princeton University (Ph.D.), Shih was a Professor at the New High Energy Theory Center at Rutgers University from 2010-2026. Shih's career has spanned a broad set of topics, from X-ray astronomy, to string theory, supersymmetry, collider phenomenology and dark matter. His recent work on AI/ML for physics include new methods and applications for anomaly detection, fast and accurate surrogate models with generative AI, robust and interpretable AI, and physics-inspired neural networks. His work has been recognized by numerous awards, including the DOE Early Career Award, the Sloan Foundation Fellowship and the Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation.



Daniel Whiteson

University of California, Irvine

Daniel Whiteson is a Professor of Physics at UC Irvine, specializing in developing novel machine learning strategies to make the most of data from particle physics experiments and reveal the fundamental nature of matter, energy, space and time. He is the host of a podcast, “Daniel and Kelly’s Extraordinary Universe” and the author of several books for a popular audience.