

CONDENSED MATTER SEMINAR

Thursday 2 March at 14.30

Simpkins Lee room/Zoom

“Exploring fractionalization and flat-bands in nanographene lattices with STM”

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I will present recent advances[1] in the design and understanding of non-trivial quantum phenomena, such as fractionalization [1] and the emergence of flat bands[2], both in 1D and 2D lattices formed with open-shell nanographenes. I will discuss the simple rules[3] that relate the atomic structure of nanographenes to the spin of their ground state, as well as the rules for intermolecular exchange [4]. I will review how Scanning Tunnel Microscopy (STM) can be used to carry out both inelastic electron tunnel spectroscopy (STM-IETS) and single-spin resonance (STM-ESR), and how these can be used to probe the emergence of fractional $S=1/2$ excitations at the edge of a $S=1$ Haldane spin chain made with graphene triangulenes[1]. I will end by discussing the emergence of narrow and flat bands in nano-graphene 2D lattices [2], reminiscent of magic-angle twisted bilayer graphene and how to probe broken symmetry phases with STM-IETS.

[1] Observation of fractional edge excitations in nanographene spin chains

S Mishra, G Catarina, F Wu, R Ortiz, D Jacob, K Eimre, J Ma, CA Pignedoli, Xinliang Feng, Pascal Ruffieux, Joaquin Fernandez-Rossier, Roman Fasel

Nature 598, 287 (2021)

[2] Theory of triangulene two-dimensional crystals,

R Ortiz, G Catarina, J Fernández-Rossier,

2D Materials 10 (1), 015015 (2023)

[3] Exchange rules for diradical pi-conjugated hydrocarbons

R Ortiz, RÁ Boto, N García-Martínez, JC Sancho-García, M Melle-Franco, J Fernández-Rossier

Nano Lett. 19 (9), 5991-5997 (2019)

[4] Theory of intermolecular exchange in coupled spin 1/2 nanographenes

D Jacob, J Fernández-Rossier

Physical Review B 106 (20), 205405 (2022)

Host: Prof Arzhang Ardavan