Quantum Information Classification Scheme - QICS

Version 1.3, February 2013

QICS authors
D. Binosi (Trento) **T. Calarco (Ulm)**

00. QUANTUM INFORMATION SCIENCE

01. PHYSICS AND INFORMATION SCIENCE

01.10.+i Encoding, processing and transmission of information via physical systems
01.20.+e Reversibility and irreversibility in information processing
01.30.+r Quantum states and dynamics as a resource for information processing
01.40.+n Entanglement as a resource for information processing
01.50.+e Entropy and other measures of information

02. FUNDAMENTAL PROBLEMS

02.10.+t Quantum-Classical Transition
02.20.+c Mesoscopic and Macroscopic Quantum Coherence
02.30.-n Entanglement, nonlocality, complementarity
02.30.Bi Bell inequalities
02.30.An Bell theorem without inequalities
02.30.Lh Loopholes in Bell-type experiments
02.40.+d Interaction with environment
02.50.+r Reference frames in quantum mechanics
02.60.+g Geometric/topological phases
02.70.+a Theories alternative to quantum mechanics
02.80.+i Fundamentals of quantum interference (quantum eraser, which-way information, etc.)
02.90.+f Foundational issues of quantum mechanics

03. ENTANGLEMENT

03.02.+s Separability properties
03.05.+c Characterization and classification of entanglement
03.10.+m Entanglement measures
03.20.+w Entanglement detection/witnesses
03.25.+y Entanglement catalysts
03.30.+e Entangling/Disentangling power of quantum evolutions and transformations
03.40.+t Thermal/mixed state entanglement
03.50.+b Bound entanglement

03.60.+i Entanglement of identical particles and statistics
03.70.+c Entanglement versus correlation
03.80.+p (Theory of) purification, distillation, concentration
03.90.+m (Other) mathematical aspects of composite quantum systems

04. ENTANGLEMENT IN MANY-BODY SYSTEMS

04.10.+s Entanglement in spin models/oscillator chains
04.20.+b Squeezing and entanglement in quantum degenerate gases and BCS model
04.25.+l Entanglement in solid state systems, Luttinger liquids, etc.
04.30.+p Entanglement in phase transitions
04.40.+c Entanglement, chaos and disorder
04.50.+m Efficient simulation of quantum many-body systems
04.60.+s Entanglement in mesoscopic/macroscopic systems
04.70.+m Multi-particle/multi-photon entanglement
04.80.+d Entanglement dynamics in composite quantum systems
04.90.+t Entanglement transfer

05. CROSS DISCIPLINARY LINKS

05.05.+r Quantum information & relativity/cosmology
05.10.+s Quantum information & quantum statistics
05.20.+c Quantum information & quantum chaos
05.30.+t Quantum information & thermodynamics
05.40.+n Quantum information & neural networks
05.50.+a Quantum information & adaptive learning and feedback control
05.60.+c Quantum information & chemistry
05.70.+o Quantum information & quantum control
05.80.+m Quantum information & complex systems
05.90.+p Quantum information & quantum field theory/particle physics

06. QUANTUM MEASUREMENTS

06.10.+d Dynamics of the measurement process
06.15.+e Measurement-induced transformations
06.20.+m Quantum measurement theories
06.25.+n Quantum non-demolition measurements
06.30.+p Positive Operator Valued Measurements (POVM's)
06.35.+w Weak measurements
06.40.+z Quantum Zeno effect
06.50.+t Tomographic state reconstruction
06.60.+r Non-tomographic state reconstruction/estimation
06.70.+e Phase estimation
06.80.+s Quantum state discrimination
06.85.+o Quantum operator discrimination/reconstruction
06.90.+m Parameter estimation

07. MATHEMATICS OF HILBERT SPACE

07.10.+r State representations (quasi-probability distributions, Poincare' sphere, Stokes parameters, etc.)
07.20.+b Properties of special bases
07.30.+o Properties of operators
07.40.+d Distance between states
07.50.+n No-go theorems
07.60.+s Special states (graph states, cluster states, etc.)

10. QUANTUM COMPUTATION

11. ALGORITHMS

11.10.+c Quantum complexity theory
11.20.+a Role of entanglement in quantum algorithms
11.30.+h Factoring, hidden subgroup
11.40.+s Quantum search
11.50.+m Quantum maps, quantum chaos
11.60.+g Quantum games, strategies
11.70.+w Quantum random walks
11.80.+e Spectral evaluation
11.90.+m Quantum template matching
11.95.+o Other algorithms

12. SIMULATIONS

12.10.+i Simulations of many-body interactions
12.20.+h Optimal simulation of few-qubit Hamiltonians
12.30.+u Universal quantum simulators with specific systems (e.g. trapped ions, optical lattices, etc.)
12.40.+e Efficient classical simulation of quantum computation

13. DEFEATING ERRORS

13.10.+n Effects of noise and imperfections
13.20.+e Quantum error correction
13.30.+t Fault-tolerant quantum computation
13.40.+d Decoherence-free subspaces /noiseless subsystems
13.50.+d Dynamical/algebraic decoupling/recoupling
13.60.+p Geometric/topological protection
13.70.+f Quantum feedback/filtering and control
13.80.+a Errors and chaos

14. MODELS AND ARCHITECTURES

14.10.+c Quantum circuit model
14.20.+a Quantum cellular automata
14.30.+t Quantum Turing machine
14.35.+i Initialization of quantum registers
14.40.+m Measurement-based quantum computation
14.50.+a Adiabatic quantum computation
14.60.+g Geometric/topological and holonomic quantum computation
14.70.+p Post-selected quantum computation
14.80.+f Quantum computation with fixed couplings
14.90.+l Quantum computation with local control
14.95.+p Probabilistic quantum computation

15. IMPLEMENTATIONS: QUANTUM OPTICS

15.10.–p Quantum Optics: Physical qubits
15.10.El Electrons
15.10.Ie Ions: electronic states
15.10.Iv Ions: vibrational states
15.10.Ne Neutral atoms: electronic states
15.10.Nv Neutral atoms: vibrational states
15.10.Ry Rydberg atoms
15.10.Ph Photons

15.10.Qd Quantum dots
15.10.En Atomic ensembles
15.10.Mo Molecules
15.20.–e Quantum Optics: Experimental system
15.20.Pt Penning traps (planar and circular)
15.20.Lp Linear Paul traps
15.20.Ml Micro-fabricated lithographic traps
15.20.Ol Optical lattices
15.20.Mc Magnetic atom chips
15.20.Oc Optical atom chips
15.20.Lo Linear optics
15.20.Ca Cavity QED
15.20.Ro Readout techniques in quantum optics

16. IMPLEMENTATIONS: CONDENSED MATTER

16.10.–p Condensed Matter: Physical qubits
16.10.Ec Electrons in solids: charge
16.10.Es Electrons in solids: spin
16.10.Sc Spin chains
16.10.Is Ions in solids
16.10.Ns Nuclear spins
16.10.Jn Josephson nanodevices
16.20.–e Condensed Matter: Experimental system
16.20.De Electrically realized quantum dots
16.20.Db Band-gap modulation quantum dots
16.20.Sr Electron spin resonance
16.20.Re Rare-earth-ion-doped crystals
16.20.Ln Liquid NMR
16.20.Pd Atomic donors in semiconductor substrates
16.20.Ec Endohedral C60 on surfaces
16.20.Ih Isotopically engineered heterostructures
16.20.Ns QD nuclear spin ensembles
16.20.Cq Charge qubits
16.20.Pq Phase qubits
16.20.Fq Flux qubits
16.20.Sq Superconducting qubits coupled to resonators
16.20.Dc Defect centers in diamonds
16.20.Rc Readout techniques in condensed matter

17. OTHER IMPLEMENTATIONS

17.10.+n Nanotubes and nanowires
17.20.+m Single-domain magnetic particles
17.30.+e Electrons on helium films
17.40.+d Molecular spin/dipole arrays
17.50.+h Quantum Hall systems
17.60.+r Nanomechanical resonators
17.70.+s Spectral hole burning
17.80.+h Hybrid systems
17.90.+s Surface-acoustic-wave-based quantum computer

18. DECOHERENCE STUDIES

18.10.+b System-bath interaction (harmonic bath, spin bath)
18.20.+s Electron spins in semiconductors (phonons, nuclear spins)
18.30.+a Atoms close to surfaces/in laser fields or cavities
18.40.+n Electromagnetic noise on trapped ions

18.50.+p Electric and phonon noise in semiconductors
18.60.+d Disentanglement via dissipation/dephasing
18.70.+s Decoherence in solid state systems
18.80.+d Quantum dissipative systems

20. QUANTUM COMMUNICATION

21. PROTOCOLS

21.10.+a Quantum authentication/identification
21.20.-s Quantum secret sharing/data hiding
21.20.Kl Quantum key distillation
21.20.Kd Quantum key distribution
21.20.Rp Remote state preparation
21.20.Rc Quantum remote control
21.20.Sc Quantum bit-string commitment
21.30.+c Quantum coding
21.40.+d Quantum data compression
21.50.+t Teleportation
21.60.+e Entanglement based protocols
21.70.+q Qudits
21.80.+c Quantum cloning

22. INFORMATION SECURITY BEYOND QUANTUM CRYPTOGRAPHY

22.10.+k High key rates
22.20.+d Continuous variables
22.30.+c Quantum codes
22.40.+p Privacy amplification
22.50.+t Teleportation as a cryptographical primitive
22.60.+e Eavesdropping detection
22.65.+a Eavesdropping attacks/strategies
22.70.+s Security proofs
22.80.+p Plug and play systems
22.90.+d Distrustful cryptography

23. LONG-DISTANCE QUANTUM COMMUNICATION

23.05.+f Fiber-based quantum communication
23.10.+l Limits for shared entanglement
23.20.+f Free-space entanglement
23.25.+c Free-space quantum communication
23.30.+o Outer-space quantum communication
23.40.+a Adaptive optics
23.50.+s Feasibility studies for satellite based quantum communication
23.60.+d Study of decoherence
23.70.+s Space qualified technologies

24. SOURCES

24.10.-s Single photons
24.10.Od Single photons on demand
24.10.Tw Single photons at telecom wavelength
24.20.-e Entangled photons
24.20.Od Entangled photons on demand
24.20.Tw Entangled photons at telecom wavelength

24.30.+s Squeezed states sources
24.40.+h High efficiency sources
24.50.+m Multiphoton sources
24.60.+s Generation of specific states of radiation
24.70.+c Color-center/quantum dot photon sources

25. DETECTORS

25.10.+e Quantum efficiency of detectors
25.20.+n Number resolution
25.30.+c Clock synchronization
25.40.+t Automated state and process tomography
25.50.+m Miniaturization
25.60.+a Quantum state analyzers

30. QUANTUM NETWORKS

31. QUANTUM CHANNELS

31.10.+l Long distance photonic channel
31.20.+t Quantum state transport in quantum chains and arrays
31.25.+d Decoherence in quantum channels
31.30.+c Characterization of quantum channels
31.35.+i Dissipative quantum channels
31.40.+d Entanglement distribution
31.50.+m Quantum channel memory
31.60.+n Non-photonic quantum channels
31.70.+g Gaussian channels
31.80.+b Bosonic channels
31.90.+e Entangled channels

32. QUANTUM REPEATERS

32.10.+c Communication over noisy channels
32.20.+m Quantum memories/storage of qubits
32.30.+s Entanglement swapping
32.40.+p Realization of purification, concentration, and distillation in physical systems
32.50.-c Quantum communication complexity
32.50.Fp Quantum fingerprinting
32.60.+s Small scale quantum processors

33. QUBIT INTERFACES

33.10.+a Cavity QED (atoms or ions)
33.20.+d Quantum dots
33.30.+s SQUIDs
33.40.+j Josephson junctions <-> ions
33.45.+u Superconducting qubits <-> spins
33.50.+n Nanomechanical resonators <-> quantum dots, superconducting qubits
33.60.+a Atomic systems <-> mesoscopic conductors
33.70.+o Optical systems <-> solid-state systems
33.80.+m Atomic-ensemble quantum memory for light
33.90.+e Entanglement between atoms and photons

40. QUANTUM INFORMATION TECHNOLOGIES

41. METROLOGY

41.05.+l Quantum limits
41.10.+p Quantum enhanced measurements
41.20.+c Quantum clock synchronization
41.30.+i Quantum imaging
41.40.+s Precision spectroscopy via entangled states
41.50.+n Nanomechanical sensors
41.60.+s Single electron spin measurements
41.70.+a Aligning reference frames
41.80.+c Absolute calibration of detectors
41.90.+n New sensor technologies
41.95.+m Quantum magnetometry

Source URL: http://qurope.eu/content/qics-book