Overview of SUNY Research Enterprise and Quantum Research Capacity

Grace Wang
Senior Vice Chancellor for Research and Economic Development
SUNY
SUNY Leads in Research

64
Campuses

424 K
Degree Seeking Students

$13 Bn
Annual Operating Budget

14
Doctoral Degree Granting Institutions

13
University Colleges

7
Technology Colleges

30
Community Colleges

18
Incubators and Accelerators (NYSERDA Funded)

6
SUNY Centers for Advanced Technology

7
SUNY Centers of Excellence

22
Small Business Development
SUNY Research Enterprise

$1.6 Bn  Annual R&D Expenditure (FY 2017)

2,700  Principal Investigators

7,100  Projects
SUNY Innovation Activities

Ranks #30 among worldwide universities for U.S. granted utility patents in 2018

1,522  Issued Patents

717  Active License Agreements

110  Active Startups

18  Incubators
SUNY Economic Impact

$28.6B
IN NEW YORK STATE ANNUALLY, 2015-16
(1.9 percent of gross state product)

$8.17
RETURN ON INVESTMENT for every $1 of state funding

34%
SHARE OF EDUCATED WORKFORCE WITH A DEGREE FROM SUNY
30,600 Students
$401 M Annual R&D (FY 2017)
26,000 Students

$238 M Annual R&D (FY 2017)
Binghamton University
State University of New York

17,300 Students
$98 M Annual R&D (FY 2017)
3,000 Students
$309 M Annual R&D (FY 2017)
SUNY Medical Schools and Hospitals

4 Medical Schools
3 Hospitals
$2.8 Bn Annual Revenue
9 M Unique Patient Records
SUNY Quantum Research and Education Capacity

- Quantum Materials, Devices and Packaging
- Quantum Information Science
- Quantum Enabled Research Frontiers

Quantum Sensing, Quantum Communication, Quantum Computing

Quantum-Smart Workforce
Quantum Materials, Devices and Packaging
Superconducting Materials

Growth, characterization applications (e.g. Josephson Junctions) of superconducting films (such as YBa$_2$Cu$_3$O$_7$, NbN, MoN, and TiC).

Refs:  

Quanxi Jia et. al. (Currently at University at Buffalo)
Quantum Qubit Fabrication & Measurement

- Wafer-scale, high-quality qubit fabrication in SUNY Poly 300mm facility
- Collaboration with AFRL and NIST

Papa Rao et.al., SUNY Polytechnic Institute
Center for Heterogeneous Integration Research in Packaging (CHIRP)

- Thermal Management
- Holistic Scaleout Designs Within Heterogeneous Packages
- Power Delivery and Power Management Systems
- Minimizing Thermal Interfacial Resistance
- Alternative Fine Pitch Interconnect Technologies

Bahgat Sammakia (Center co-Director), Binghamton University
In collaboration with Purdue University
Computational and Experimental Tools for Next-gen Nanoelectronics Packaging

Electromigration and Thermomigration Reliability

All Graphene Nano Ribbon TFET Switch

Molecular Dynamics

Cemal Basaran (Center Director), University at Buffalo
Benefits of AIM Photonics TAP Facility

- 300mm wafer compatibility
- Die attach for 2.5D and 3.0D packaging
- Automated fiber attach
- High speed automated Electro-optical testing
- Metrology for process capability evaluation
- MPW Compatibility
- Custom wafer compatibility
Quantum Information Science
Theoretical analysis of a nearly optimal analog quantum search

Carlo Cafaro\textsuperscript{1} and Paul M Alsing\textsuperscript{2}

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International Journal of Quantum Information

| Vol. 17, No. 03, 1950025 (2019)
| Research Paper

Continuous-time quantum search and time-dependent two-level quantum systems

Carlo Cafaro and Paul M. Alsing
Superdense teleportation using hyperentangled photons

Trent M. Graham, Herbert J. Bernstein, Tzu-Chieh Wei, Marius Junge & Paul G Kwiat

Nature Communications 6, Article number: 7185 (2015) | Download Citation

Spontaneous emission of matter waves from a tunable open quantum system

Ludwig Krinner, Michael Stewart, Arturo Pazmiño, Joonhyuk Kwon & Dominik Schneble

Nature 559, 589–592 (2018) | Download Citation
In collaboration with BNL, ORNL, Stockholm, and Padova.

Possible NY partners: AIM Photonics, AFRL.
Quantum Computing Enabled New Research Frontiers
Informatics Driven Discovery of Quantum Materials

References:
MRS Bulletin 43; (Sept.2018): Data centric science for materials innovation; I Tanaka, K.Rajan & C. Wolverton ;
Predicting New High-Energy Compounds

Artem R. Oganov et. al., Stony Brook University

Hafnium nitride (HfN10) structure. Credit: MIPT
Faulty Genomic Pathway Linked to Schizophrenia

“... could lead to treatments for pregnant mothers at risk for bearing children with the disease.”
-- NSF

Michal K. Stachowiak, et. al., University at Buffalo
SUNY Quantum Research and Education Capacity

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Quantum Sensing
Quantum Communication
Quantum Computing

Quantum-Smart Workforce
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