Quantum Computing, Physical Computational Complexity, and the Mind

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Combining physics, mathematics and computer science, quantum computing has developed in the past two decades from a visionary idea into one of the most exciting areas of quantum mechanics, and has become a small industry, with a worldwide research budget exceeding one billion dollars. A little more than a decade after the debut of the first quantum algorithm, the theoretical study of quantum systems serving as computational devices has achieved tremendous progress. According to some authorities in the field, we now have strong theoretical evidence that quantum computers, if built, might be used as powerful computational tools, capable of performing tasks which seem intractable for classical computers.

In this talk I will discuss how quantum computers may reflect on two long standing disputes in Cognitive Science, namely, the debate between functionalism and connectionism and between "reductionists" and "emergentists". To this end I shall discuss different abstract models of computation, the putative physical realizations thereof, and the consequences of these realizations on the computational model of the mind.

Amit Hagar came to the philosophy department in UDel after a year as a post doc in the Alexander Von Humboldt Foundation's Philosophy, Probability and Modeling research group in Konstanz. He earned his PhD in the philosophy of physics (2004) in the University of British Columbia in Vancouver, and his MA in philosophy (2000) and BA in psychology and cognitive studies (1996) in the Hebrew University of Jerusalem. His research interests span modern physics and computer science; the intersection thereof; and the bearing of both on metaphysics, in particular on the philosophy of time. He is interested in foundational puzzles in modern physics, especially in space-time theories, statistical mechanics, and quantum theory; in the philosophical foundations of computer science and AI; and in non-standard physical models of computation (e.g., quantum computing, hypercomputation). He is also engaged in an attempt to reconstruct the enduring debate between scientific realism and anti-realism in the philosophy of physics on the a novel basis, namely, the practice of physics-theorizing, and in persuading physicists and computer scientists that, sometimes, it may be worth their while to listen to philosophers.