Name and contact information:



Jagoda Sławińska

Associate Professor

Email: jagoda.slawinska@rug.nl

Website: https://www.rug.nl/staff/jagoda.slawinska/

https://research.rug.nl/en/persons/jagoda-slawinska/

https://www.rug.nl/research/zernike/theory-of-condensed-matter/slawinska-group/

Affiliation:

Zernike Institute for Advanced Materials, University of Groningen

Biographical information:

Jagoda Sławińska received her Ph.D. in 2012 at the University of Łódź, after which she completed the postdocs at the ICMM-CSIC (Spain), CNR-SPIN (Italy) and the University of North Texas (USA). She joined Zernike Institute for Advanced Materials as an assistant professor in 2020. Her research group Computational Materials Science is focused on modeling, designing, and understanding novel quantum materials for nanoelectronics and spintronics. The major research themes are ferroelectric spintronics, chiral spintronics, and 2D materials and heterostructures. The group actively contributes to the development of computational tools based on density functional theory used for calculations at different scales. They also closely collaborate with experimentalists, predicting new effects, explaining experimental observations, and proposing novel applications for electronics.

Sławińska received a prestigious Prime Minister's Award for the Ph.D. Thesis in 2013 in Poland, Mobility Plus Fellowship 2013-2015 from the Polish Ministry of Science, and Rosalind Franklin Fellowship at the University of Groningen in 2020.

Title: Unconventional responses in condensed matter physics: from ferroaxial order to chirality induced spin selectivity

Abstract

Symmetries of materials determine how they respond to external stimuli and provide a powerful route toward controlling condensed matter phenomena. In this talk, I will discuss unconventional

charge and spin responses arising from ferroic orders and other symmetry-driven properties. I will first focus on ferroaxial crystals, where ferroaxial order can enable unconventional charge and spin responses and provide a route toward their nonvolatile control.

I will then turn to chirality in solids, which gives rise to charge-to-spin conversion with spin accumulation parallel or antiparallel to the applied current, resembling the intriguing phenomenon of chirality-induced spin selectivity (CISS) observed in molecular systems. Recent results showing efficient charge-to-spin conversion and long-range spin transport in chiral materials will be discussed, including Te, $TaSi_2$, OsSi, and $NiTa_3S_6$, where symmetry-enforced persistent spin textures remain robust over large regions of the Brillouin zone, enabling efficient generation of spin signals and potentially enhanced spin lifetimes.

Finally, I will extend these ideas to twisted van der Waals materials, both nonmagnetic and magnetic, including altermagnets. These examples illustrate the range of unconventional charge and spin responses that can be obtained by exploiting symmetry in quantum materials.

References:

1. Z. He, G. Khalsa, J. Sławińska, *Universal unconventional responses controlled by ferroaxial order, arXiv: 2608.30706 (2026)*
2. B. Kilic, S. Alvarruiz, E. Barts, B. van Dijk, P. Barone, J. Sławińska, *Universal symmetry-protected persistent spin textures in nonmagnetic solids*, Nature Communications 16, 7999 (2025)
3. E. Barts, K. Tenzin, J. Sławińska, *Efficient spin accumulation carried by slow relaxons in chiral tellurium*, Nature Communications 16, 4056 (2025)
4. K. Tenzin, B. Kilic, R. Sattigeri, Z. He, C. Chen Ye, M. Costa, M. Buongiorno Nardelli, C. Autieri, J. Sławińska, *Persistent spin textures, altermagnetism, and charge-to-spin conversion in metallic chiral crystals TM_3X_6* npj Spintronics 3 (1), 46 (2025)
5. J. Sławińska, Spin selectivity in elemental tellurium and other chiral materials, Applied Physics Letters 123, 240504 (2023)
6. A. Roy, F.T. Cerasoli, A. Jayaraj, K. Tenzin, M. Buongiorno Nardelli, J. Sławińska, *Long-range current-induced spin accumulation in chiral crystals,* npj Computational Materials 8, 243 (2022)

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