IQST

IQST Seminar by Dr. Leo Gross

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Tip-Induced Synthesis of Elusive Molecules

Time: Thursday, 12 November 2026, 11:00
Location: University of Stuttgart
Pfaffenwaldring 57, Room 6.141

Abstract:

Chemical reactions can be induced with the tip of a scanning probe microscope [1]. Thereby reactions can be triggered [2], and elusive molecules can be synthesised and then studied by scanning tunnelling microscopy (STM) and non-contact atomic force microscopy (AFM) with bond-resolved contrast [3,4]. I will focus on the synthesis and characterization of cyclocarbons, rings of carbon atoms that are model systems to study aromaticity and benchmark theoretical predictions [5-8]. In a related molecule, a ring of 13 carbon atoms with two chlorine atoms attached, a molecule which orbital basis is of half-Möbius topology, periodic only after four circumnavigations, can be realized, see Figure. Helical molecular orbitals, a hallmark of the unusual topology, were calculated using quantum hardware [9].

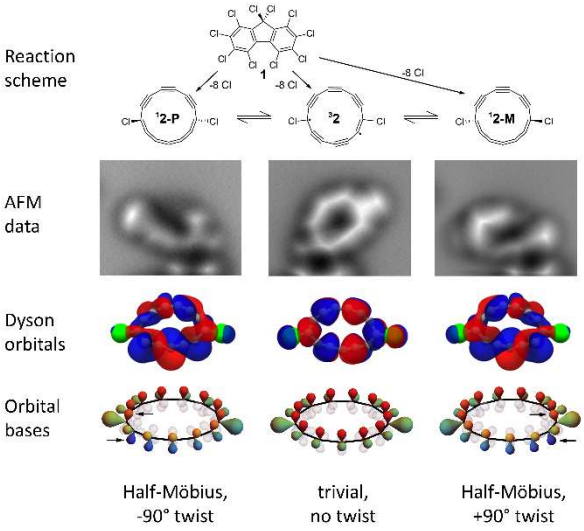


Figure: Synthesis and characterization of a molecule, with half-Möbius topology [9]. The molecule (**2**) can be switched between half-Möbius singlet enantio-mers with opposite helicity (**^{1}2-P** and **^{1}2-M**) and a triplet state with trivial topology (**^{3}2**).

[1] B. Stipe et al., Phys. Rev. Lett. 78, 4410–4413 (1997)
[2] F. Albrecht et al., Science 377, 298–301 (2022)
[3] L. Gross et al., Science 325, 1110–1114 (2009)
[4] L. Gross et al., Science 337, 1326–1329 (2012)
[5] K. Kaiser et al., Science 365, 1299-1301 (2019)
[6] Y. Gao et al., Nature 623, 977–981 (2023)
[7] F. Albrecht et al., Science 384, 677–682 (2024)
[8] L. Sellies et al., arXiv (2026) https://arxiv.org/abs/2603.02040
[9] I. Roncevic et al., Science 392 (2026), DOI: 10.1126/science.aea3321

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