RISQ - reduced instruction set quantum computers

Klaus Mølmer
Institute of Physics and Astronomy, University of Aarhus
DK-8000 Århus C., Denmark
e-mail: moelmer@ifa.au.dk

Without a very detailed control, *i.e.*, precise access to individual qubits and sufficient elimination of decoherence, we shall not be able to build a quantum computer. We may, however, operate some physical systems as RISQ - *reduced instruction set* quantum computers and devices, and produce multi-particle entanglement, squeezing of collective spin variables, and quantum dynamics, equivalent to – and thus simulating – many-body effects such as ferro-magnetism and anti-ferro-magnetism.
These tasks are useful, *e.g.*, for improvement of the sensitivity in interferometers and clocks, and we shall present concrete proposals for "easy" implementation of such RISQ computers with trapped ions and atoms, which cannot be addressed individually, and for which the centre-of-mass motion, mediating interactions and two-qubit operations, does not need to be fully controlled.
RISQ ideas may thus both provide something useful here and now, and they may advance development of a general purpose quantum computer by testing, via its macroscopic properties, the functioning of its microscopic mechanisms.