



Graz Advanced School of Science
PHYSICS COLLOQUIUM OF THE UNIVERSITY OF GRAZ AND
THE GRAZ UNIVERSITY OF TECHNOLOGY

Guido Fratesi

Milano University

Towards single-crystal silicene by interface engineering

Two-dimensional (2D) materials of single/few-atom thickness are attracting significant attention for applications in low-power and flexible electronics and optoelectronics. Their properties, often different from those of corresponding bulk materials, can further be tailored by stacking different 2D materials in van der Waals heterostructures.

By presenting the results of our ab initio investigations in conjunction with experimental studies, here I will focus on silicene, the Si-analogue of graphene ideally hosting Dirac fermions and proposed for actual devices such as field effect transistors.

Silicene, not being exfoliable, is typically grown by molecular beam epitaxy on a silver surface. However, such synthesis is characterized by the formation of multiple phases and domains, as well as a strong Si-Ag hybridization severely affecting electronic properties[1] and optical response[2]. While the latter aspect can be solved by subsequent Ag removal, the former poses severe constraints on the spatial charge conduction and application in devices in contrast to recent single-crystal growth of graphene and h-BN on the wafer scale. After briefly reviewing the basics of silicene, I'll present our scheme to realize silicene-stanene (2D tin) heterostructures on silver [3], and how tin can be used to engineer the silicene/silver interface to achieve very well-ordered single-phase silicene phases in the monolayer and multilayer range [4].

[1] Polina Sheverdyaeva et al., ACS Nano 11, 975 (2017) [2] Eugenio Cinquanta et al., Phys. Rev. B 92, 165427 (2015) [3] Daya Sagar Dhungana et al., Adv. Funct. Mater. 31, 2102797 (2021) [4] Simona Achilli et al., Nanoscale 15, 10845 (2023)

Date: Tuesday, 7 November 16:15

Location: HS 05.01

Host: Peter Puschnig

For a regularly updated colloquium program see: <https://www.if.tugraz.at/colloquium.html>