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Magnetic Ordering in Superconducting Sandwiches

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Our cuprate-manganite 'superconducting sandwich' multilayers exhibit a highly unusual magnetic-field induced insulating-to-superconducting transition (IST), contrary to the commonly held understanding that magnetic fields are detrimental to superconductivity [1, 2]. This new behaviour is a result of the specific magnetic and electronic properties of the manganite coupling with the high-Tc cuprate (YBa2Cu3O7-δ, YBCO). Due to the specific manganite composition, Nd0.65(Ca0.7Sr0.3)0.35MnO3 (NCSMO), we hypothesize the behaviour to originate from CE-type antiferromagnetic ordering as well as charge and orbital ordering [3].

The magnetic data presented here will focus on polarized neutron reflectometry (PNR) and elastic neutron scattering on a YBCO-NCSMO trilayer and superlattice. The model that best described the PNR data for the trilayer had antiparallel moments at the YBCO-NCSMO interfaces. In the superlattice, the direction of moments at NCSMO interfaces were found to alternate with film depth whose long-ranged ordering was broken below 35 K in a 1 T applied field. The stability of the AFM order in the superlattice was further supported by a robustness of magnetic in-plane half-order elastic scattering peaks at 9 T. This evidences the interplay of magnetism and superconductivity that play a role in realizing the IST effect in our superconducting sandwiches.

REFERENCES
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Level of Expertise

Early Career <5 Years

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Centre for Neutron Scattering

Students Only - Are you interested in AINSE student funding

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Condition of submission

Yes

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