第362回GMSI公開セミナー／第185回CIAiSセミナー／第107回WINGSセミナー

Subdiffractional Spectral-Microscopy for Multidimensional Materials Imaging

Professor Slava V. Rotkin

Materials Research Institute and Department of Engineering Science & Mechanics,
The Pennsylvania State University

Date: Thursday, 21st July 2022 15:00-16:30
Venue: 31A, 3F Faculty of Engineering Bldg. 2
／Online (hybrid)

For online zoom participants, register by July 19th.
https://forms.gle/m4fjLoHxz1Juyx45A

Abstract:

Recent success in synthesis of new two-dimensional (2D) materials beyond graphene (including TMDCs, heteronanotubes, hBN family, MXenes and atomic polar metals), followed by exploring their novel applications in quantum technologies, biosensing, energy and computing, motivated scientists to extend existing characterization capabilities to better understand physics at 2D.

Atomically thin 2D materials, having an ultimate surface-to-volume ratio, may possess surface non-uniformities at the nanometer scale (atomic impurities/adsorbates/defects, wrinkles/ruptures) that modulate their optical properties. For example, lattice mismatch and work function difference in the heterostructure material result in strain and charge transfer, often varying at nanometer scale, hard to detect and study.

In this talk, a new multidimensional optical imaging technique will be presented. A few examples will be discussed including: a vertical heterostructure comprised of monolayer graphene and single layer flakes of MoS2,[1] heteronanotubes with carbon core and hBN/MoS2 shell,[2] and heterostructures of graphene/Ag/SiC atomic layers. The core of analytic technology is scattering Scanning Near-field Optical Microscopy (sSNOM). Being correlated with other characterization channels, it allows multidimensional nanoscale imaging and reveals the physical origin for local optical response of 2D materials. For example, it allows us to map sub-diffractional distributions for doping and strain and understand the role of those for modulation of electronic properties.

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1. ACS Nano 2022, 16, 2598.
2. ACS Nano 2021, 15, 5600.

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and Department of Engineering
Science & Mechanics,
The Pennsylvania State University

主催：
東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション（GMSI）
最先端融合科学イノベーション教育研究コンソーシアム（CIAiS）
未来社会協創 国際卓越大学院（WINGS CFS）
未来社会デザインフェローシップ（DFS）
量子科学技術フェローシッププログラム（Q-STEP）

本件連絡先：
東京大学大学院工学系研究科機械工学専攻 教授 丸山 茂夫
GMSI事務局 E-mail: office@gmsi.t.u-tokyo.ac.jp Phone: 03-5841-0696