UCI Samueli School of Engineering

Department of Materials Science and Engineering UCI

UNIVERSITY OF CALIFORNIA, IRVINE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

IS PROUD TO HOST A SEMINAR BY

"QUANTUM SCIENCE AND TECHNOLOGY WITH RARE EARTH IONS AND NANO-PHOTONICS"

ANDREI FARAON

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Thursday, April 23, 2026

2:00 PM - 3:20 PM

McDonnell Douglas Engineering Auditorium

Abstract: Rare earth ions doped in solids are highly versatile optically addressable spin qubits with long optical and spin coherence. In this talk I give an overview of our latest progress utilizing both single and ensembles of rare earth ions to advance quantum science and technology. At low doping concertation, single ions coupled to nano-photonic resonators are well suited for establishing remote entanglement in optical quantum networks. At the same time, they couple to other nuclear spins in the environment which can be harnessed for local quantum storage and processing as needed for quantum repeater network nodes, and to explore highly entangled spin states. At high doping concertation, dense ensembles of rare earth ions can be used to mediate microwave to optical transduction and to explore exotic quantum interactions. I discuss recent results on frequency multiplexed entanglement distribution in optical quantum networks, efficient microwave to optical transduction at single photon level, quantum memories and quantum many body physics with electron and nuclear spins. We explored these research directions mainly with ytterbium 171 in yttrium orthovanadate and calcium tungstate.

References:
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[4] Andrei Ruskuc, Chun-Ju Wu, Jake Rochman, Joonhee Choi, Andrei Faraon, Nuclear spin-wave quantum register for a solid state qubit, Nature, 602, 408–413 (2022)
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Bio: Dr. Andrei Faraon is the William L. Valentine Professor of Applied Physics and Electrical Engineering and the Fletcher Jones Director of the Kavli Nanoscience Instititute at California Institute of Technology. After earning a B.S. degree in physics with honors in 2004 at California Institute of Technology, he received his M.S. in Electrical Engineering and PhD in Applied Physics both from Stanford University in 2009. From 2009 to 2012 he was a postdoctoral fellow at Hewlett Packard Laboratories. During his PhD he was involved in seminal quantum optics experiments using single semiconductor quantum dots coupled to photonic crystal resonators. At HP, he pioneered quantum nano-photonic devices in single crystal diamond coupled to color centers.

Dr. Faraon left HP in 2012 for a faculty position at Caltech where he works on nano-photonic technologies for both classical and quantum applications including: optically addressable quantum bits, optical quantum memories, microwave to optical quantum transduction, metasurfaces and metamaterials for multi-functional imaging applications.

Dr. Faraon is the recipient of the 2018 Adolph Lomb Medal of Optica that recognizes a noteworthy contribution to optics made by a researcher who is still early in his or her career, and was elected as Optica Fellow in 2020.