NUS National University of Singapore | Department of Materials Science & Engineering
College of Design and Engineering

Department Seminar

Dear Colleagues & Students,
You are cordially invited to a special seminar on

Date: 16 July 2026, Thursday
Time: 11am - 12pm
Venue: EA-06-03 Seminar Room, Block EA, 9 Engineering Dr 1, Singapore 117575 (Map)

Tuning the electronic phases of graphene nanoribbons

By Prof. Michele Pizzochero
Department of Physics, University of Bath, United Kingdom

Hosted by Assistant Professor Ahmet Avsar

Abstract:
Graphene nanoribbons (GNRs) are a fascinating class of quasi-one-dimensional semiconductors consisting of nanometer-wide strips of hexagonally bonded carbon atoms [1]. Recent advancements in fabrication techniques have enabled the realization of atomically precise GNRs with complex edge geometries and widths [2]. In this talk, I will present graphene nanoribbons as a promising platform for controlling and manipulating unconventional electronic phases, drawing on both ab initio and model-Hamiltonian calculations. First, I will demonstrate the formation of half-semimetallic phases in zigzag-edged nanoribbons upon incorporation into a lateral heterostructure [3,4]. Second, I will discuss the formation of ultra-flat bands and π-electron magnetism in chevron-edged graphene nanoribbons under an external electric field [5]. Third, I will show that localized states induced by nitrogen doping can drive a topological phase transition in armchair-edged nanoribbons [6]. These findings may open new possibilities for engineering quantum phases in one-dimensional carbon nanostructures, even beyond graphene [7], with potential applications in spintronics and related device concepts.

[1] O. V. Yazyev, Account of Chemical Research 46, 2319 (2013)
[2] A. Narita, K. Müllen, Advanced Materials 32, 2001893 (2020).
[3] N. V. Tepliakov, R. Ma, J. Lischner, E. Kaxiras, A. A. Mostofi, M. Pizzochero, Nano Letters 23, 6698 (2024); M. Pizzochero, N. V. Tepliakov, J. Lischner, A. A. Mostofi, E. Kaxiras, Nano Letters 24, 6521 (2024).
[5] R. Ma, N. V. Tepliakov, A. A. Mostofi, M. Pizzochero, The Journal of Physical Chemistry Letters 16, 1680 (2025)
[6] P. H. Jacobse, M. Pizzochero, et al, ACS Nano 19 13029 (2025)
[7] B. Peng & M. Pizzochero, ACS Nano 19, 29637 (2025); B. Peng & M. Pizzochero, Nano Letters 26, 6034 (2026).

Biography:
Michele Pizzochero is an Assistant Professor of Theoretical Physics at the University of Bath (UK). His research focuses on understanding and engineering unconventional electronic phases in low-dimensional crystals. Prior to joining the University of Bath, he was a Research Associate at Harvard University (USA), supported by a fellowship from the Swiss National Science Foundation. He received his PhD in Physics from EPFL (Switzerland).