HARVARD John A. Paulson School of Engineering and Applied Sciences

MENU

Photon detectors, quantum randomness, random flip-flops and their use in ICT security and hyper computation

Electrical Engineering Seminar Series

Dr. Mario Stipcevic, Ruder Boskovic Institute, Zagreb, Croatia

Wednesday, May 4, 2016 - 1:00pm to 2:00pm

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In the introductory part I will shortly present my work on building a solid-state single-photon detector with less imperfections than present in commercial ones and its advantages in a hyper-entangled QKD protocol developed under DARPA program InPho. I will then briefly summarize my work on randomness and quantum random number generators and their use in enhancement of security of cryptography, both classical and quantum. The main body of the talk will be devoted to my latest published work on an information processing device that I named "random flip-flop" (RFF). This completely novel logic circuit features inputs and outputs compatible with classical information but internally it uses quantum information to ensure its random action. It will be shown how RFF can be combined with classic logic circuits to achieve a bio-inspired "random pulse computing" (RPC) paradigm. Today, our attention is oriented towards two computational paradigms, namely: the Turing computer and the quantum computer. Information-wise the RPC paradigm lies somewhere between those two but shows a few interesting technological advantages over both, such as: inherent parallelism, higher speed with slow hardware and resilience toward hardware failure. A few examples of new functional circuits enabled by the RFF, not only in the realm of computation, will be presented. Such devices could open a venue for new technologies. An outline of possibilities for both experimental and theoretical follow-up research

will be discussed.

Speaker Bio:

Dr. Mario Stipcevic is a senior scientific associate at the Ruđer Bošković Institute and head of Photonics and Quantum Optics division of Centre of Excellence for Advanced Materials and Sensors, Zagreb, Croatia. Author of over 75 CC articles in physics, 17 popular articles in the field of electronics, 3 patent applications and 1 granted patent. Obtained PhD in high energy physics working on CERN's experiment Atlas in 1994 at L'Universite de Savoie, Chambery, France. Research interests: quantum information, quantum cryptography, two-photon entanglement, random number generators, holography and APD based single-photon detectors. During 2010/2011 he was a Fulbright scholar at University of California Santa Barbara (UCSB) and in continuation during sabbatical leave he has been working at UCSB and Duke University as a research collaborator on DARPA projects related to very high speed quantum cryptography.

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