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Gregory D. Fuchs is the James R. Meehl Professor of Applied and Engineering Physics at Cornell University. He earned his Ph.D. in Applied Physics from Cornell in 2007. Afterward, he moved to the University of California, Santa Barbara as a postdoctoral associate. In 2011, he re-joined Cornell as a faculty member. Fuchs's research group focuses on quantum interactions between spins, magnons, photons, and phonons in solid-state systems, drawing inspiration from atomic physics, condensed matter physics, and materials engineering. He works on a wide range of physical systems including defect spins, magnetic materials, and materials for superconducting quantum devices.

Quantum and nonlinear magnonics with the ultralow damping molecular material vanadium tetracyanoethylene

As we progress in the second quantum revolution, a natural question we ask is – is there a role for molecular materials in quantum information platforms? In this presentation, I will dicuss our work using the ultra-low loss molecule-based ferrimagnet vanadium tetracyanoethylene $V[TCNE]_x$ as a quantum magnonic resource for future quantum technologies. Quantum magnonics offers key advantages in terms of nonreciprocity and nonlinearity, however, a major challenge in the context of quantum applications is mitigating loss. First I'll discuss our experimental efforts to establish a scalable cavity magnonics platform based on $V[TCNE]_x$ [1, 2]. Then, I'll describe our approach to a cavity-magnonics implementation of the optomechanical-type nonlinear Hamiltonian [3]. Using this nonlinear interaction, we theoretically show how driving magnons coupled to a microwave electromagnetic resonator can enable resonator cooling and quantum squeezing. Finally, I'll describe a quantum sesning experiment using NV centers to quantitatively measure the precession angle of $V[TCNE]_x$ microstructures [4].

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[2] M. I. B. Utama, R. Claassen, S. Pal, D. S. Cormode, D. Lebedev, S. Chaudhuri, Q. Xu, H. Y. Park, S. D. Namgung, G. C. Schatz, G. D. Fuchs, E. Johnston-Halperin, and M. C. Hersam, *Nat. Commun.* **16**, 10546 (2025).
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