

THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING PRESENTS

FACULTY CANDIDATE:

LINYOU CAO



ATOMISTIC DESIGN, DISCOVERY, AND MANUFACTURING OF 2D MATERIALS FOR EXTREME CONTROL OF ELEMENTARY QUANTUM PHYSICS

ABSTRACT

Controlling elementary quantum particles such as electrons, spins, excitons, photons, and phonons consists of one major foundation for the scientific and technological innovation in modern ages. In this talk, I will present our efforts in the design and manufacturing of two-dimensional (2D) materials for purpose of gaining capabilities to control the elementary particles in unprecedented ways. I will first present our development of unique techniques for wafer-scale (4" wafer or larger) synthesis and transfer of high quality, uniform 2D transition metal chalcogenide (TMDC) materials with controlled physical features, including layer numbers, compositions, defects, and doping. In particular, I will show the development of room-temperature magnetic semiconductors with remarkable ferromagnetism and semiconducting properties by doping 2D materials. Following the synthesis work, I will show our endeavor on exploring the designed 2D materials to control photons, phonons, and charges in ways rarely seen previously. These include giant gate-tunability in light-matter interactions, room-temperature exciton condensates, efficient electrical control of phonon transport, and room-temperature specular scattering of thermal phonons. Last but not least, I will demonstrate that the atomically designed 2D materials also provide tremendous opportunities for the field of clean energy by showing our development of low-cost catalysts with unprecedented high performance for water splitting.

BIOGRAPHY

Dr. Linyou Cao is an associate professor of Materials Science and Engineering, of Physics, and of Electrical and Computer Engineering at North Carolina State University. Prior to joining NC State in 2011, he obtained a PhD degree on nanophotonics at Stanford University in 2010, and held a Miller Research Fellowship working on quantum dots at UC Berkeley from 2010 to 2011. Dr. Cao's research focuses on atomistic design, discovery, and manufacturing of functional materials for extreme control of elementary quantum particles and on exploring this control for the development of novel devices. He has published 60+ papers with 8300+ citations, held 7 patents/provisional patents, and founded a start-up company of 2Dlayer. His achievement has been recognized by numerous prestigious awards, including NSF CAREER Award, Young Investigator Award from the Army Research Office, Ralph E. Powe Junior Faculty Enhancement Award, and Miller Research Fellowship, and by 50+ invited talks at international conferences and academic institutes worldwide. Dr. Cao has also actively served for the academic community, leading multi-million grants/proposals, organizing numerous symposia, and recently being selected as one co-chair for an incoming MRS Spring Conference and editor for a theme issue of MRS Bulletin on quantum materials.

FEBRUARY 28, 2019
WCH 205/206



SEMINAR: 11:10 A.M. - 12:00 P.M.
*** VISION TALK: 12:00 P.M. - 12:30 P.M.**

*FACULTY ONLY