SHORT COMMUNICATIONS

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Privacy of experiments in the absence of local reality

Karl K. Rebane

Institute of Physics, University of Tartu, Riia 142, 51014 Tartu, Estonia; rebanek@fi.tartu.ee

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Eksperimendi privaatsus lokaalse reaalsuse puudumisel

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Quantum Computing and Quantum Information form a new exciting field of fundamental problems of physics and philosophy. The future of building a practically useful quantum computer is an open question. But the activities push ahead the mathematics and understanding of quantum mechanics. And what seems really important is that the experimental studies of Bell's inequalities, entanglement, teleportation, and quantum cryptography have been started.

The important result which can be formulated briefly, clearly, and definitely is the (imperative) conclusion that Einstein's fundamental concept of local reality [1] does not hold. This point of view seems to be widely accepted and is frequently repeated in written (see, e.g., [2]) and oral presentations.

I am concerned about the absence (as far as I know) of explanations, comments, or remarks on the arising now problem of philosophy of physics: how should the experimental physics continue without relying on local reality? Especially the nowadays high-precision experiments with single atoms, molecules, and elementary particles? The experimentalist has often to wait for a subtle display of the desired event for many hours, days, or weeks. There is plenty of time to disturb the privacy of the experiment by, e.g., sending an entangled particle. Is it not justified to ask: "Do we not lose together with the local reality the very important condition for the experiment – the possibility of

guaranteeing the absence of outside influence? How can you, my dear experimentalist, be sure that your fine measurement is not being manipulated by some nasty competitor or a science terrorist who is using the know-how of nowadays deeper understanding of quantum mechanics? Do not trust any of your results, because there is no local reality in your experimental setup." I would very much like to hear and learn about the influence of dismissing local reality.

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