

## AGENDA

### University of Connecticut Board of Trustees

#### Committee for Research, Entrepreneurship, and Innovation June 27, 2024, at 1:00 p.m. Virtual Meeting

Public Streaming Link (with live captioning upon request): <https://ait.uconn.edu/bot>

(A recording of the meeting will be posted on the Board website <https://boardoftrustees.uconn.edu/> within seven days of the meeting.)

Call to order at **1:00 p.m.**

1. Public Participation\*

\*Individuals who wish to speak during the Public Participation portion of the Thursday, June 27, meeting must do so 24 hours in advance of the meeting's start time (i.e., 1:00 p.m. on Wednesday, June 26) by emailing [BoardCommittees@uconn.edu](mailto:BoardCommittees@uconn.edu). Speaking requests must include a name, telephone number, topic, and affiliation with the University (i.e., student, employee, member of the public). The Committee may limit the entirety of the public comment to a maximum of 30 minutes. As an alternative, individuals may submit written comments via [BoardCommittees@uconn.edu](mailto:BoardCommittees@uconn.edu), and all comments will be transmitted to the Committee.

2. Minutes from the April 25, 2024, Meeting

3. Research Updates – Dr. Pamir Alpay, Vice President for Research, Innovation and Entrepreneurship

4. QuantumCT Initiative Update – Dr. Abhijit Banerjee, Associate Vice President, Research, Innovation & Entrepreneurship

5. Quantum Startup Presentations:

- a. Quasim, Dr. Bodhi Chaudhuri, Professor, Pharmaceutical Sciences, and Dr. Sanguthevar Rajasekaran, Director, School of Computing, Board of Trustees Distinguished Professor, and Pratt & Whitney Chair
- b. Access Quantum, Dr. Sanjeev Nayak, Program Specialist Quantum Technologies
- c. Doublet Labs, Dr. Alexander Balatsky, Professor, Physics

6. University Senate Representative Report

7. Other Business

8. Executive Session (as needed)

9. Adjournment

PLEASE NOTE: *If you are an individual with a disability and require accommodations, please e-mail the Board of Trustees Office at [boardoftrustees@uconn.edu](mailto:boardoftrustees@uconn.edu) prior to the meeting.*



# RESEARCH UPDATE

## **Dr. Pamir Alpay**

Vice President for Research, Innovation and  
Entrepreneurship

UCONN BOARD OF TRUSTEES RESEARCH, ENTREPRENEURSHIP  
AND INNOVATION COMMITTEE MEETING

June 27, 2024





# A Record-Setting Year for UConn Research

- Approximately 2,000 proposals
- Approximately \$1.5 billion requested
- 790 New awards, \$351M
- \$311M Expenditures through May, 2024. We are leading last year's mark of ~\$286M for May and expect FY24 expenditures to exceed the record of \$322M set last year

# New Awards and Expenditures FY2018-FY2024 (thru May)

In millions



\*In 2021, UConn Health received a \$40M instrumentation award from NSF, the largest in UConn history

# Selected Large Grants

**\$3,448,918**

**Nancy Redeker, School of Nursing.**

Phenotypes of Sleep Health Among  
Black and Hispanic Women of  
Childbearing Age

DHHS/NIH/National Heart, Lung, and  
Blood Institute

Award date: 3/13/24

**\$2,673,449**

**Lixia Yue, School of Medicine.**

Calcium Signaling Mechanisms in Cardiac  
Fibrogenesis.

DHHS/NIH/National Heart, Lung, and Blood  
Institute

Award date: 6/1/2024

**\$2,000,000**

**Baikun Li, CEE,  
College of Engineering.**

Developing a Digitization and Automation  
Platform for Reducing Greenhouse Gas  
Emissions from Biological Nutrient  
Removal Unit Processes in Water  
Resource Recovery Facilities,

DOE/Office of Energy Efficiency and  
Renewable Energy,

Award date: 3/5/2024

**\$1,721,357**

**Heidi Dierssen, Marine Sciences,  
CLAS.**

Exploring the Role of Phytoplankton  
Community Composition in Air-Sea Carbon  
Exchange West of the Antarctic Peninsula  
through Field and Satellite Measurements  
NASA/NASA Shared Services Center  
(NSSC)

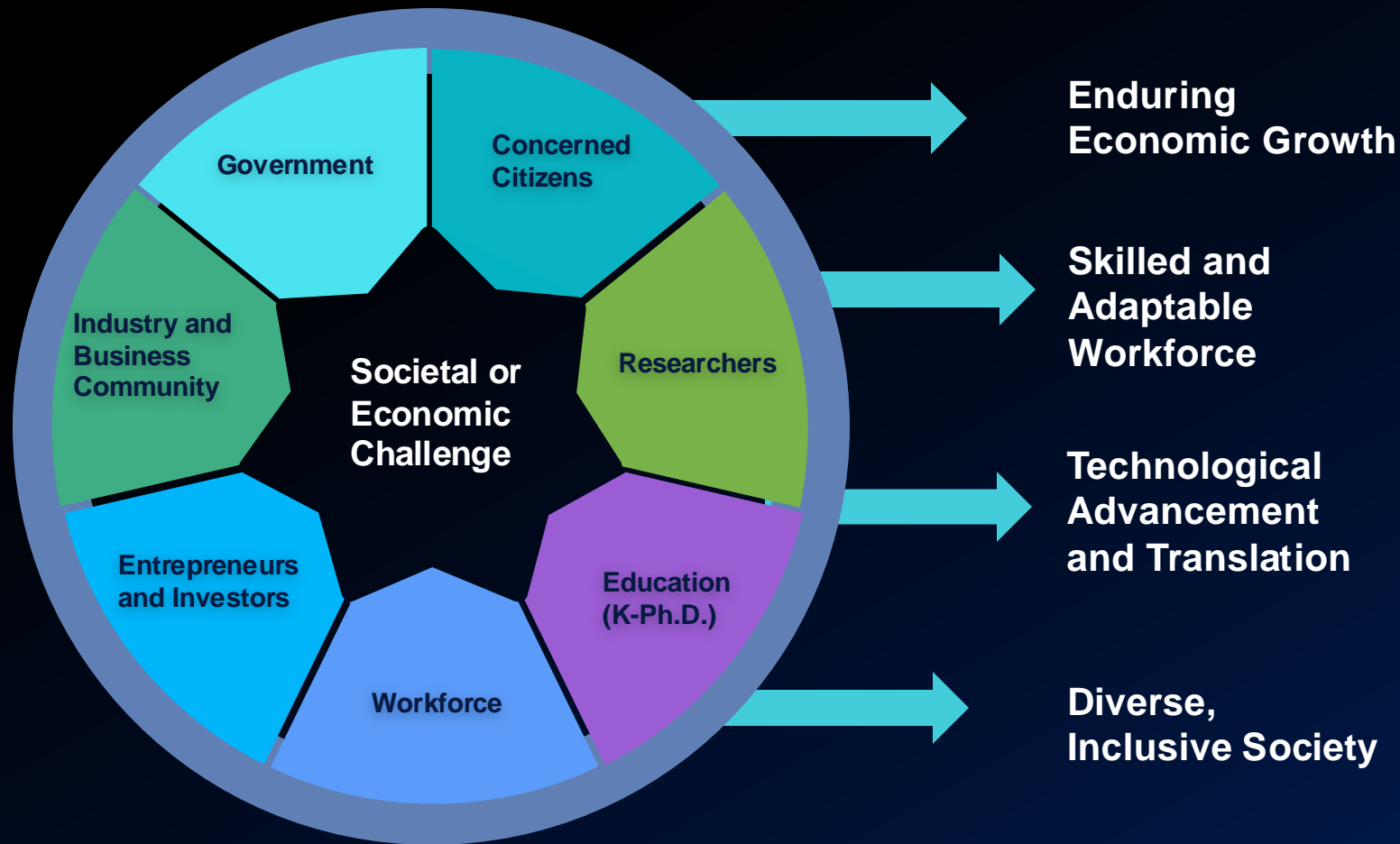
Award Date: 1/24/24.



# QuantumCT Update



# NSF Regional Innovation Engines



In an unprecedented collaboration for Connecticut, UConn and Yale responded to the NSF program and secured an engine development award. We are collaborating on QuantumCT, a joint effort to make Connecticut an engine for quantum innovation-driven economic development

# QuantumCT: Partners and Strategy



**QuantumCT  
Innovation  
Ecosystem**

**UConn**

**Yale**

**DECD**

**Connecticut  
Innovations**

Interdisciplinary Research

Quantum Computing

Quantum Applications

Life Science Applications

Cybersecurity

Materials Science

Quantum Education

CT Impact and Community

Future Workforce

Regional Quantum Buildup

Fund Management

Startup Selection

Ecosystem Buildup

Startup Accelerator

Pharmaceuticals

Aerospace and Defense

Insurance and Financial

Future Workforce and  
Community

Regional Expertise and  
Partnerships

National and International  
Partnerships



# QuantumCT Accomplishments at a Glance



100 participants from  
15+ organizations statewide



21 seed projects, including  
10 industry challenge projects



\$1,300,000 invested in  
quantum initiatives

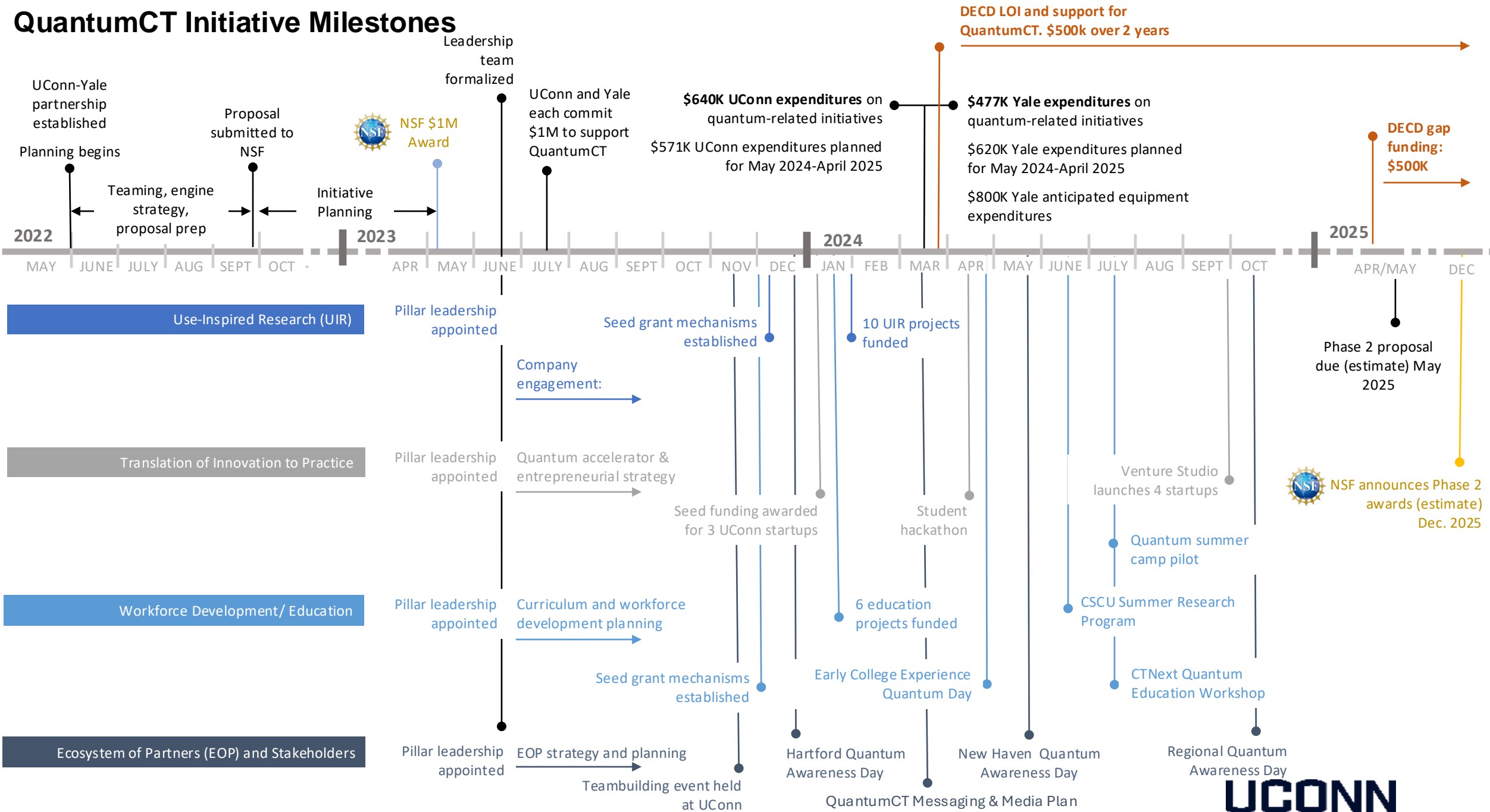


Major industry partnerships:  
RTX, Boehringer Ingelheim,  
Microsoft, NVIDIA



Support from state and  
local governments

# QuantumCT Initiative Milestones



# State Support

The State of Connecticut has committed \$100M to support application of next-generation technologies, including quantum technologies, in critical sectors of Connecticut's economy.



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STATE OF CONNECTICUT  
**GOVERNOR NED LAMONT**

05/29/2024

## Governor Lamont Announces Creation of the Innovation Clusters Program To Support Growth in Cutting-Edge Industries

### **New State Program Will Make up to \$100 Million in Strategic Investments**

(HARTFORD, CT) – Governor Ned Lamont today announced the creation of the Connecticut Innovation Clusters Program, a \$100 million initiative to support the continued growth of critical sectors of the Connecticut economy, including biotechnology, financial technology, insurance technology, and advanced manufacturing in support of national defense.

Administered by the Connecticut Department of Economic and Community Development (DECD), this program will leverage private and public investment to support the application of next-generation technologies, such as artificial intelligence and quantum computing, to accelerate innovation in high-growth clusters where Connecticut has shown competitive advantage.

“Connecticut has the best educated and best trained workforce in the nation, which is the number one resource needed to conceive, develop, and produce the cutting-edge products and services that revolutionize industries and make businesses thrive,” **Governor Lamont said.** “We are the home of innovation, and through this new program we can support the growth of the sectors that are driving job creation and advancements in technology.”





**THANK YOU**

# **UConn Quantum Initiative Update October 2023 – June 2024**

**Abhijit (Jit) Banerjee**

**BOT-REI Committee Presentation**

**June 27, 2024**

# OPERATIONAL ACHIEVEMENTS AT UCONN

TCS led effort to identify faculty and expertise in quantum and quantum adjacent areas

- Two events hosted by TCS convened on:
  - October 3<sup>rd</sup> 2023
  - March 20, 2024
- UConn Quantum Consortium
- These efforts identified **60+ faculty** working in 4 scientific focus areas in quantum.
  - Quantum Materials
  - Quantum Sensors
  - Quantum Algorithms, Computation, and Cryptography
  - Quantum Education and Promotion



# Focus Areas and Faculty Participants

FOCUS	QUANTUM MATERIALS	QUANTUM SENSORS	QUANTUM ALGORITHMS, COMPUTATION, & CRYPTOGRAPHY	QUANTUM EDUCATION AND PROMOTION
<b>Leads</b>	Alexander Balatsky Menka Jain	Baikun Li Ilya Sochnikov	Walter Krawec Bing Wang	Caroline Dealy, Jason Hancock, Amit Savkar
<b>Faculty</b>	Necmi Biyikli Bodhisattwa Chaudhuri Gayanath Fernando Jose Gascon James Nathan Hohman Jeongho Kim Adil-Gerai Kussow Anson Ma Jeffrey McCutcheon Serge Nakhmanson Sanjeev Nayak Yang Qin Sanguthevar Rajasekaran Sanjubala Sahoo Ranjan Srivastava Ioulia (Julia) Valla Pavel Volkov Brian Willis Jing Zhao	Simone Colombo Joseph Courtney Alexander Dupuy Hamid R. Eghbalnia Jose A. Gascon Ali Gokirmak Ravi Gorthala Jeffrey Hoch Menka Jain Bahram Javidi Vasili Kharchenko Anh-Thu Le Yu Lei Tomoyasu Mani Daniel McCarron Serge Nakhmanson Georges Pavlidis Sanjubala Sahoo Pavel Volkov	Beykal Burcu Monika Filipovska Chang Liu George Lykotrafitis Fei Miao Sanguthevar Rajasekaran Alexander Russell Zongjie Wang Shan Zuo	Xinnian Chen Morgaen Donaldson Monika Filipovska Michael Jones Walter Krawec Tomo Mani Serge Nakhmanson Desen Ozkan Sanjubala Sahoo Lea Santos Helena Silva Alexander Teplyaev Vincent Tycer Diego Valente Bing Wang

# Seed Funding Investments in Quantum Research



UConn and Yale - over **\$1.3M** in Quantum seed fund investments

# UConn Quantum Seed Funding Programs

Innovations in Quantum STEM Education	Quantum Innovation Seed Grants	Quantum Startup Awards	Quantum Regional Partnership Investments	UConn Totals
Education and workforce development 4 Awards	R&D – applications of quantum technologies 5 Awards	Support for quantum tech-based startups 3 Awards	Quantum challenge problems posed by industry partners 9 Awards	<ul style="list-style-type: none"><li>• 52 proposals</li><li>• 18 awards</li></ul>



# Translation Accomplishments: 3 Quantum Startups Launched



S. Nayak

Access Quantum: Advanced Materials Discovery through Computational Engineering

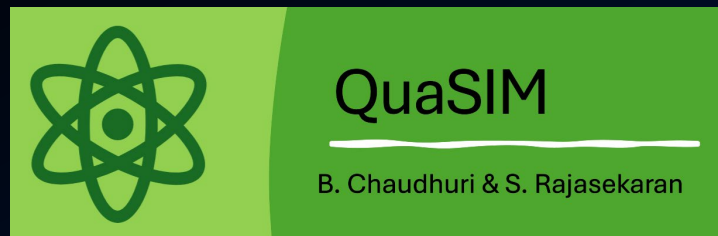
Engineering materials with exotic properties  
Handling critical and futuristic industrial needs



*S. Griffin & A. Balatsky*

Doublet Labs: Creating ML tools for search, prediction, and analysis of new organic materials for quantum technologies and adaptable microelectronics

Development of ML-Driven Materials Forecast Suite



*B. Chaudhuri & S. Rajasekaran*

QuaSIM: Creating breakthrough classical and quantum algorithms to exponentially reduce the time required to simulate granular materials

# Education and Curriculum Development

- ~ 50 school-teachers attended the UConn ECE Physics Quantum Day – Dr. Diego Valente
- Quantum Workshop for K12 Teachers, June 23-25, 2024 – Dr. Clyde Cady
- CHEM5 393: Quantum Information Science for Chemists – Dr. Tomoyasu Mani
- Quantum for Kids animation – Prof. Vincent Tycer
- QEd curriculum development – Dr. Jason Hancock
- CETL's non-degree certificate in Quantum Science and Technology – Dr. Amit Savkar
- Career consultation and educational exchange pilot programs with University High School of Science and Engineering and Annie Fisher STEM Magnet School – Dr. Sanjeev Nayak and Dr. Jeffrey Hines





# Industry Engagement

- Joint project launched with Microsoft – Bing Wang and Walter Krawec
- Industry visits:
  - Microsoft – Brad Lackey (Partner, Quantum Architect)
  - Quantinuum – Rajeeb Hazra (CEO)
  - IBM – Scott Crowder (Vice President, IBM Quantum Adoption), Marilyn Wagner (Head of Quantum Academia)
- Faculty met with industry to identify seed projects in partnership with Yale
  - Microsoft, Quantinuum, IBM, RTX, Travelers, Mirion Technologies, Pfizer, Novartis
- Limited access to IBM Quantum Computer, Quantinuum’s Nexus and InQuanto software suites
- Grant applications and success stories to be announced







# MOVING ONWARD





# QuaSIM

*Pioneering Quantum Algorithms  
for Particle Dynamics*

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B. Chaudhuri and S. Rajasekaran

June 27, 2024

# Company Mission

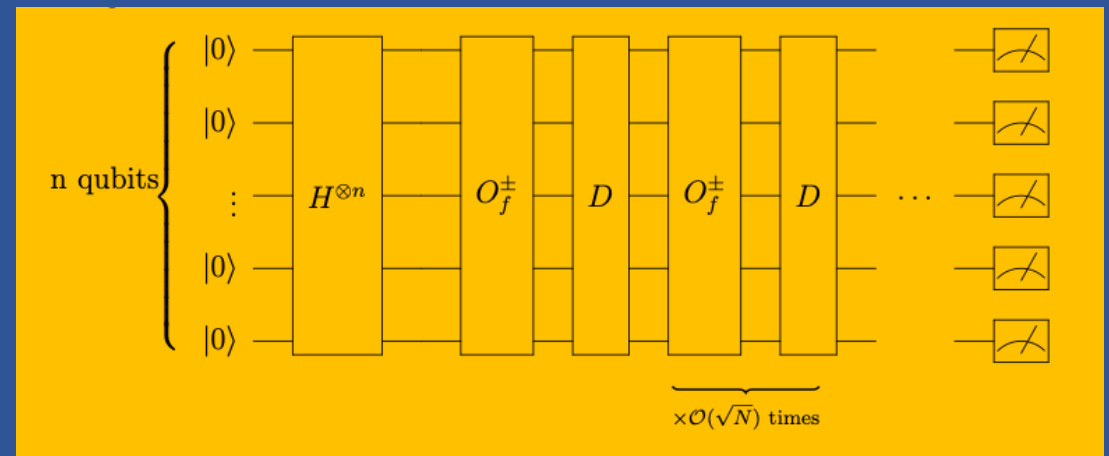
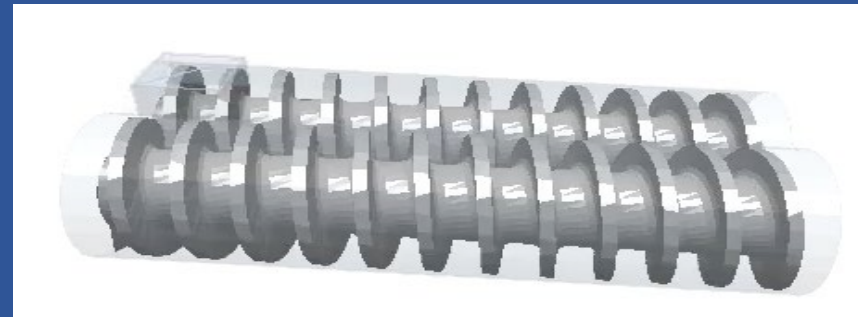
Creating breakthrough classical and quantum algorithms to exponentially reduce the time required to simulate bulk powder flow pertinent for manufacturing Pharma, Agriculture, Construction, and Defense products.



# Technology Overview

- **Discrete Element Method (DEM)** is currently used to model powder flow.
- Bottlenecks:
  - Too much time
  - Memory Intensive
- Quantum Algorithms come to the rescue !!

Twin screw granulation

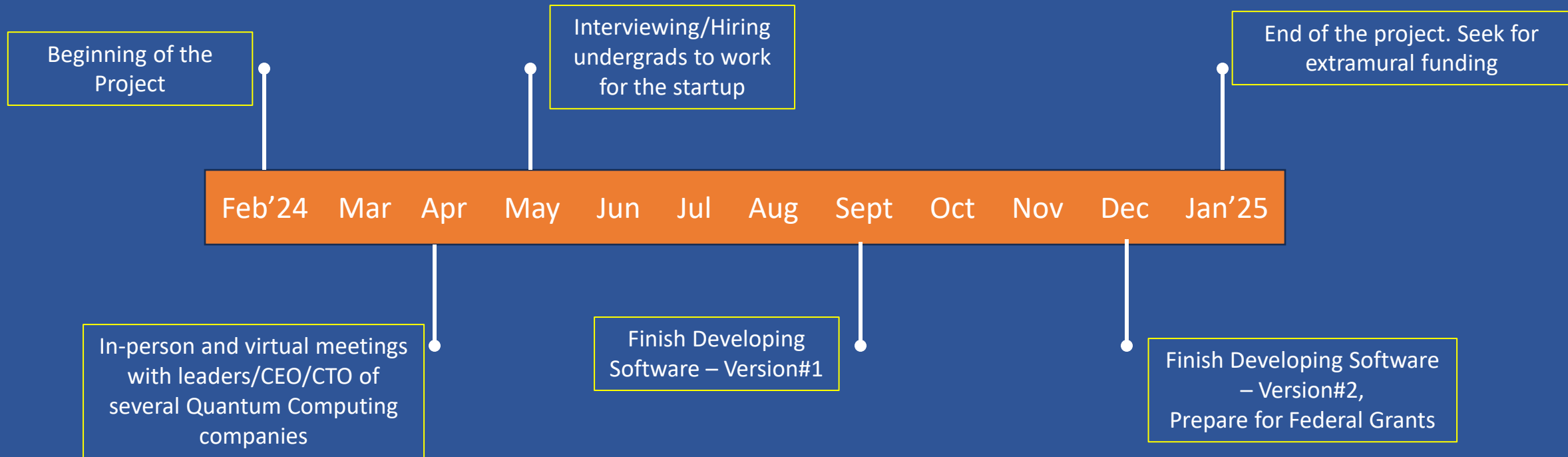


# Market Summary

- Powder handling industry: US\$5.2 billion (2022)
  - DEM market size: \$400 Million (Estimated)
- Market Dynamics:
  - Rocky DEM, Inc.: \$21.7 Million (Revenues, 2022)
    - Acquired in 2023 by Ansys (Revenue, \$2 Billion 2022)
  - Altair (DEM & other software): \$612 Million (Revenues, 2023)
  - MStar (DEM & other software): \$490 Million (Revenues, 2023)



# Timeline



# The Team



**Bodhi Chaudhuri**

Professor, Pharmaceutical Sciences,  
Chemical & Biomolecular Engineering  
Email: [Bodhi.Chaudhuri@uconn.edu](mailto:Bodhi.Chaudhuri@uconn.edu)

- Multi-Scale Computer Modeling
- Powder Technology
- Additive Manufacturing
- AI/ML
- 3 years industrial experience of SW development



**Sanguthevar Rajasekaran**

Director of the School of Computing (SoC)  
Board of Trustees Distinguished Professor  
Pratt & Whitney Chair Professor of CSE  
Email: [Sanguthevar.Rajasekaran@uconn.edu](mailto:Sanguthevar.Rajasekaran@uconn.edu)

- Algorithm and Complexity
- Big Data Analytics
- Materials Genomics
- AI/ML and Quantum Algorithms
- Parallel Computing
- Founder of Startup



# Access Quantum

## Materials Design through Computational Engineering



Sanjeev K. Nayak, PhD (Physics) & MBA

- 12 years post-PhD research experience
- 46 scientific publications; Mentored 8 graduate student researchers
- Program Specialist – Quantum Technologies, UConn OVPR
- Technology Transfer and Translation Research, UConn TCS

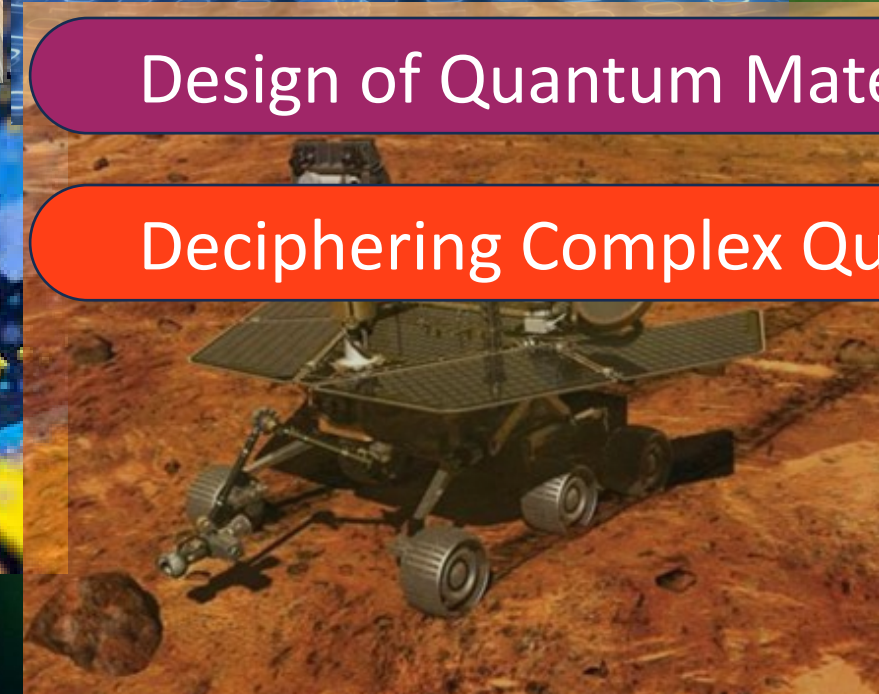


Accelerated Materials Discovery

Optimization of Material Properties

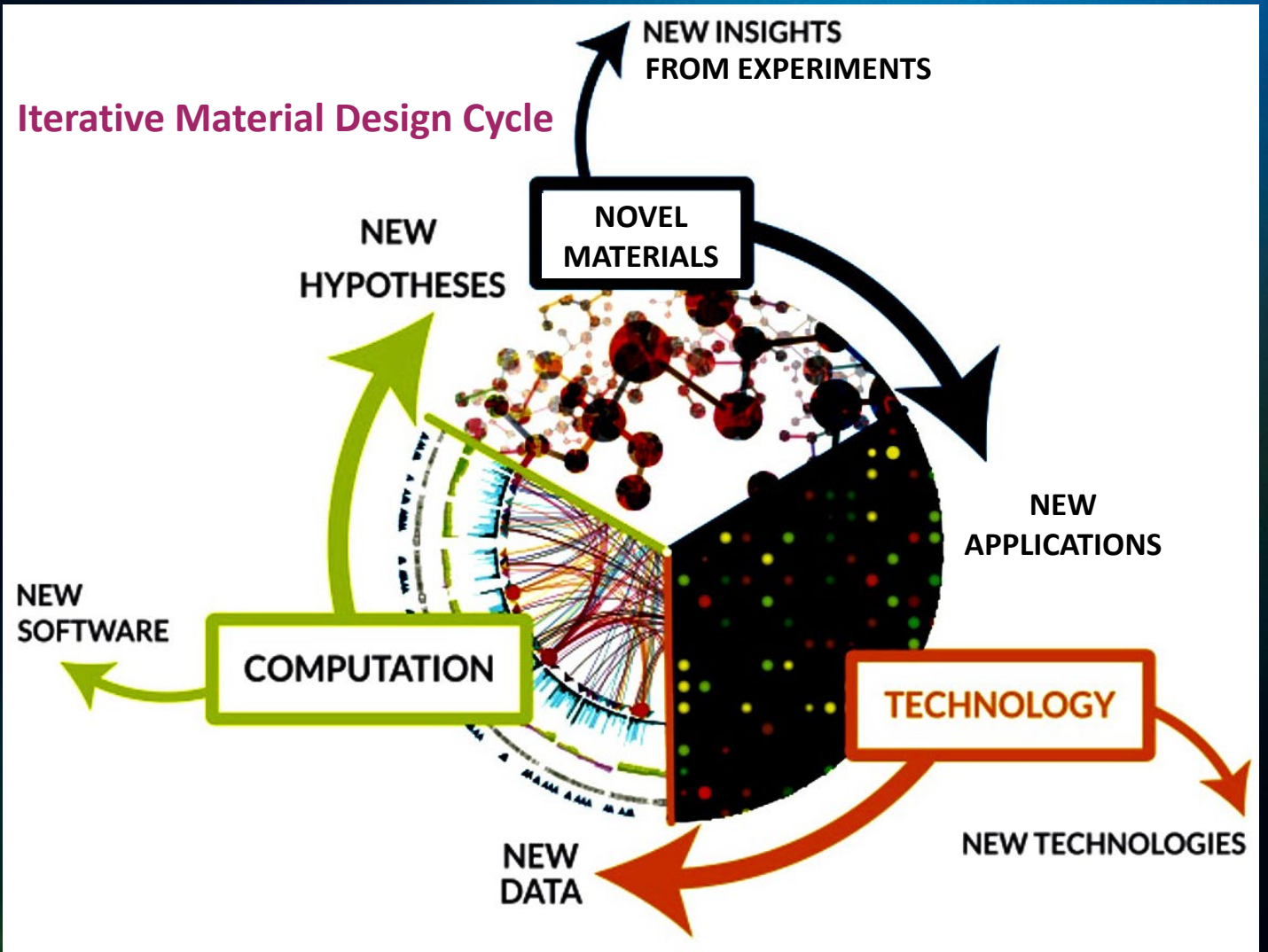
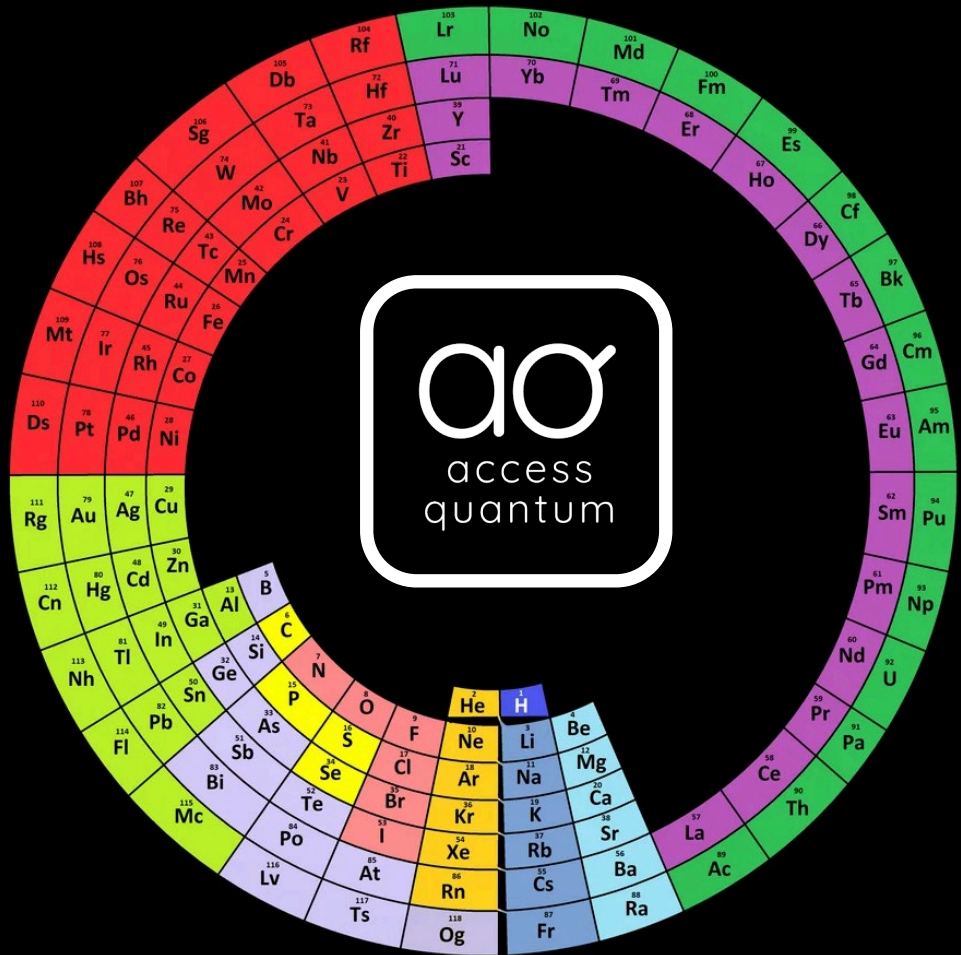
Design of Quantum Materials

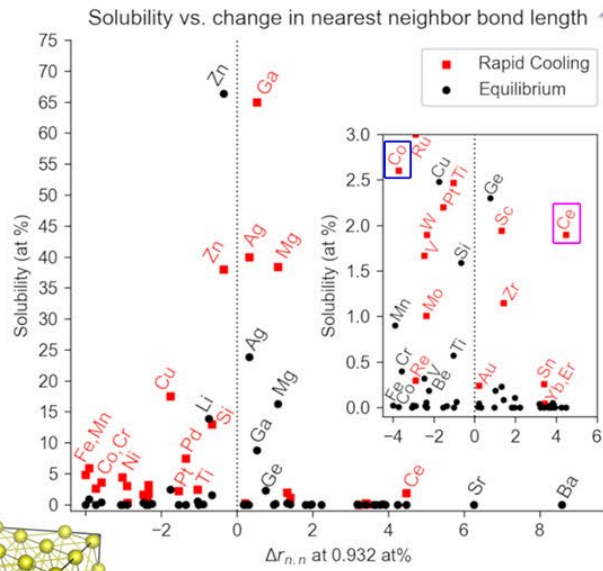
Deciphering Complex Quantum Phenomena



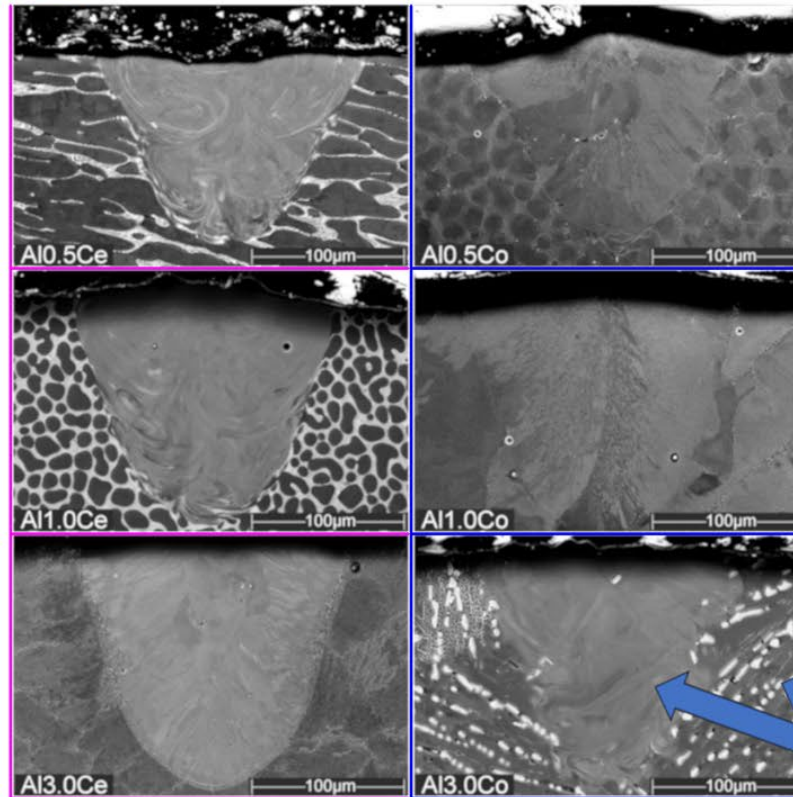


# Quantum Theory for Materials Modeling

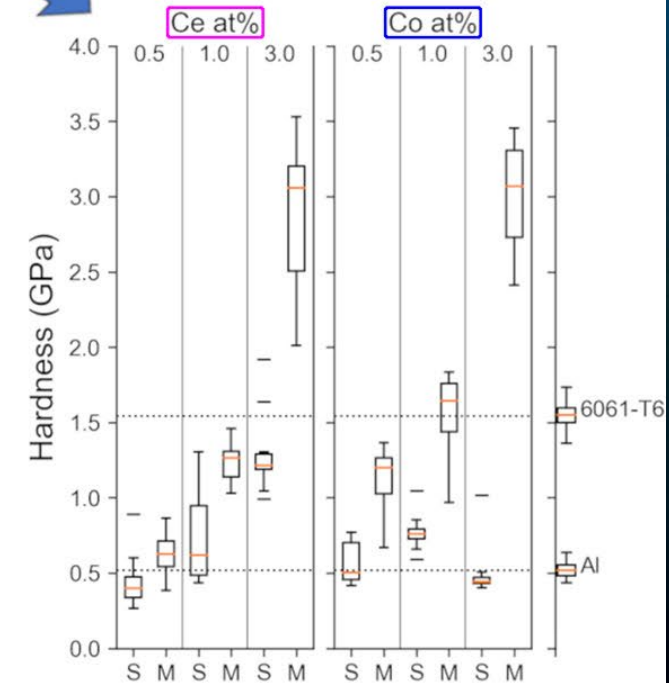




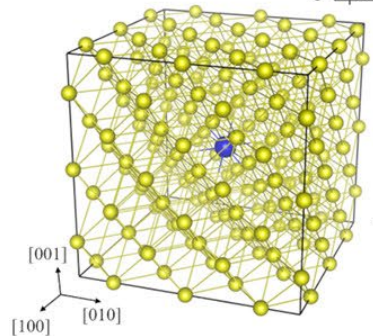
### Laser Glazed Tracks on Arc Melted Substrates



### Nanoindentation Hardness vs. Location



(S)ubstrate  
(M)elt Pool

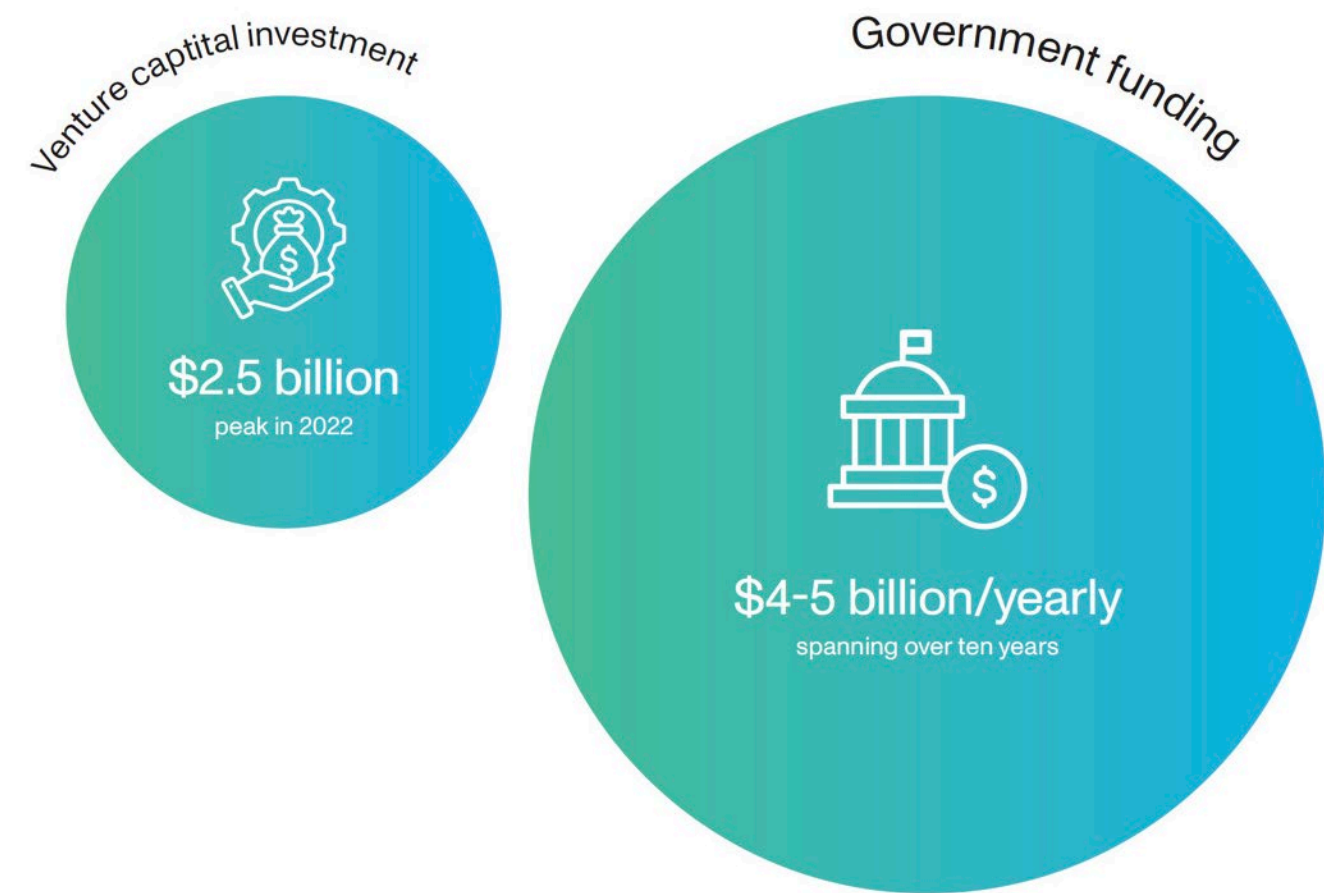


Density Functional Theory

Novel Al-X alloys with improved hardness, *Materials & Design* 192, 108699 (2020).



If conservatively spread over ten years (\$4-5 billion yearly), government funding commitments to quantum represent 2x the quantum VC investment peak in 2022.



## Roadmap

- SBIR proposals
- Partner with universities
- Develop novel solutions for industry applications



Founded in 2016  
Headquarter: Simon Fraser  
University, Vancouver, Canada  
Financing rounds: 2  
Raised \$140M VC capital

Founded in 2019  
Headquarter: Georgia Tech  
Finance round: 1  
Raised \$0.27M VC capital



Founded in 2021  
Headquarter: Austin, Texas  
Financing rounds: 2  
Acquired by Comstock Mining Inc.  
for \$50M for 50% equity



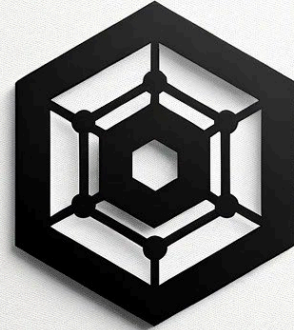
## Differentiation

- Physics-based materials design
- Engineering chemical nature



Why **ACCESS QUANTUM**?

...because **QUANTUM** is the future.



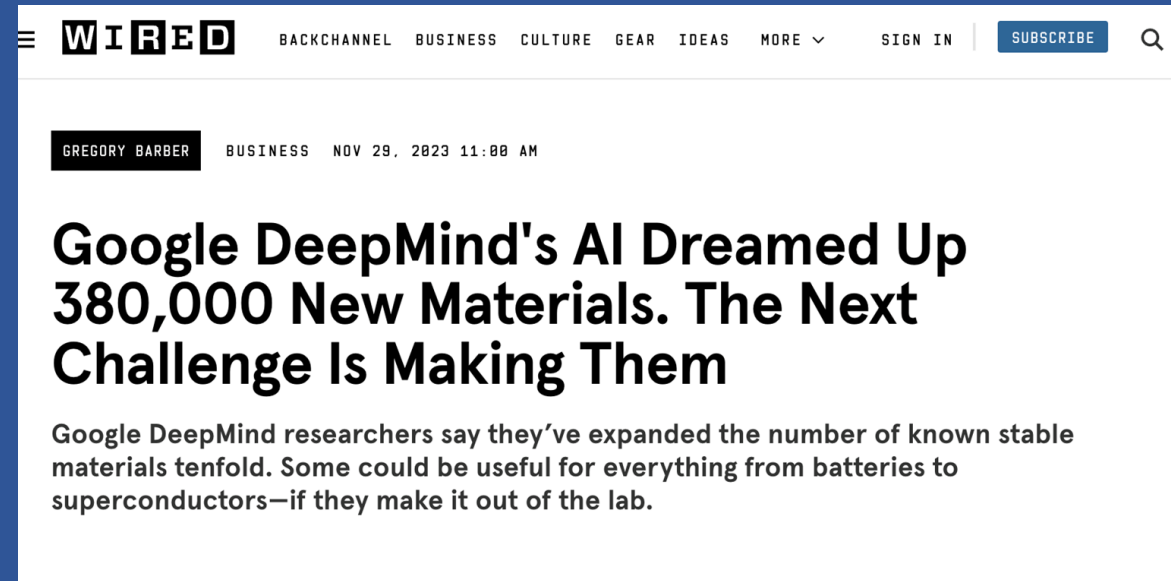
**DOUBLET**  
**= LABS =**

Creating ML tools for search, prediction, and analysis of new organic materials for quantum technologies and adaptable microelectronics

A. Balatsky

# We are at the cusp of AI/ML materials discovery

- Large-scale AI/ML materials discovery now possible
- **ML-driven inverse design** can only be achieved with high-quality training data
- ML-approaches to materials discovery require **comprehensive, high-quality databases**



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GREGORY BARBER | BUSINESS | NOV 29, 2023 11:00 AM

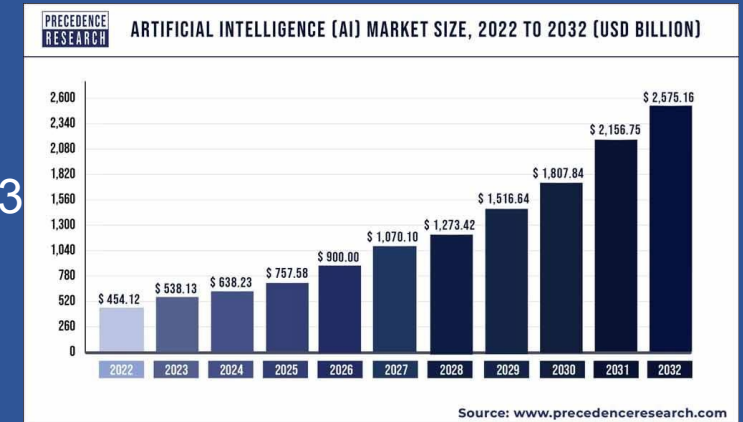
## Google DeepMind's AI Dreamed Up 380,000 New Materials. The Next Challenge Is Making Them

Google DeepMind researchers say they've expanded the number of known stable materials tenfold. Some could be useful for everything from batteries to superconductors—if they make it out of the lab.



# Market Size and Business Model

- Google, MSFT AI Materials expected to spend about \$100 M per year
- Projected AI overall market growth- 20X by 2030 to \$2 Trillion
- As a proxy, we estimate AI Materials will be 20X to \$2 Billion by 2030
- Subscription Model for academic institutions and business
- Springer Materials Database - \$25-50 K institutional subscription per unit.
- Total for 50 universities = \$1.2 M - \$2.5 M/year
- Citrine- Boeing as client \$2-\$5 M per year



# Organic materials are a unique opportunity for ML-driven materials discovery

- Needed for a range of application from **green quantum technologies** to **adaptable microelectronics**
- Current AI/ML materials discovery **do not include organic materials**

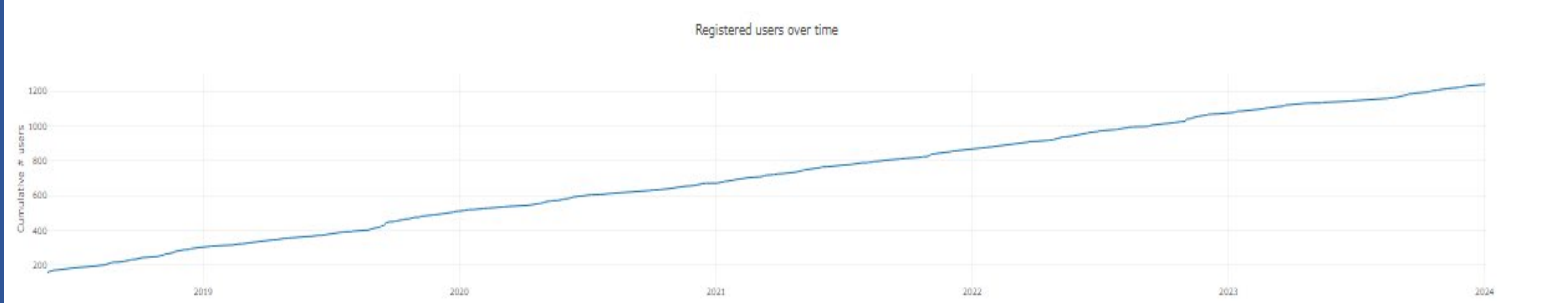
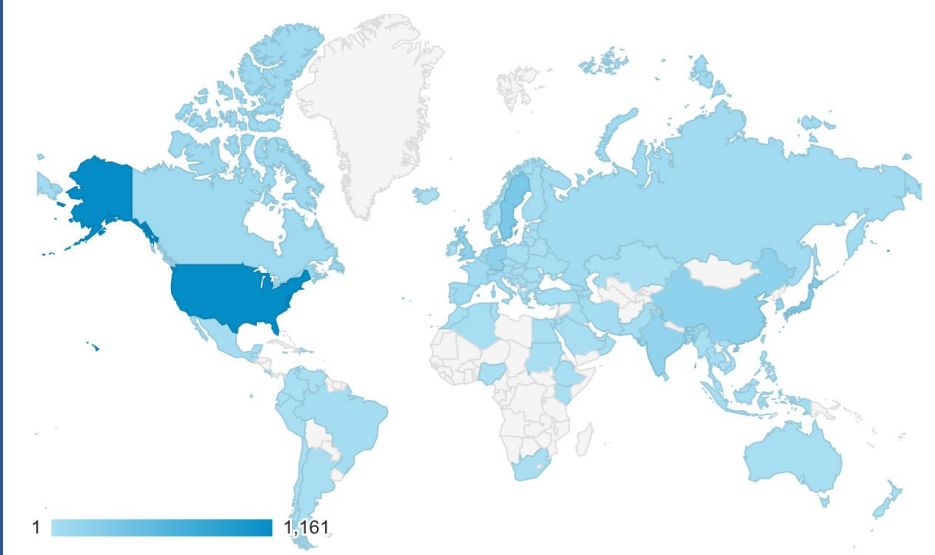


# Goal: Development of ML-Driven Materials Forecast Suite

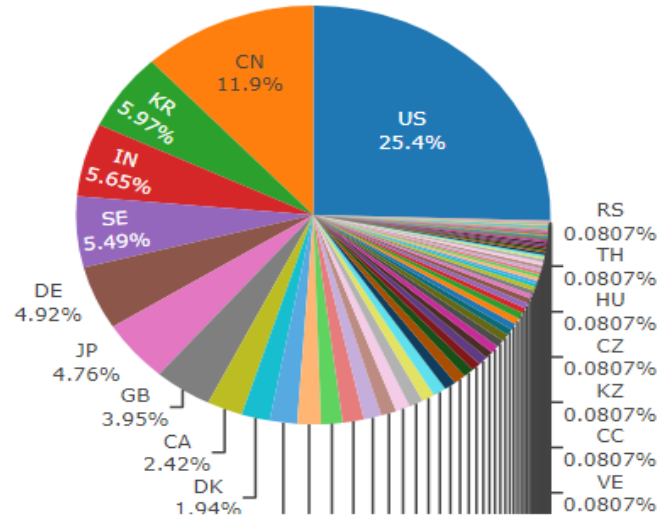
- **Training Data: The Organic Materials Database** (OMDB, <https://omdb.mathub.io/>) is a comprehensive repository of electronic and magnetic structures of diverse organic materials. Largest organic crystal database to date: 40000+ compounds
- **Analytic tools:** forecast of materials, devices, environmental, financial and technical performance.
- **Generative Models** and analytic predictive tools for new materials search and property forecasting, quantum materials.



# Organic growth of international userbase with increasing recent demand



Countries of registered users



# Uniquely Qualified Expertise and Resources of Team

- A Balatsky -CEO
- Avinash Raju – GAI
- Sinead Griffin – advisor



- A. Balatsky- American Phys Society Fellow, Am Association for Advancement of Science Fellow, Los Alamos Fellow – 7 years in OMDB, vision for organics in q tech use, 1 patent, ~400 papers,
- Sinéad Griffin - PI, Team Lead at LBL, Materials Project Scientist, PhD ETHZ, ~80 papers, MIT Rising Star in Physics, LBL Director’s Award