AGPhil 7: Poster

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Cluster-state quantum computation: the role of entanglement — •Filippo Annovi — Department of Philosophy, University of Bologna, Italy

Cluster-state quantum computation is computationally equivalent to the traditional circuit model, but the pictures of computational processes outlined by the two are radically different.

Here are investigated some of the consequences of this situation for the explanation of the quantum speed-up, whit particular regard to the role played by entanglement. At first sight, the evolution of a cluster-state computer seems to be disentangling (at each step one qubit is measured and discarded), but in a fully-unitary dynamical account it appears to be entangling (at each step a correlation is established between one qubit and its respective recorder). It is thus suggested that the different uses made of the features of quantum systems by the two frameworks, do not rule out the thesis that the speed-up is achieved by means of an entangling transformation.

However, in this last case entanglement is created step by step, and thus the main difference between the two frameworks seems to remain the absence of "quantum parallelism". The only entangling-generating unitary transformations acting at the same time on all the qubits are the controlled-phase operation involved in the preparation of the cluster. Thus, the explanation of the quantum speed-up should be looked for just in these type of transformations.