

主催：未来社会創造機構 マテリアルイノベーション研究所

主催協力：文部科学省令和5年度大学教育再生戦略推進費「大学の世界展開力強化事業 ～米国等との大学間交流形成支援～」

Slava V. Rotkin 先生講演会 (Pennsylvania State University)

日時：2023年10月31日（火）10：30－12：00

場所：工学部5号館2階 材料会議室



From nanocarbon plasmonics to near-field imaging: Multifaceted physics of low-dimensional materials

Fellow of the Electrochemical Society Frontier Professor of Engineering Science & Mechanics
Professor of Biomedical Engineering Materials Research Institute,
The Pennsylvania State University

In this talk I will give a try to cover several major themes of my research in the past couple of decades. The talk will start with touching upon the van-der-Waals/quantum forces in NEMS devices: in 2002 I proposed that these new terms are needed in classical MEMS theory. vdW/Casimir force, never studied in the past, was incorporated in MEMS theory and a new model was developed applicable for simulation of nanoscale devices. Since then, this model has been accepted by a wide community of researchers and allowed to understand the scaling laws for NEMS and physical limitations for their operation. I will continue with the electrostatics of 1D devices: the concept of nanotube quantum capacitance will be introduced which is required for modelling of 1D-transistors, diodes, heterostructures, compound materials, etc. I will continue with the theory of bandstructure engineering in 1D-materials via symmetry breaking, either with the electric field, of surface potential or DNA wrapping. Another concept we introduced, remote polariton scattering in low-dimensional materials, led to formulation of a new theory of polar surface scattering and, ultimately, to discovering a novel channel for heat exchange in nanotube based materials and devices – quantum heat tunneling. This concept is important for solving the heat dissipation problem for next generation electronic devices. I will briefly review several most recent theoretical and experimental results on nanoscale optical characterization for 1D and 2D-materials. Several vignettes on near-field microscopy will be presented: imaging of doped and twisted graphene, chemical bond modification is damaged glass surface, hBN shells in heteronanotubes and vdW vertical heterostructures. A few topics in Raman microscopy and multidimensional (correlated) imaging will be reported next. If time will allow, I will touch on nano-biophysics of DNA-wrapped nanotubes and their interaction with neural stem cells and methods of multiplexed biosensing with 2D- materials.

問い合わせ先：大学院工学研究科 化学システム工学専攻 松尾 豊
(yutaka.matsuo@chem.material.nagoya-u.ac.jp; 内線6113)