

# Four Questions about Quantum Computing

1. What is quantum computing?
2. What has been done?
3. Where is it going?
4. What does quantum computing say to quantum physics?

# Four Questions about Quantum Computing

1. What is quantum computing?

(surprisingly difficult to answer)

2. What has been done?

(what I found out on my summer vacation)

3. Where is it going?

(speculation)

4. What does quantum computing say to quantum physics?

(epistemological analysis)

# Four Questions about Quantum Computing

## 1) What is quantum computing?

- Quantum algorithms
- Quantum circuits
- Quantum machine analogous to Turing machine

# Quantum Links

## Quantum Algorithms

- Shor, Peter W., 1995, [Polynomial-Time Algorithms for Prime Factorization and Discrete Logarithms on a Quantum Computer](#)
- [Grover's Algorithm](#)
- [Berkeley Book on Quantum Algorithms](#)

## Quantum Circuits

- [Quantum Circuit - Wikipedia, the free encyclopedia](#)
- [The Quantum Circuits Group](#)
- [Q-circuit](#)

## Quantum Turing Machines

- [Quantum Turing machine - Wikipedia, the free encyclopedia](#)
- [Quantum Turing Machines.\(Berkeley\)](#)
- [Quantum Turing Machine Simulator \(Mathematica\)](#)

# Four Questions about Quantum Computing

## 2. What has been done?

- Particles
- Photons
- Superfluids
- Junctions

# Four Questions about Quantum Computing

## 3. Where is it going?

- Junctions
- Superfluids

# Four Questions about Quantum Computing

4. What does quantum computing say to quantum physics?
  - Does entanglement exist?
  - What are the *real* statistics?
  - Is the theory still satisfactory?

“One of the interesting things that quantum information processing has brought is an interesting way to look at the contrast between the classical and quantum worlds, that is, looking essentially at how much it costs to do something. How do resources scale when you're looking at a quantum problem compared to a classical problem? At the boundary between the classical and quantum worlds you have quantum computers, which are a macroscopic scale machine that operates on a preserved quantum phenomenon. It's a really interesting physics task.”

- Prof. Ian Walmsley, Head of Atomic & Laser Physics,  
[Interview for Dr. Dobb's.](#)



# Links

- This Presentation
  - [http://www.softwoehr.com/softwoehr/qc/QC\\_FIG.odp](http://www.softwoehr.com/softwoehr/qc/QC_FIG.odp)
- My Dobb's articles
  - [Supercool Dude: A chat with Anthony J. Leggett](#)
  - [The Hdirt factor: A chat with John Martinis](#)
  - [Frustrated Bosons on a Two-leg Ladder: A chat with Simon Trebst](#)
  - [Topological Quantum Computation: A chat with Michael Hermele](#)
  - [Quantum Memory: A chat with Ian Walmsley](#)
- Various Web resources
  - [Quantiki](#)
  - [Google Research: Machine Learning with Quantum Algorithms](#)
  - [DWaveSys.com](#)
  - [My Quantum Computing Page](#)
  - [QCL](#)
  - [qasmcirc Quantum Circuit Viewer](#)