Quantum Research Centre

# Quantum Communications at the Technology Innovation Institute, Abu Dhabi

**EPIC Quantum Technologies:** New Opportunities Now for the Quantum Photonics Supply Chain (April 2021)

Technology Innovation Institute

# Introduction to TII's Quantum Research Centre

## Basic and applied research into quantum technologies in the UAE

- Based in **Abu Dhabi**, the capital of the United Arab Emirates
- Under the umbrella of the Advanced Technology Research Council (**ATRC**)
- **Technology Innovation Institute** hosts 7* research centres, covering: Autonomous Robotics, Directed Energy, Advanced Materials, Cryptography, Digital Security, Secure Systems and **Quantum**

- Within the Quantum Research Centre we have six groups, three experimental, two theory and one middleware*
- Experimental groups are **Quantum Computation, Quantum Sensing** and **Quantum Communication**
- All PIs joined in late 2020, along with our CRO Prof Jose Ignacio Latorre
- Currently (April 2021) the experimental groups are in the recruitment stage, and labs are undergoing fit-out works
- All significant (i.e. long lead time) procurement is complete, most of it is delivered

# Roadmap for Quantum Communication

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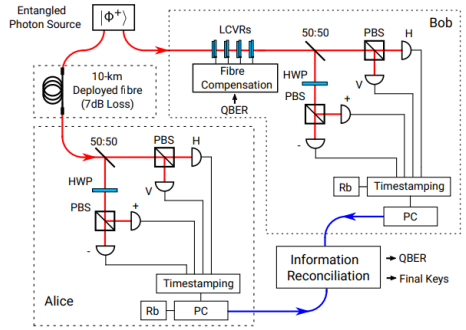
## Three primary research directions




### Quantum Key Distribution

Practical systems & field tests

Develop and test domestic QKD capabilities for the UAE, to secure the nation's networks in a QC-enabled future.

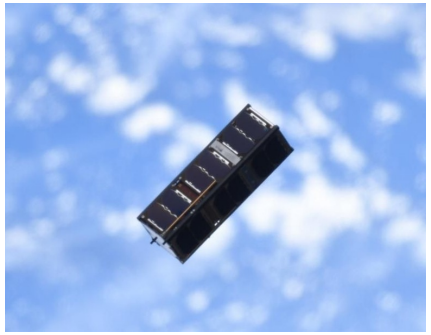
Act as a regional locus for QKD research and know-how, including training and awareness-building activities.

### On-chip Light Sources

Devices for quantum networks

On-chip photon pair sources and single photon sources, including technologies for multiplexing and switching multiple sources.

Integration of chip-based sources into live quantum networks.



SpooQy-1 in orbit, courtesy CQT/NASA

### Future Quantum Networks

Exploring range, alternative protocols

Technologies for increasing the range of QKD and related protocols

Testbeds for protocols such as device independent QKD, entanglement swapping, etc.

# Opportunities & challenges

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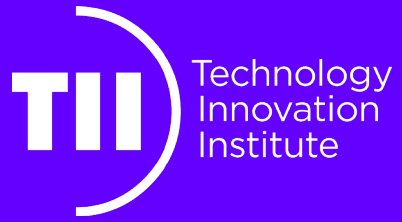
## Focusing on near-term (5 year horizon)

- **Domestic:**
  - Challenge: Growing research culture in the UAE – little prior heritage for Quantum in particular
  - *Opportunity to establish great foundations for future industry (blank slate)*

  - Challenge: Engaging with local industry to promote use cases and technology transfer
  - *Opportunity exists in the local enthusiasm for innovation and technological solutions*

  - Challenge: Domestic capabilities in precision fabrication, telecoms equipment etc. is present but not well connected
  - *Opportunity to discover and connect some capabilities, and identify promising niches to be filled*

- **International:**
  - Many key components for Quantum Communications are sourced from a very small number of companies
  - Most suppliers concentrated in the EU, North America and China
  - Supply chains are often vulnerable: hard to make long-term bets on particular technologies
  - Current volume requirements are low: mostly still a niche industry
  - Export restrictions are starting to become more visible
  - *For all: opportunities clearly exist for new entrants to contribute meaningfully to the ecosystem, or for established players to expand their portfolio/research areas*





EPIC Quantum Technologies Meeting - James A. Grieve (james.grieve@tii.ae)