

**Welcome to
the IQ Initiative/PITT PACC
Workshop:
Axions, Fundamental and Synthetic**

W. Vincent Liu

*Interdisciplinary Quantum Initiative
Department of Physics and Astronomy*

April 6, 2023

What is IQ Initiative

- **Interdisciplinary Quantum Science for Fundamental Physics Initiative [IQ]**
- **Created in August 2022**
- **Website *under construction*** <http://iq.pitt.edu/>



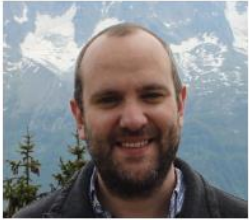
About IQ Initiative

Quantum science, since its inception in the early 1900s, has continued yield to concepts that challenge our understanding across the foundations of physics, from mysterious fundamental particles and fields that make up the Universe, to novel quasi-particles emerging in natural physical systems or artificial non-relativistic quantum matter laboratories.

The Interdisciplinary Quantum Science for Fundamental Physics Initiative, the IQ Initiative, for short, aims to become the center for inquiry, training, and exchange in fundamental quantum physics. Our research programs focus on the interdisciplinary areas of common interest to quantum condensed matter, atomic, molecular, and optical (AMO), and high energy physics (HEP), with members joining from traditionally disjointed backgrounds. At its conception, the IQ Initiative directs its main focus on theoretical and experimental research in the areas of:

Who are we? IQ People

Members



Brian Batell »
th, HEP



Gurudev Dutt »



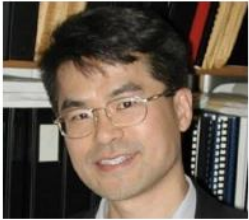
Ayres Freitas »



Sergey Frolov »



Tao Han »



Hong Koo Kim »



Arthur Kosowsky »



Adam Leibovich »



W Vincent Liu »
IQ Director (2022-2027)



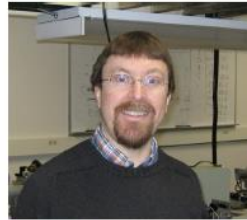
Vittorio Paolone »
HEP



Hrvoje Petek »



Vladimir Savinov »



David Snoke »



David Wallace »



Andrew R Zentner »

Postdoctoral Fellow



Amit Bhoonah »

- **Steering:** Hrvoje Petek (chair), Brian Batell, W. Vincent Liu, Vittorio Paolone
- **Advisory:** Tao Han, Adam Leibovich

IQ People Background

- Multiple disciplinary
 - Non-relativistic quantum physics: qCM + AMO + QIS
 - ❑ Quantum Quantum CM
 - ❑ AMO
 - ❑ Q information science
 - ❑ Artificial “engineered” quantum simulators
 - Nano Engineering
 - High Energy Physics
 - Astrophysics
 - Philosophy of Science
- Experiment, Theory, & Computation
 - HEP experimentalists and theorists
 - Quantum exp and theorists

IQ Mission

Goal: to become the center for
inquiry, training, and exchange
in fundamental quantum physics

*Stimulating ideas from High
Energy, Cosmology, and Astro
physics*

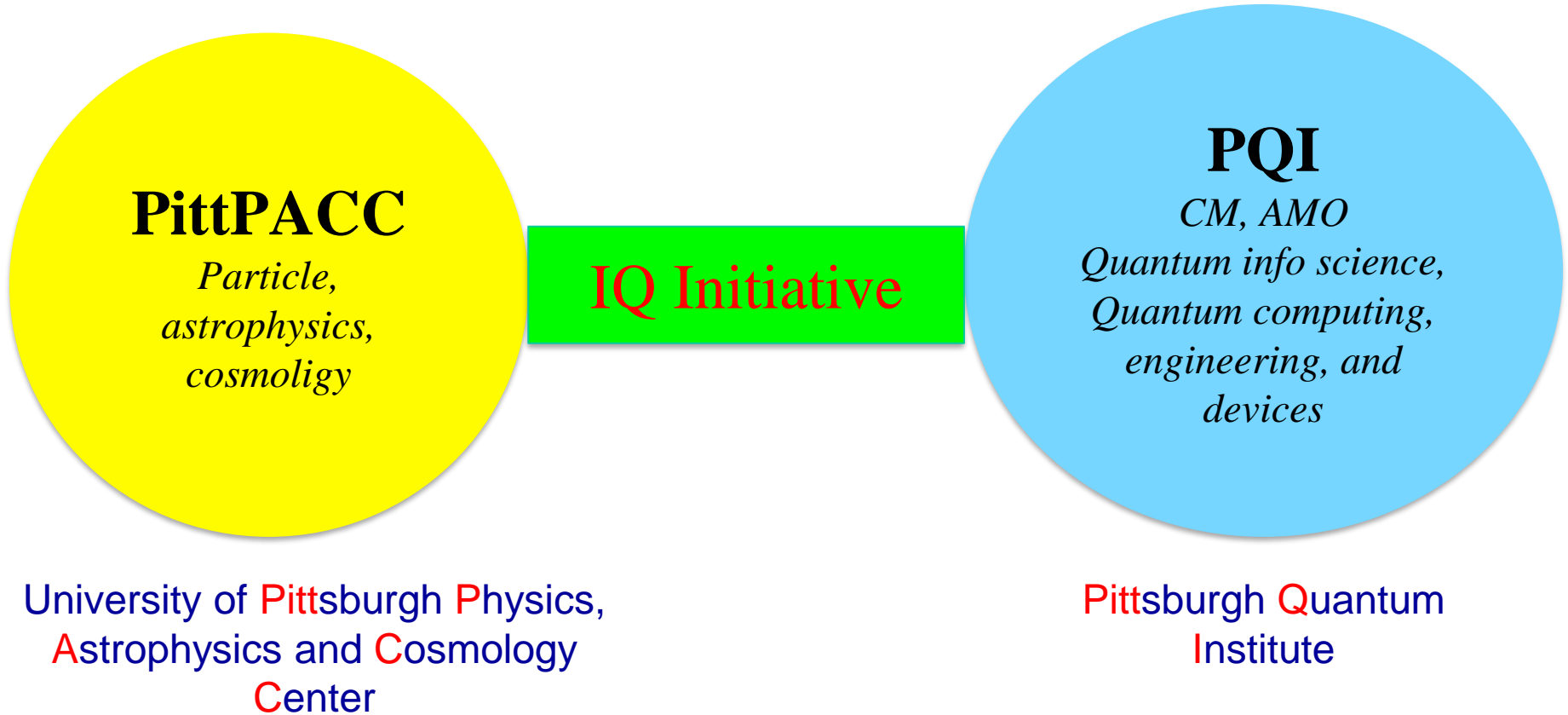
to

*Condensed Matter & AMO physics,
Quantum Info Science &
Engineering
and back!*

IQ Areas

- Interdisciplinary Work: qCM+ AMO+ HEP
- Fundamental physics:
 - Probes new physics beyond the Standard Model of particle physics through precision many-body measurements by **table-top** experiment
 - *Targets low energy scale ---complementary to high energy accelerators*
 - ...
- Quantum Simulation:
 - Emergent analogues of fundamental particles in quantum simulation platforms.
 - Realization of QFT concepts by next-generation quantum materials and technologies.
- Quantum system inspired problems for Particle Physics
 - Particle physics theory in particular
 - Particle & Astro-physics exp design

IQ as Quantum-HEP Bridge



Pittsburgh made the *National Geographic Traveller's* 19 for 2019 Cool List. The British edition of the publication names Pittsburgh as a destination set to hit the headlines in 2019. Pittsburgh, the only U.S. city to make the list, was ranked third among the coolest places to travel in the coming year.

Cathedral of Learning

PITT

1787



Carnegie Museum

Soldiers & Sailors Museum



Phipps Conservatory

Pittsburgh: The Coolest American City You Haven't Been To

01/06/2015 08:44 pm ET | Updated Mar 06, 2015



Andrea Poe

Journalist who covers travel, adoption and business issues around the globe



Hope to see you in-person in Pittsburgh before long!



This Workshop

GOALS

1. Novel ideas for axion detection using quantum systems.
2. Overview of exciting developments in the rapidly emerging field of axion electrodynamics in condensed matter systems.
3. Bring together people working on these two disparate topics for creative new ideas & collaborations both in fundamental axion detection and the emergence of axionic quasi-particles in materials.

***Thank you all !
Look forward to & wish you a
fruitful workshop!***