Emerging Technologies Track
Session #4

Quantum

Meet Your Panel

Dr. Al Mink
Moderator
Managing Director
MIT Alumni Angels DC

Dr. John Burke
National Security Perspective
Prin Dir Quantum Science,
OUSD R&E for S&T

Dr. Joseph Broz
Technology Provider Perspective
VP, Quantum Supercomputing
IBM

Scott Buchholz
Consultant Perspective
Global Quantum Lead
Deloitte Consulting

Dr. Jeremy Levy
Academia Perspective
Distinguished Professor of Physics
University of Pittsburgh

Today's Mission & Flight Plan

Today's Mission

Identify the highest potential applications (use cases) for each of the three Quantum technologies -- and identify near-term actions for advancing them.

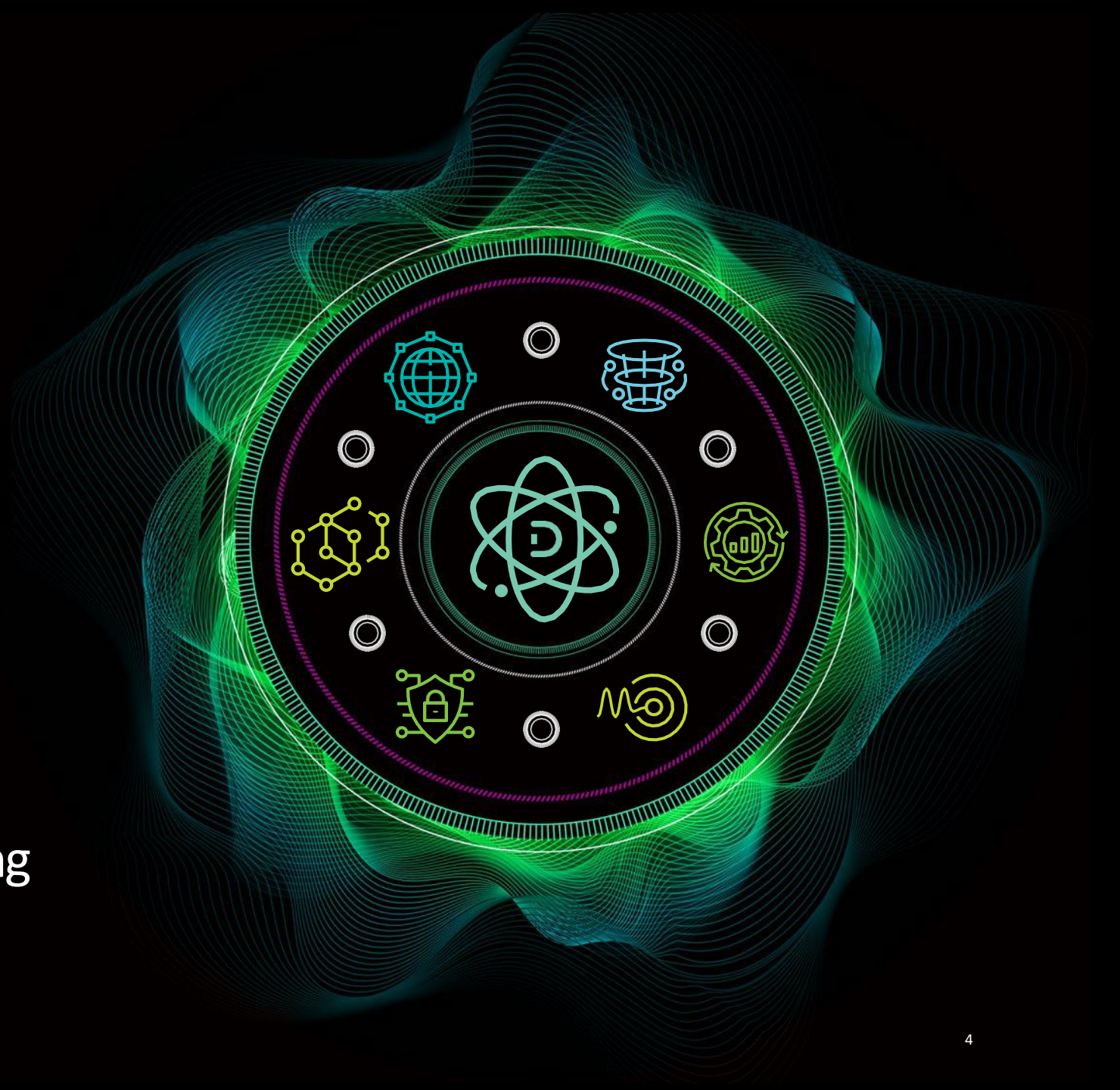
Our Flight Plan

✓Introductions

- Three Quantum Technologies
- For each QT:
  - Potential applications & timeframes
  - Near-term actions for advancing these applications
- Wrap-up with Key Take-aways
- *Attendee Networking with Panelists!*

Questions?

Deloitte.

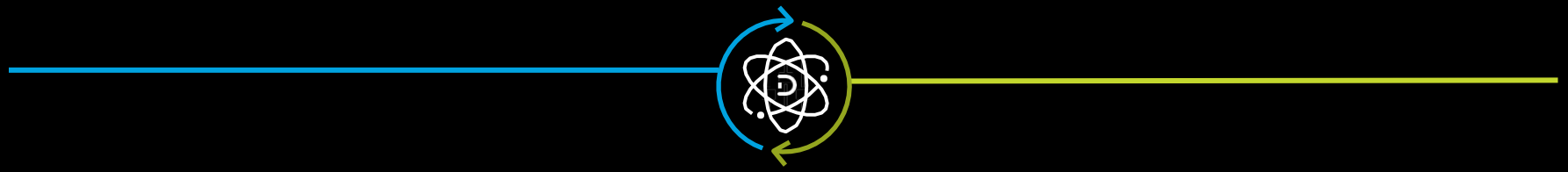


March 12th, 2024

The State of Quantum Computing

What are the quantumtechnologies?

There are 3 main quantum technologies. Today, we will focus on quantum computing.



QUANTUM TECHNOLOGIES

Computing

Controllable devices that exploit the properties of quantum physics to perform computation.

Sensing

Sensing devices use quantum mechanical effects to **enhance accuracy and sensitivity** in signaldetection.

Communications

Creates **secure communication networks.** Certain technologies can detect interception or eavesdropping.

Quantum Technology #1: Sensing

Navigation & Timing Applications
(TRL 3-5; Capabilities < 5yrs)

1. GPS Alternative?
2. Military Increased Precision Targeting?
3. …
4. …
5. …
6. …
7. …
8. …

Spectrum, Imaging, & Detection Apps
(TRL 2-5; Capabilities 4-10yrs)

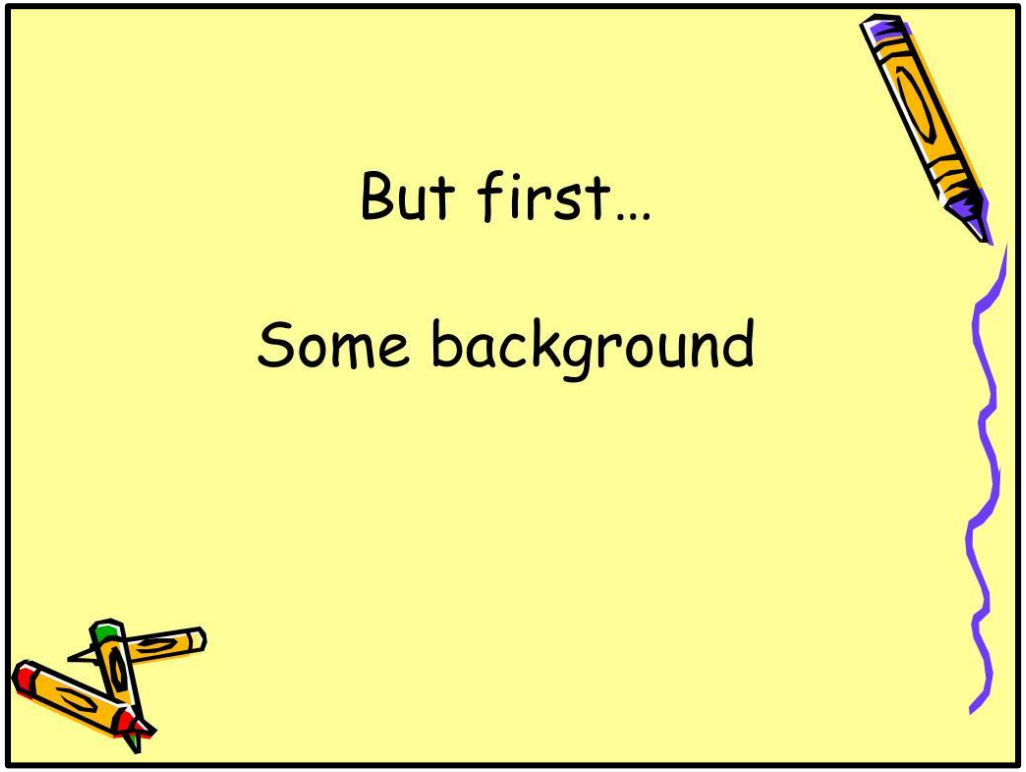
1. Electromagnetic sensors?
2. Optical Detectors?
3. Wireless applications?
4. Imaging applications?
5. …
6. …
7. …
8. …

Quantum Technology #2: Communications

Applications?

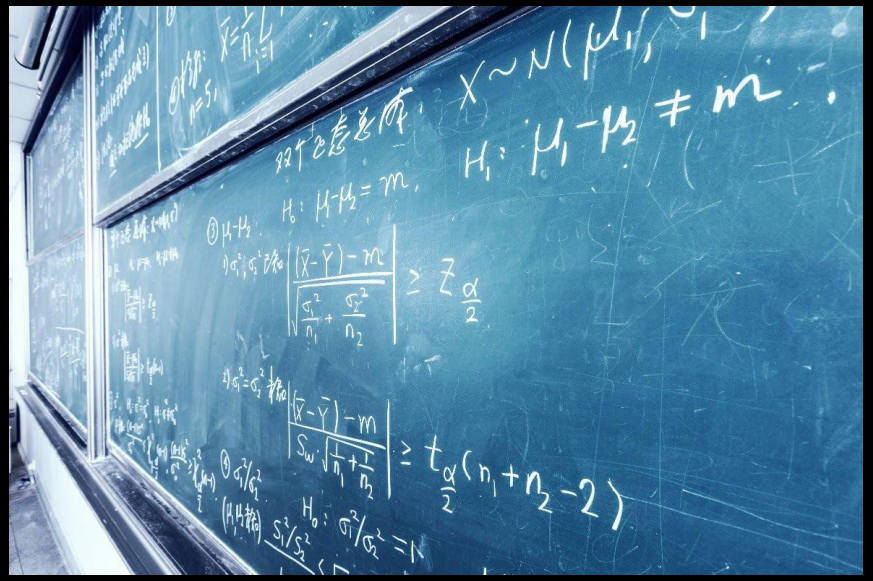
1. …
2. …
3. …
4. …
5. …
6. …

Quantum Technology #3: Computing



What's different about quantum computers?

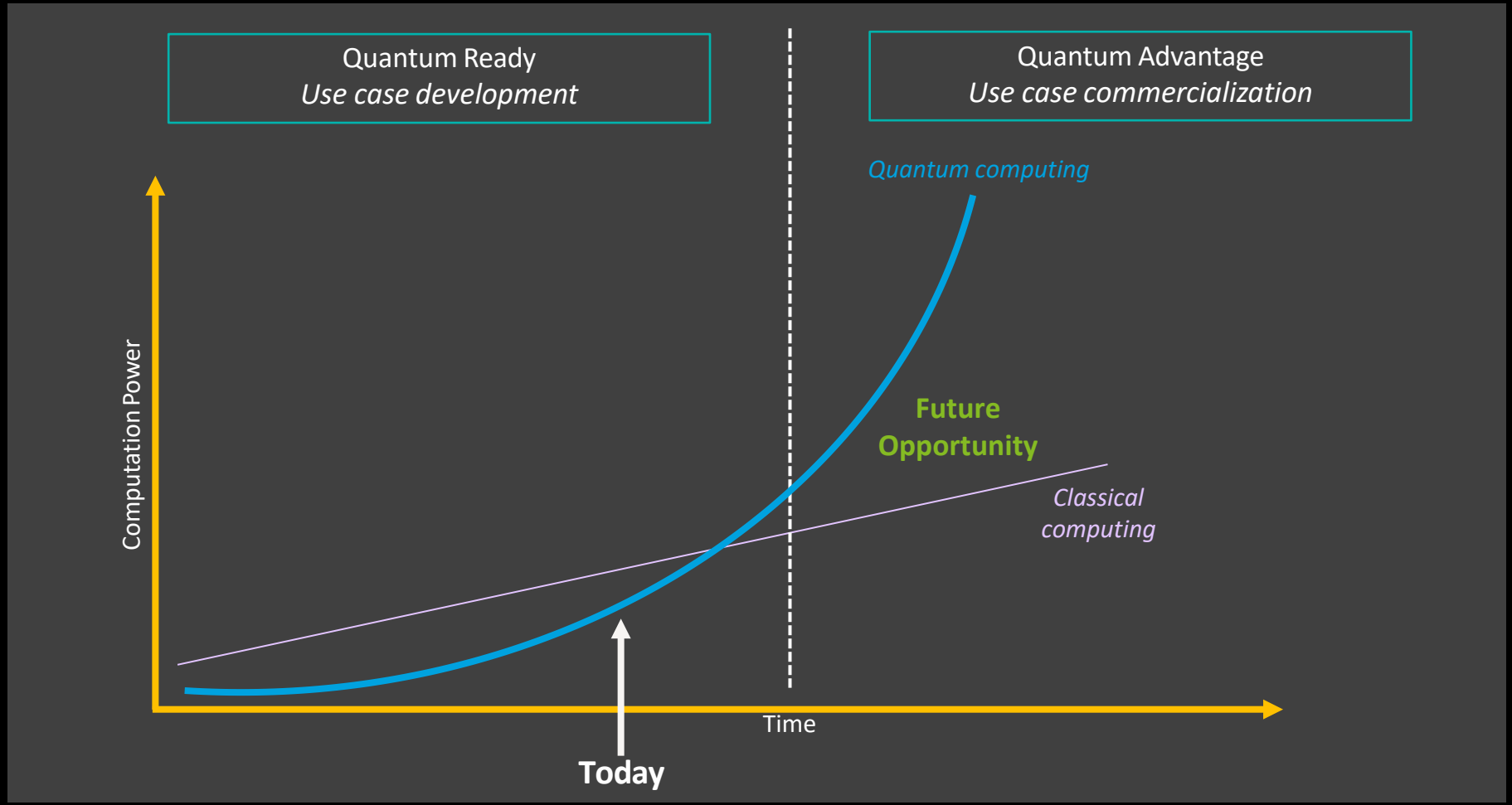
*Classical computers use **math***



*Quantum computers use **physics***

Quantum computers are rapidly maturing

And yet, we're still looking forward to a time soon when a quantum computer can do something that can't be done on today's classical computers.



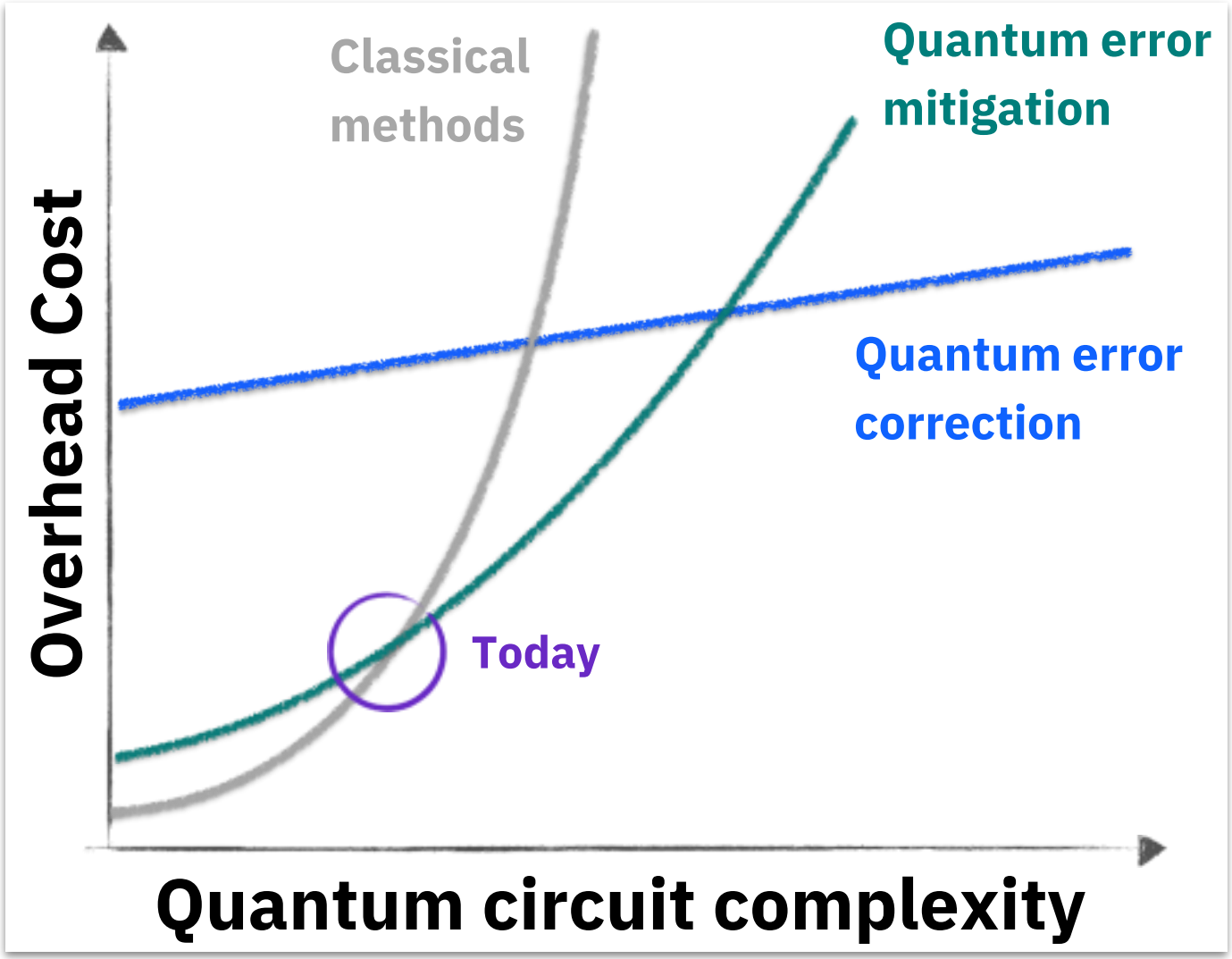
There are many ways to build a quantum computer

There are many ways of building a quantum computer. Each has its relative strengths, challenges and maturity curves.
And this is only a subset…

More mature ⟵ ⟶ *Less mature*

Annealer	Superconducting	Trapped Ions	Neutral Atom	Photonics	Silicon Quantum Dots
D-Wave ParityQC Fujitsu	IBM Quantum rigetti, Google, aws OQC	Quantinuum AQT IonQ	QuEra Computing Inc. atom computing Pasqal	Xanadu PsiQuantum ORCA Computing	intel diraq Quantum Motion

Quantum error mitigation provides a path to both beyond-classical computation and realizing quantum error correction.



Use Cases for Quantum Computing

In the coming years quantum computing is expected to enable innovations across industries. This represents the application of the technology as it stands today.

Communication & Cybersecurity

- *Post Quantum Encryption*
- *Quantum Random Number Generation*
- *Quantum Key Distribution*

Optimization

- *Resource Scheduling*
- *Vehicle Route Optimization*
- *Fraud Detection*
- *Portfolio Optimization*
- *Feature Selection*

Artificial Intelligence & Machine Learning

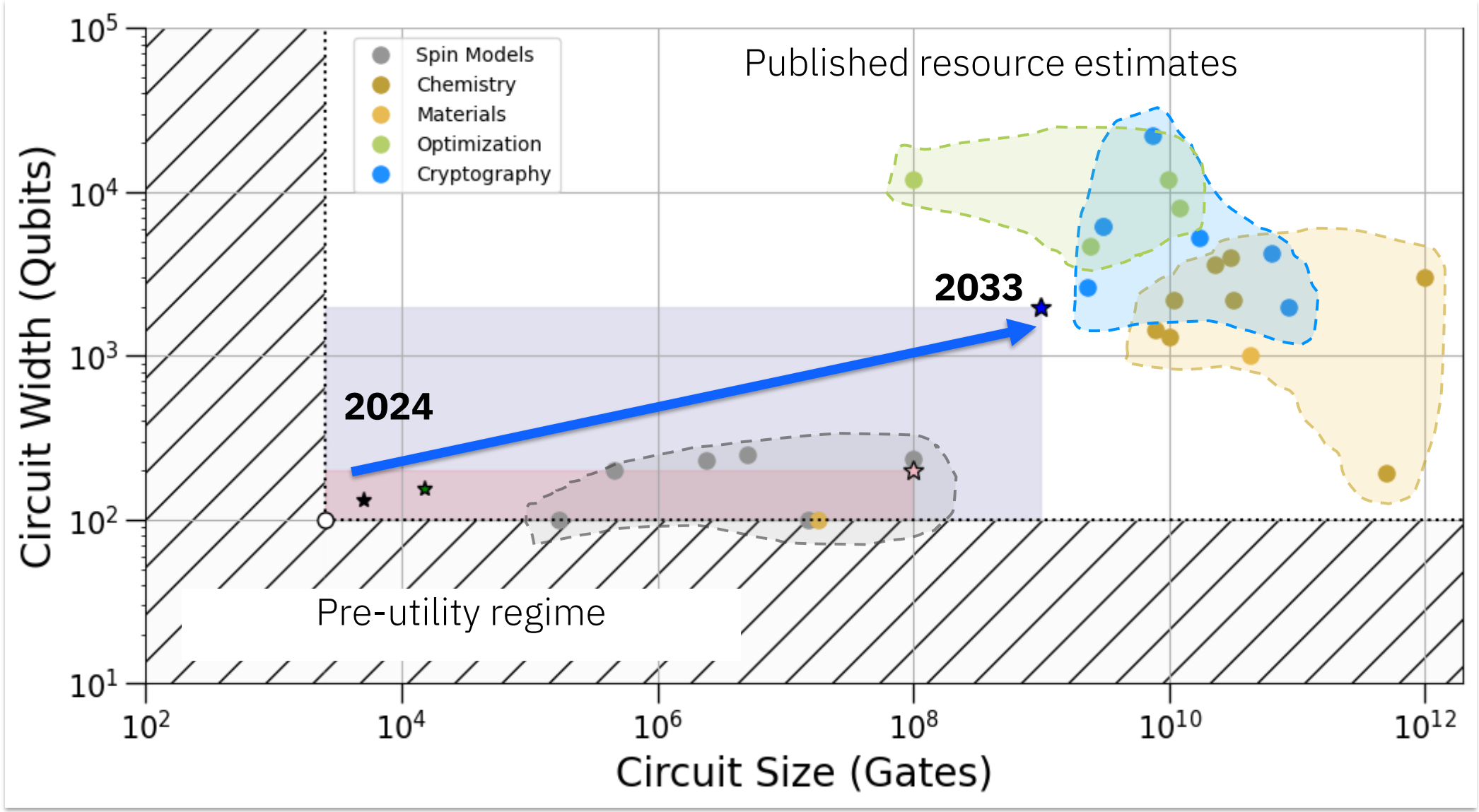
- Text Analytics
- Image Classification
- Anomaly Detection
- Recommendation Engines
- Predictive Forecasting

Chemistry & Material Science

- Drug Discovery
- Molecular Simulation
- Material Design
- Multi-Omic Classification
- Protein Folding

Immediate — ***Now*** — Mid Term — Longer Term →

As we advance our roadmap, more applications of quantum computers will be unlocked.



Quantum Technology #3: Computing

Cryptography/Cyber Apps (Immediate?)

1. Post Quantum Encryption?
2. Quantum Random Number Generation?
3. Quantum Key Distribution?
4. …
5. …
6. …
7. …
8. …

Optimization Apps (Now?)

1. Resource Scheduling?
2. Vehicle route optimization?
3. Fraud detection?
4. Portfolio Optimization?
5. Feature Selection?
6. Computational Fluid Dynamics?
7. …
8. …

Quantum Technology #3: Computing

AI & Machine Learning Apps (Mid-Term?)

1. Text Analytics?
2. Image Classification?
3. Anomaly Detection?
4. Recommendation Engines?
5. Predictive Forecasting
6. …
7. …
8. …
9. …

Chemistry & Material Science Apps (Longer-Term?)

1. Drug Discovery?
2. Molecular Simulation?
3. Protein Folding?
4. Material Design?
5. Multi-Omic Classification?
6. …
7. …
8. …
9. …

Quantum Technology #3: Computing

Quantum Technology #3: Computing

Getting Prepared - Actions
(Soon?)

1. …
2. …
3. …
4. …
5. …
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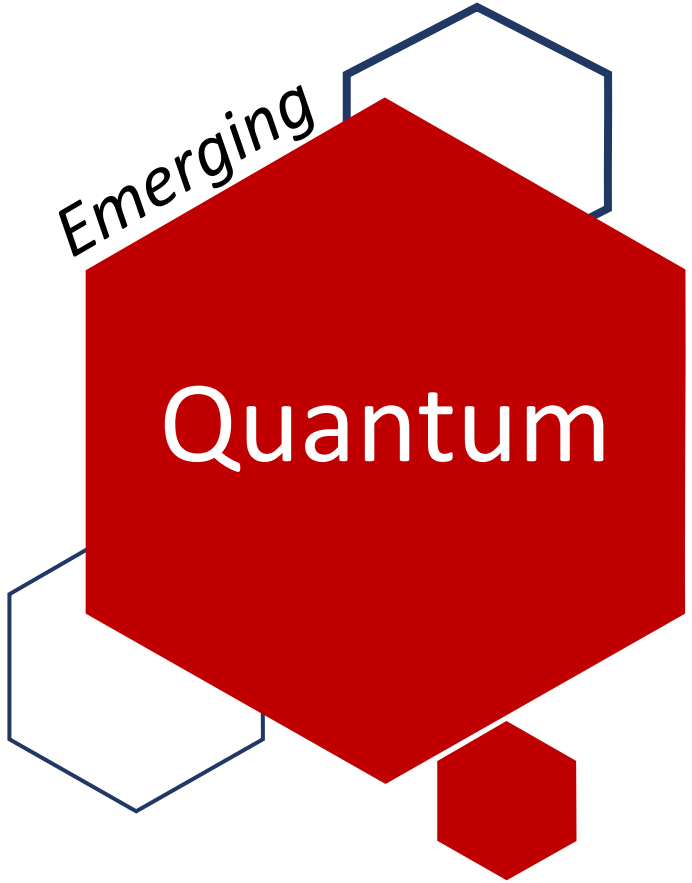
8. …
9. …

Track 1: **Emerging Tech**



Focus: Identify the highest potential *applications* (use cases) for each of the three Quantum technologies -- and identify near-term *actions* for advancing them

Key Takeaways:

1. **One**
2. **Two**
3. **Three**
4. **Four**

***Speakers**: Dr. John Burke | Scott Buchholz | Dr. Joseph Broz | Dr. Jeremy Levy | Dr. Al Mink*

Emerging Technologies Track

Session #4 – END

(Backup slides follow)

Quantum

Quantum Technology

Continued…

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Quantum Technology

Continued…

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Quantum Technology

Continued…

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- …

Moderator Notes – Fun Facts

Jeremy – Bacon number is 2.
Scott – Speaks to spanish wife in romantic French
Joe – Horseman. Come from cowboy country, western Nebraska
John – Photographer. Even planning trip to see total solar eclipse (Texas). With Fran?!