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From Fundamentals to Applications: A forward look for AI/ML & Quantum Systems

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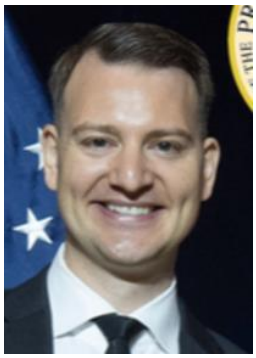

Friday, March 11th, 2022

1:00 pm EST · MSEE 239

Seminar: https://purdue-edu.zoom.us/j/94797001895

Event Agenda: Volker J. Sorger is an Associate Professor in the Department of Electrical and Computer Engineering and the Director of the *Devices & Intelligent Systems Laboratory* at the George Washington University. Volker will give a 30-minute lecture covering the material presented in the abstract below followed by a 30 minute Fireside chat with Blake Wilson (Ph.D. Student at Purdue) to discuss emerging frontiers at the cross-section of machine learning, quantum computing, and photonics.

Abstract: This seminar provides a forward-looking perspective around emerging hardware concepts for next-generation information processing and computing targeting machine learning and quantum IT systems. It offers insights drawn from fundamental physical limits for both device and system technology. We will start asking question such as whether 1-atto-joule per bit is the lower-bound for switching devices. Then move on to discuss synergistic-physics based device-engineering solutions such as using the elsewise 'parasitic' Kramers-Kronig relations synergistically to in-fact enhance electrooptic modulator performance. Next, is a section on brain-inspired neuromorphic computing utilizing temporal spikes for neural networks including a path to engineer the nonlinear activation function of a neuron and a concept derived self-learning from synaptic interconnect functionality of biological neurons. Then we will briefly explore a path towards 'conscious' machines based on neuro-evolutionary models leading to 'emerging' and non-programmed behavior. Drawing inspiration from programmable photonic integrated circuits for analog computing to, exemplary, solve partial differential equation, we will explore route for photonic coherent Ising machines. Finally, we will take a brief look at algorithm-hardware-application homomorphism and arrive at compute-system scaling laws including quantum information processors, and conclude with a particular focus on chirality-

based approaches for quantum IT systems. The seminar is followed by a fireside engagement on student-centered career strategies.

Bio: Volker J. Sorger is an Associate Professor in the Department of Electrical and Computer Engineering and the Director of the *Institute on AI & Photonics*, the Head of the *Devices & Intelligent Systems Laboratory* at the George Washington University. His research areas include devices & optoelectronics, AI/ML accelerators, mixed-signal ASICs, quantum matter & processors, and cryptography. For his work, Dr. Sorger received multiple awards including the Presidential PECASE Award, the AFOSR YIP Award, the Emil Wolf Prize, and the National Academy of Sciences award of the year. Dr. Sorger is an Associate editor for OPTICA, serves on the board of Chip, and was the former editor-in-chief of Nanophotonics. He is a Fellow of Optica (former OSA), a Fellow of SPIE, a Fellow of the German National Academic Foundation, and a Senior Member of IEEE. He is a co-founder of Optelligence Company.