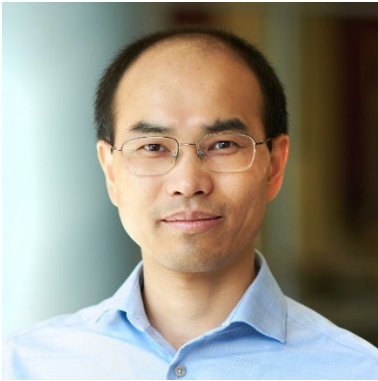


Quantum sensing with spin defects in 2D and 1D materials



Dr. Tongcang Li

Professor of Physics and Astronomy,

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**Date: Tuesday April 23 @ 3.30pm in BRK 1001
(Coffee & Snacks @ 3.15pm)**

Zoom Link: <https://purdue-edu.zoom.us/j/99524580757>

Abstract: The recent discovery of spin qubits in hexagonal boron nitride (hBN), a two-dimensional (2D) van der Waals (vdW) material, has opened up exciting possibilities for quantum sensing. Owing to its layered structure, hBN can be easily exfoliated and integrated with various materials and nanostructures for in-situ quantum sensing. In this talk, I will provide a brief overview of recent advancements in quantum sensing and imaging using spin defects in hBN and discuss our contributions to this emerging field. We have demonstrated high-contrast plasmon-enhanced spin defects in hBN for quantum sensing [*Nano Letters* 21, 7708 (2021)] and investigated their excited-state spin resonance. Additionally, we achieved optical polarization and coherent control of nuclear spins in hBN at room temperature [*Nature Materials* 21, 1024 (2022); *Nature Communications* 15, 104 (2024)], paving the way for manipulating nuclear spins in vdW materials for quantum information science and technology applications. Recently, we observed optically active single spin defects in boron nitride nanotubes (BNNT), a one-dimensional (1D) vdW material [arXiv:2310.02709]. We have developed a method to deterministically transfer a BNNT onto a cantilever and use it to demonstrate scanning probe magnetometry.

Bio: Dr. Tongcang Li is Professor of Physics and Astronomy, and Professor of Electrical and Computer Engineering at Purdue University. He joined Purdue University as an Assistant Professor in 2014, and was promoted to an Associate Professor in 2020 and a Full Professor in 2023. He earned his Ph.D. degree from the University of Texas at Austin in 2011, and conducted postdoctoral research at the University of California, Berkeley from 2011-2014. Prof. Li is an expert in quantum sensing and optomechanics. He has won multiple awards, including the NSF CAREER Award in 2016 and the Moore Foundation Experimental Physics Investigators award in 2023. Prof. Li has published one book and over 70 peer-reviewed articles in leading journals. His recent work on GHz rotation of an optically levitated nanoparticle was selected as one of the APS Physics “Highlights of the Year” of 2018. His research on on-chip optical levitation with a metalens was included in 30 breakthroughs in “Optics in 2022” by the Optics & Photonics News.