

Other topics in quantum mechanics and in its applications

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Quantum information

- Quantum cryptography
 - Entanglement version of BB84.
 - B92, EPR, 6 states, protocols involving qudits.
 - Security analysis for collective or coherent attacks.
 - Unconditional security.
 - ...
- Quantum information and communication
 - Quantum error correction.
 - Channel capacity, superdense coding.
 - Quantum teleportation.
 - Bipartite entanglement.
 - Holevo bound.
 - ...
- ...

Quantum computing

- Quantum algorithms
 - Search algorithms, Grover algorithm.
 - Quantum random walk algorithms.
 - Subgroup detection.
 - Phase determination.
 - Quantum Fourier transform.
 - Shor's factoring algorithm.
 - Quantum inspired algorithms for classification.
 - ...
- Physical realisations of quantum circuits
 - Solid state devices.
 - Optical devices.
 - Atomic devices.
 - Quantum dots.
 - Biological devices, speculations about microtubules in brain.
 - ...

Quantum mechanics

Mathematically more demanding

- Foundational aspects
 - Hilbert space approach.
 - von Neumann and C^* -algebras approach.
 - Lattices, othomodular lattices and quantum logics; quantum probability.
 - States and effects.
 - Informational approach.
 - ...
- Computational problems of quantum mechanics
 - Study of Schrödinger operators.
 - Spectral theorems for unbounded operators.
 - Second quantisation, quantum optics.
 - Atomic and molecular physics.
 - Solid state physics.
 - Nuclear physics.
 - Open systems, quantum stochastic calculus.
 - Quantum field theory.

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