2D Materials
Physics of
van der Waals
[hetero]structures

SPP 2244

DFG Deutsche Forschungsgemeinschaft

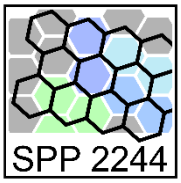
# Mid-term Colloquium
# SPP 2244 2nd Funding Period

**Physikzentrum Bad Honnef, October 21 – 24, 2025**

**Event Locations:**

- Meeting venue: Physikzentrum Bad Honnef (Hauptstraße 5, 53604 Bad Honnef)
- Hotel rooms at Physikzentrum are provided and paid for by the central project
- Hotel rooms are available from October 21 to October 24, unless communicated otherwise with the organization committee during the registration process.

| Times | | Tuesday | Wednesday | Thursday | Friday | Times | |
|---|---|---|---|---|---|---|---|
| 08:00 | 00 15 30 45 | | Breakfast | Breakfast | Breakfast | 00 15 30 45 | 08:00 |
| 09:00 | 00 15 30 45 | | Opening | Invited Lecture 1 | Invited Lecture 2 | 00 15 30 45 | 09:00 |
| 10:00 | 00 15 30 45 | | Session 1 | Sesion 4 | Coffee Break | 00 15 30 45 | 10:00 |
| 11:00 | 00 15 30 45 | | Coffee Break | Coffee Break | Session 7 | 00 15 30 45 | 11:00 |
| 12:00 | 00 15 30 45 | | Session 2 | Session 5 | Closing<br>Lunch | 00 15 30 45 | 12:00 |
| 13:00 | 00 15 30 45 | | Lunch<br>+<br>14:00 Meeting Steering Cmte. | Lunch | Departure | 00 15 30 45 | 13:00 |
| 14:00 | 00 15 30 45 | | Session 3 | Session 6 | | 00 15 30 45 | 14:00 |
| 15:00 | 00 15 30 45 | | Coffee Break | Coffee Break | | 00 15 30 45 | 15:00 |
| 16:00 | 00 15 30 45 | Arrival<br>+<br>Registration | Posters A | Posters B | | 00 15 30 45 | 16:00 |
| 17:00 | 00 15 30 45 | | | | | 00 15 30 45 | 17:00 |
| 18:00 | 00 15 30 45 | Dinner | Dinner | Dinner | | 00 15 30 45 | 18:00 |
| 19:00 | 00 15 30 45 | | | | | 00 15 30 45 | 19:00 |

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## Tuesday, October 21st

| | |
|---|---|
| **16:30 – 18:30** | **Registration** |
| **18:30 – 20:00** | **Dinner** |

## Wednesday, October 22nd

| | | | |
|---|---|---|---|
| **8:00 – 9:00** | **Breakfast** | | |
| **9:00 – 9:30** | **Opening** (Thomas Heine, Miroslav Položij**)**<br>Update on SPP2244 status + information from the central project | | |
| **9:30 – 10:30** | **Session 1 (Chair: tba)** | | |
| | 9:30 | Jonathan J. Finley<br>Fei Ding<br>Rolf Haug | Tunable Moiré Potentials in 2D-Heterostructures using Anisotropic Strain |
| | 9:50 | Jurgen H. Smet | Magnetotransport studies of interfacial interactions in van der Waals structures |
| | 10:05 | Wouter Jolie | Creating many-body states in two-dimensional van-der-Waals heterostructures by design |
| | 10:20 | Angelo Di Bernardo<br>Elke Scheer<br>Hadar Steinberg<br>Wolfgang Belzig | Towards 2D superconducting spintronics |
| **10:45 – 11:30** | **Coffee break** | | |
| **11:30 – 13:00** | **Session 2 (Chair: tba)** | | |
| | 11:30 | Dante M. Kennes<br>Tim Wehling<br>Ursula Wurstbauer | Correlations in van der Waals [Hetero]Structures by the Spectroscopic Fingerprints of Quasiparticles and Collective Excitations |
| | 11:50 | Alexander Steinhoff-List<br>Alexey Chernikov<br>Alexander Högele | Quantum gases in moiré-ordered and reconstructed heterostructures: effective dimensionalities, hybrid states, and interactions |
| | 12:10 | Gabriel Bester | Atomistic theory of excited states in van-der-Waals heterostructures: Moiré confinement, strain and electric field effects |
| | 12:25 | Felix Ehring<br>Emeline Nysten | Straintronics with van der Waals Ferroelectrics |
| | 12:40 | Angelika Knothe | Electronic, Optical, and Transport Properties of Quantum Dots in Proximitised Bilayer Graphene |
| **13:00 – 14:30** | **Lunch + Steering Committee Meeting + PhD Student meeting** | | |
| **14:30 – 15:45** | **Session 3 (Chair: tba )** | | |
| | 14:30 | Thomas Heine<br>Xinliang Feng<br>Thomas Weitz | Magnetic and electronic properties of graphene/MOFene superlattices |
| | 14:50 | Dmitri Efetov | In search of a quantum critical point - Thermodynamic investigations of superconducting and incoherent metal phases in twisted bilayer graphene |
| | 15:05 | Felix Lüpke | Nanoscale control of 2D superconductivity and Majorana states |
| | 15:20 | Hubert Dulisch<br>Christoph Stampfer | Confining electrons in twisted and proximity-coupled bilayer graphene |
| **15:45 – 16:30** | **Coffee break** | | |
| **16:30 – 18:00** | **Poster Session A** | | |
| **18:30** | **Dinner** | | |

# Thursday, October 23rd

| | | | |
|---|---|---|---|
| **8:00 – 9:15** | **Breakfast** | | |
| **9:15 – 10:15** | **Moshe Ben Shalom**<br>Tel Aviv University, Israel<br>**Sliding Multiferroic vdW Polytypes** | | |
| **10:15 – 10:45** | **Session 4 (Chair: tba)** | | |
| | 10:15 | Sebastian Bange | High-lying excitons and tuneable excitonic quantum optics in stacked van-der-Waals semiconductors |
| | 10:30 | Jaroslav Fabian | Proximity spin interactions in 2D magnetic vdW (hetero)multilayers |
| **10:45 – 11:30** | **Coffee break** | | |
| **11:30 – 13:00** | **Session 5 (Chair: tba)** | | |
| | 11:30 | Sai Shradha,<br>Julian Picker<br>Andrey Turchanin<br>Bernhard Urbaszek<br>Ermin Malic | Dipolar excitons and interlayer coupling: Optics, dynamics and transport in Janus TMD heterostructures |
| | 11:50 | Bent van Wingerden<br>Marcel Reutzel<br>Stefan Mathias | Dark excitons: Energetics, dynamics, transport and correlated phases |
| | 12:10 | Jeison Fischer<br>Amilcar Bedoya-Pinto | Non-collinear spin textures in magnetic moiré van der Waals heterostructures |
| | 12:30 | Kirill Bolotin | Fingerprinting, tailoring, and transporting excitons in strained 2D heterostructures |
| **13:00 – 14:30** | **Lunch** | | |
| **14:30 – 15:45** | **Session 6 (Chair: tba )** | | |
| | 14:30 | Tommaso Pincelli<br>Ralph Ernstorfer | Exploring Electronic Correlations, Excitonics and Topology on Ultrafast Timescales in van der Waals Heterostructures |
| | 14:50 | Hamoon Hedayat<br>Paul van Loosdrecht | Ultrafast Optical Control of Spins in Antiferromagnet-TMDC Heterostructures |
| | 15:10 | Janina Maultzsch | Optical and vibrational properties of twisted 2D layered heterostructures |
| | 15:20 | Christopher Gies<br>Stephan Reitzenstein<br>Christian Schneider | Manybody non-linear and coherent phenomena in optical cavities with embedded van der Waals heterostructures: The bosonic versus the fermionic regime |
| **15:45 – 16:30** | **Coffee break** | | |
| **16:30 – 18:00** | **Poster Session B** | | |
| **18:30** | **Dinner** | | |

## Friday, October 24th

| | | | |
|---|---|---|---|
| **8:00 – 9:15** | **Breakfast** | | |
| **9:15 – 10:15** | **Antonio H. Castro Neto**<br>National University of Singapore<br>**Old Materials, New Visions: Sustainable Approaches to Modern Challenges** | | |
| **10:15 – 10:45** | **Coffee break** | | |
| **10:45 – 11:30** | **Session 7 (Chair: tba)** | | |
| | 10:45 | Marko Burghard<br>Christoph Kastl<br>Alexander Holleitner | Electronic control of combined spin-orbit and magnetic exchange coupling in graphene vdW-heterostructures |
| | 11:05 | Stuart Parkin | Interplay between magnetism and superconductivity in 2D van der Waals heterostructures |
| **11:30 – 11:45** | **Closing** | | |
| **12:00 – 13:00** | **Lunch** | | |
| | **Departure** | | |

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## Invited Lecture 1

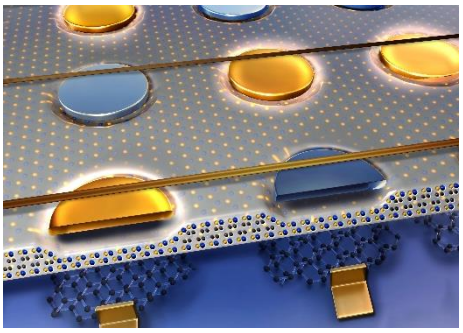
Thursday, October 23rd, 9:15 - 10:15


# Moshe Ben Shalom


## Sliding Multiferroic vdW Polytypes


School of Physics, Tel Aviv University, Israel

https://www.qlmgtau.com

We present superlubricant arrays of van der Waals polytypes (SLAP): nanoscale commensurate domains embedded in a superlubricant matrix that permit electrically driven lattice restructuring and non-volatile, room-temperature multiferroic response. The talk covers intrinsic charge redistribution and shifted dispersions in polytypes made of hBN, TMDs, and graphene layers [1–3], structural stability versus rapid switching by sliding boundary solitons [4], and long-range elastic coupling between domains via the superlubricant medium [5], highlighting a low-energy pathway to controllable structural phase transitions in vdW systems.


[1] "Interfacial ferroelectricity by van-der-Waals sliding" (Science, 2021)
[2] "Cumulative Polarization in Conductive Interfacial Ferroelectrics" (Nature, 2022 )
[3] "Spontaneous Electric Polarization in Graphene Polytypes" (ADPR, 2024)
[4] "Sliding van der Waals Polytypes" (Nature Rev.Phys. 2024)
[5] " Polytype switching by super-lubricant van der Waals cavity arrays" (Nature, 2025)

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**Invited Lecture 2**
Friday, October 23rd, 9:15 - 10:15


## Antonio H. Castro Neto


# Old Materials, New Visions: Sustainable Approaches to Modern Challenges


Centre for Advanced 2D Materials, National University of Singapour, Singapour

https://graphene.nus.edu.sg/



Professor Castro Neto delves into how traditional materials can be reimagined to address contemporary sustainability challenges, emphasizing innovative research strategies and technologies emerging from the NUS Centre for Advanced 2D Materials (CA2DM). The seminar highlights the pivotal role of advanced materials research in overcoming environmental and societal obstacles through sustainable solutions and modern scientific approaches.

# List of posters

*Numbers are assigned in the same order as talks*

| Poster | Principal Investigators | Project name |
|---|---|---|
| | | |