



Steven Koester  
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## Concept:

Enabling quantum information, science, and technology via network-wide nanofabrication infrastructure and expertise.

## Approach:

Rethink current methods to develop **quantum-specific** best practices:

- Materials processing & characterization to promote quantum performance
- Materials interface preparation, treatment and characterization
- Systems integration of quantum devices
- Packaging technologies

## Partners:

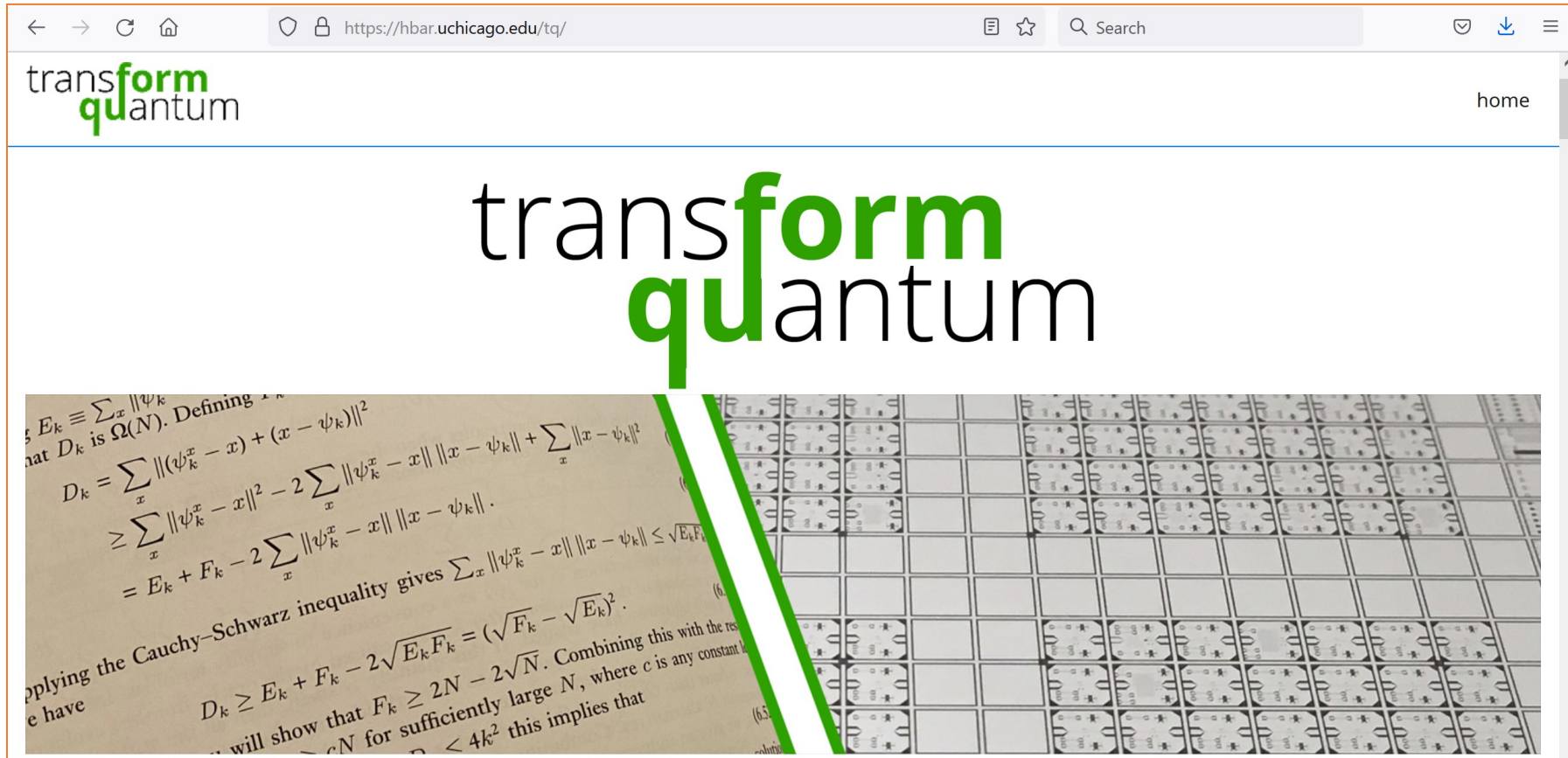
- **Global Quantum Leap:** NSF AccelNet network-of-network program (PI: S. Koester – UMinn); includes U.S., European & Asian networks
- **Chicago Quantum Exchange @ UChicago**
- **QNEXT** – DOE National Quantum Information Science Research Center
- More are welcome, esp. industry & national laboratories

## Activities:

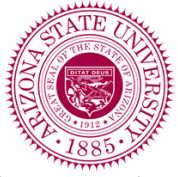
- ✓ Website providing easy information & links
- ✓ Contact person at each NNCI site for quantum-related development
- ✓ Workshops on quantum fabrication
- ✓ Roadmap for quantum fabrication

Under aegis of Global Quantum Leap  
(NSF Accelnet)

TransformQuantum website: <https://hbar.uchicago.edu/tq/>



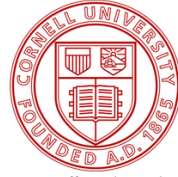
## Member institutions:



Arizona State University



Chalmers University of Technology



Cornell University



Georgia Institute of Technology



Harvard University



Jülich Research Center



University of Louisville



University of Minnesota



Massachusetts Institute of Technology



Montana State University



Northern Arizona University



North Carolina State University



University of Nebraska - Lincoln



Northwestern University



Stanford University



Syracuse University



University of California - Santa Barbara



University of California - San Diego



University of Pennsylvania



University of Texas - Austin



University of Washington



Virginia Institute of Technology



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## TransformQuantum Events

March 24-26, 2021

AFOSR sponsored

**Workshop on Nanoscale Acoustics in the Thermal and Quantum Regimes**

17 talks over 3 days; theory & experiment, international participation

April 13-15, 2021

NSF sponsored

**Workshop on Quantum Engineering Infrastructure**

400+ participants; 20+ presentations

Presentations:

- Overview from each NNCI node
- Hardware approaches (color centers; superconductors; ions; spins; topological)
- Breakout sessions

# Report from Quantum Engineering Infrastructure Workshop

- Report available on [TransformQuantum](#) and [Global Quantum Leap](#) websites
- Report provides:
  - Workshop goals
  - Summaries of presentations
  - Conclusions from breakout sessions
  - Recommendations for accelerating/advancing quantum capabilities *via* NNCI
- **Key takeaways:**
  - NNCI fabrication facilities must balance needs of specific hardware platforms with general-purpose useability
  - Access to key materials vital for future success
  - Better mechanisms to preserve & propagate quantum-related processes
  - Uniform and accepted characterization for quantum devices

# Road-mapping for Quantum

**Leads:** Chris Olber (Cornell), Vlad Pribiag (UMinn), Steven Koester (UMinn)

- Thrusts to cover different quantum platforms (superconducting; topological; trapped ions; spins; color centers)
- Recruited researchers in each topical area
- Includes industry, academia

## Goals:

- Version 1 roadmap by 2023
- Version 2 roadmap by 2025
- Publish in archival journal (e.g. npj Quantum Information)

Platform	Person	Institution	Partner?
<i>Organizer</i>	<i>Vlad Pribiag</i>	<i>UMN</i>	----
<i>Organizer</i>	<i>Christopher Ober</i>	<i>Cornell</i>	----
SC	Heike Riel	IBM	No
SC	Jonas Bylander	Chalmers	Yes - OpenSuperQ
SC	Mark Nelson	Skywater	No
SC/Topo	Valla Fatemi	Yale	No
Topo	Vlad Pribiag	UMN	Yes - NNCI
Topo	Sergey Frolov	U Pittsburgh	No
Topo	Chris Palmstrom	UCSB	No
Topo	Srijit Goswami	QuTech (Delft)	Yes - CQE
Trapped ion	Patty Lee	Honeywell	No
Spin	Ruoyu Li	IMEC	No
Color Center	Shangying Cui	HRL	No
Color Center	Greg Fuchs	Cornell	Yes - NNCI

# Global Quantum Leap (PI Steven Koester, UMinn)

NSF-supported AccelNet “network-of-networks”



**US-based partners**



**International partners**



# Global Quantum Leap (PI Steven Koester, UMinn)

## NSF-supported AccelNet “network-of-networks”

### GQL kick-off meeting

- Feb. 10-11 2021
- Held by Zoom
- Two days, schedule accommodates Japan, US and Europe participants
- Talks from international partners: OpenSuperQ (Europe), NIMS (Japan), ML4Q (Germany)

Time slot (CT)	Agenda (Day 1, February 10)
5:00 AM	Steven J. Koester, University of Minnesota, "Welcome and introduction to the Global Quantum Leap."
5:30 AM	Oliver Brand, Georgia Institute of Technology, "Overview of National Nanotechnology Coordinated Infrastructure."
5:50 AM	Yasuo Koide, National Institute for Materials Science, "Overview of Nanotechnology Platform Japan."
6:10 AM	Frank Wilhelm-Mauch, Saarland University, "Overview of OpenSuperQ Project."
6:30 AM	Hendrik Bluhm, RWTH Aachen University, "Overview of Matter and Light for Quantum Computing (ML4Q)."
6:50 AM	Supratik Guha, University of Chicago, "Overview of Chicago Quantum Exchange."
7:10 AM	Steven J. Koester, Wrap up and review of plan for day 2
7:20 AM	Adjourn
Time slot (CT)	Agenda (Day 2, February 11)
5:00 AM	Steven J. Koester, University of Minnesota, "Introduction to day 2 agenda."
5:10 AM	Split into breakout sessions. <i>All attendees except for executive committee (EC) will follow the Day 2 agenda below.</i>
5:15 AM	Toshikazu Kariyado, NIMS, "Theory of band engineering in 2D materials with superstructures." (NPJ)
5:30 AM	Takuya Iwasaki, NIMS, "Single-carrier transport in graphene/hBN superlattice-based quantum dot devices." (NPJ)
5:45 AM	Julian Teske, RWTH Aachen University, "Software tools for simulating and controlling qubit experiments." (ML4Q)
6:00 AM	Luca Banszerus, RWTH Aachen University, "Bilayer graphene - a tunable semiconductor for quantum electronics." (ML4Q)
6:15 AM	Jonas Bylander, Chalmers University of Technology, "Design, fab, and testing of a European superconducting quantum processor." (SuperQ)
6:35 AM	Manish Kumar Singh, University of Chicago, "Chip scale material growth for QIS applications." (CQE / NNCI)
6:50 AM	Vlad Pribiag, University of Minnesota, "1D and 2D Platforms for Topological Quantum Devices." (NNCI)
7:05 AM	Rejoin breakout sessions.
7:05 AM	Steven J. Koester, Wrap up.
7:20 AM	Adjourn

## Global Quantum Leap (PI Steven Koester, UMinn)

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### Exchange programs

- 10-week International Research and Training Experience (IRTE)
- NIMS/NPJ (Tsukuba, Japan)
- Summer 2022
  
- 12-week co-sponsored Undergraduate Research Internship Program
- ML4Q (Cologne, Aachen, Bonn)
- Summer 2022
  
- Advertising on GQL and TransformQuantum websites
- Please publicize these opportunities in your local NNCI sites!



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