Building a Quantum-Ready Workforce

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# The Big Picture

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<th>Applications</th>
<th>Quantum Systems</th>
<th>Engineering Technology</th>
<th>Workforce</th>
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<td><strong>Quantum Sensing:</strong> Atomic clocks, magnetometers, gravimeters, inertial navigation</td>
<td><strong>Atomic Qubits:</strong> Trapped ions, Rydberg atoms</td>
<td>Compact vacuum systems, laser technology, integrated photonics, control software and electronics, fabrication technology</td>
<td>PhD Physicists, Mechanical Engineers, Electrical Engineers, Vacuum Engineers, Cryo Engineers, Photonics Engineers, Fabrication Engineers, Software Engineers, Chemists, Mathematicians, Algorithm Developers, Technicians, Project Managers, IP/Patent Lawyers, Entrepreneurs</td>
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<td><strong>Quantum Computing:</strong> Quantum annealing, Noisy intermediate-scale quantum (NISQ), Logical qubits</td>
<td><strong>Superconducting Qubits:</strong> Josephson junctions, Transmon qubits, Flux qubits</td>
<td>Dilution refrigerators, microwave electronics, fabrication technology, superconducting materials</td>
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<td><strong>Quantum Communication:</strong> Quantum key distribution, quantum repeaters</td>
<td><strong>Emerging Qubit Technology:</strong> Photonic qubits, Semiconductor quantum dot qubits, Nitrogen-vacancy diamonds</td>
<td>Frequency conversion (uwave – telecom), Low SWaP-C devices, Assembly-level languages</td>
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**Applications**

- Quantum Systems
- Engineering Technology
- Workforce

**Quantum Sensing:** Atomic clocks, magnetometers, gravimeters, inertial navigation

- **Atomic Qubits:** Trapped ions, Rydberg atoms
  - Compact vacuum systems, laser technology, integrated photonics, control software and electronics, fabrication technology

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  - Dilution refrigerators, microwave electronics, fabrication technology, superconducting materials

**Quantum Communication:** Quantum key distribution, quantum repeaters

- **Emerging Qubit Technology:** Photonic qubits, Semiconductor quantum dot qubits, Nitrogen-vacancy diamonds
  - Frequency conversion (uwave – telecom), Low SWaP-C devices, Assembly-level languages

**Workforce**

- PhD Physicists, Mechanical Engineers, Electrical Engineers, Vacuum Engineers, Cryo Engineers, Photonics Engineers, Fabrication Engineers, Software Engineers, Chemists, Mathematicians, Algorithm Developers, Technicians, Project Managers, IP/Patent Lawyers, Entrepreneurs
Growing Demand for a Quantum-Ready Workforce

Challenges:
1. Understanding the technical needs of the ecosystem
2. Increasing exposure at high school and undergrad level
3. Attracting and retaining talent
4. Developing a more diverse QIST workforce
Quantum Career Pathways

Quantum Physicist Pathway:

- Bachelors
- Masters
- Doctoral
- Postdoc

10 Years

The Quantum Workforce
Quantum Career Pathways

Quantum Physicist Pathway:

10 Years

The Quantum Workforce

Physical Scientists
Computer Scientists
Mathematicians
Engineers
Quantum Career Pathways

Quantum Physicist Pathway: Bachelors → Masters → Doctoral → Postdoc

US Science and Engineering Bachelor Degrees

- Physical Scientists
- Computer workers
- Mathematics
- Engineers

Millions of Workers:
- Hispanic Men
- Hispanic Women
- Black Men
- Black Women
- White Men
- White Women

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
Quantum Career Pathways

US Science and Engineering Bachelor Degrees

- Hispanic Men
- Hispanic Women
- Black Men
- Black Women
- White Men
- White Women

Millions of Workers: 0, 0.5, 1, 1.5, 2

Physical Sciences
Computer workers

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
Quantum Career Pathways

QSTEP: Quantum Science Technologist Education Pathways
Establish industry-driven curricula at 2-year institutions to address critical workforce demand

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High School Camps
Bridge Programs
Teacher Support

Physical Scientists
Computer Scientists
Mathematicians
Engineers

Technician Jobs

Millions of Workers:

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
New Mexico’s established excellence in QIST research, our ongoing workforce development programs within and throughout the state, and our diverse majority minority community make it an ideal state for addressing the nationally recognized challenges.

If you want to get involved: qnm@unm.edu