

Welcome to the First IAIFI Colloquium!

Jesse Thaler, Jim Halverson & Phiala Shanahan

*IAIFI Director, IAIFI Colloquium Organizer &
IAIFI Research Coordinator for Physics Theory (and today's speaker!)*



February 4, 2021

The NSF AI Institute for Artificial Intelligence and Fundamental Interactions (IAIFI) *“eye-phi”*



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<http://iaifi.org>

Advance physics knowledge — from the smallest building blocks of nature to the largest structures in the universe — and galvanize AI research innovation

The NSF AI Institute for Artificial Intelligence and Fundamental Interactions (IAIFI) “eye-phi”

Boston Area: **Critical Mass** for Transformative Research at the Intersection of **Physics** and **AI**



Pulkit Agrawal
Lisa Barsotti
Isaac Chuang
William Detmold
Bill Freeman
Philip Harris
Kerstin Perez
Alexander Rakhlin

Phiala Shanahan
Tracy Slatyer
Marin Soljacic
Justin Solomon
Washington Taylor
Max Tegmark
Jesse Thaler
Mike Williams

Demba Ba
Edo Berger
Cora Dvorkin
Daniel Eisenstein
Doug Finkbeiner
Matthew Schwartz
Yaron Singer
Todd Zickler

James Halverson
Brent Nelson

Taritree Wongjirad

These Colloquia & Other IAIFI Events:
Increase **Cross Section** for **Interdisciplinary Interactions**

AI²: Ab Initio Artificial Intelligence



Machine learning that incorporates first principles, best practices, and domain knowledge from fundamental physics

Symmetries, conservation laws, scaling relations, limiting behaviors, locality, causality, unitarity, gauge invariance, entropy, least action, factorization, unit tests, exactness, systematic uncertainties, reproducibility, verifiability, ...

AI² for Theoretical Physics

Standard Model of Nuclear & Particle Physics
String Theory & Physical Mathematics
Astroparticle Physics
Automated Discovery of Physics Models

Physics
Theory



Physics
Experiment

AI Foundations

AI² for Experimental Physics

Particle Physics Experiments
Gravitational Wave Interferometry
(Multi-Messenger) Astrophysics

AI² for Foundational AI

Symmetries & Invariance
Speeding up Control & Inference
Physics-Informed Architectures
Neural Networks Theory

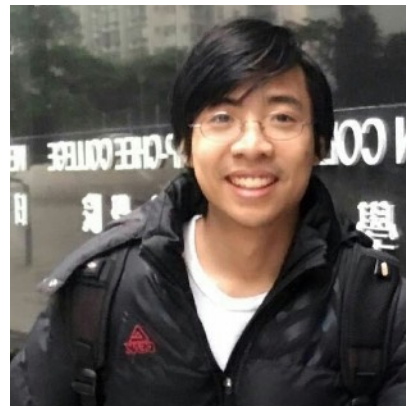
The 2021-2024 IAIFI Fellows!



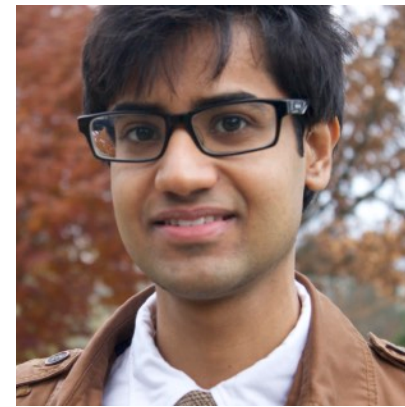
The “Gluons” of IAIFI:
Spark **multi-investigator, multi-subfield** collaborations



Anna Golubeva



Di Luo



Siddharth Mishra-Sharma



Ge Yang

*In the coming months, launching various IAIFI activities
in workforce development, digital learning, outreach,
broadening participation, and knowledge transfer*

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Physics
Theory



Physics
Experiment

AI Foundations

Training, education & outreach at Physics/AI intersection
Cultivate early-career talent (e.g. IAIFI Fellows)
Foster connections to physics facilities and industry
Build strong **multidisciplinary collaborations**
Advocacy for **shared solutions** across subfields



<http://iaifi.org/>

*We look forward to building
collaborations and synergies
within Boston and beyond!*