Quantum sensors, such as the Nitrogen Vacancy color center in diamond, exploit the strong sensitivity of quantum systems to external disturbances to measure various signals in their environment with high precision. These quantum sensors have the potential to be a revolutionary tool in material science, quantum information processing, and bioimaging. However, the same strong coupling to the environment also limits their sensitivity due to its decohering effects. Error correction strategies, including quantum error correction codes, robust many-body quantum phases, and dynamical decoupling, can help in fighting decoherence, but they incur the risk of also canceling the coupling to the signal to be measured. Here I will show recent advances in tackling this challenge, including exploiting and improving control, that achieve an advantageous compromise between noise and signal cancellation. These strategies can not only improve the sensitivity of quantum sensor, but also yield new applications, via the transduction of biological signals of interest into quantum perturbations.
12:30 PM - 1:00 PM

How “Quantum 2.0” Sensors Can Leverage “Quantum 1.0” Semiconductor Manufacturing
Dirk Englund
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Dirk Englund received his BS in Physics from Caltech in 2002. After a Fulbright fellowship at T.U. Eindhoven, he completed an MS in Electrical Engineering and a PhD in Applied Physics at Stanford University in 2008. After a postdoctoral fellowship at Harvard University, he joined Columbia University as Assistant Professor of E.E. and of Applied Physics. He joined the MIT EECS faculty in 2013. Recent recognitions include the 2011 PECASE, the 2011 Sloan Fellowship in Physics, the 2012 DARPA Young Faculty Award, the 2017 ACS Photonics Young Investigator Award, and the OSA's 2017 Adolph Lomb Medal, a Bose Research Fellowship in 2018, and a 2020 Humboldt Research Fellowship.

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