



Contribution ID: 120

Type: Poster

Reflectometry using polarised cold neutrons to probe quantum heterostructures

Tuesday 2 December 2025 15:30 (1 hour)

The pioneering experiments of Fermi and others in the 1940s revealed that thermal and cold neutrons exhibit coherent quantum wave phenomena such as interference, diffraction, and reflection [1].

It was soon recognised that this unique quantum beam offered major advantages for studying atomic structures in solids. Today, numerous international facilities produce brilliant neutron beams to probe soft and hard condensed matter across scales from sub-nanometers to centimetres, and dynamics ranging from hours to picoseconds. These include instruments at the Australian Centre for Neutron Scattering [2] and other sources in Asia-Oceania [3].

This poster explores neutron surface reflection from ultra-thin films and presents the exact solution to the 1D Schrödinger equation describing this process. This enables modelling of experimental data to probe nanometer-scale magnetic depth profiles of surfaces and thin films, down to the monolayer limit. Experiments are routinely conducted on the Platypus reflectometer at the Australian Nuclear Science and Technology Organisation, supporting diverse studies in physics, chemistry, and biology, with over 198 publications [4]. The technique is ideal for investigating quantum heterostructures with magnetic or superconducting components. Applications include ultrathin “2D” magnetic films [5], topological insulators [6], strongly correlated oxides [7], hydrogen reactions [8], superconductors [9], and graphene growth [10]

[1] E.E. Fermi and L Marshall, Phys Rev 71, 666, (1947)

[2] www.ansto.gov.au/facilities/australian-centre-for-neutron-scattering

[3] www.aonsa.org

[4] <https://neutron.ansto.gov.au/Bragg/proposal/PublicationList.jsp?instr=9>

[5] D. L. Cortie et al., Advanced Functional Materials 30 (18), 1901414 (2020)

[6] A. Bake et al., Appl. Surface Science, 570, 151068, (2021)

[8] L. Guasco et. al, Advanced Functional Materials 35 (16), 2419253 (2025)

[9] M. Bose et. al., Applied Surface Science 696, 162930 (2025)

[10] A. Pradeepkumar et al. RSC advances 14 (5), 3232-3240

Author: CORTIE, David

Presenter: CORTIE, David

Session Classification: Poster Session

Track Classification: Topical Groups: Condensed Matter & Materials