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Physical Sciences Seminar

Quantum Seminars - Delafossite oxides: natural, ultra-pure metal-insulator heterostructures

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Host: Andrew Higginbotham / Zhanybek Alpichshev

Delafossite oxides are layered compounds, which can be thought of as natural heterostructures of triangularly coordinated metallic sheets and transition metal oxide blocks. A fascinating range of electronic states can be found both in their bulk and on their surfaces, including extremely high conductivity (1) in PtCoO2 and PdCoO2, maximal Rashba-like spin-splitting (2) on the transition metal terminated surfaces of PtCoO2, PdCoO2 and PdRhO2, Stoner ferromagnetism (3) on the Pd-terminated surface of PdCoO2 and, perhaps most remarkably, an intertwined spin-charge response due to a Kondo coupling between metallic and Mott insulating layers (4) in PdCrO2. Our group has investigated these states experimentally with transport measurements and angle resolved photoemission, and theoretically with first principles calculations and model Hamiltonians, where applicable. I will show how in a number of cases the simplicity and cleanliness of the materials allows us to pinpoint to the underlying cause for the remarkable electronic behaviour, and in turn to use delafossites as model systems to understand complex phenomena.

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(2) Sunko, V., Rosner, H., Kushwaha, P., Khim, S., Mazzola, F., Bawden, L., Clark, O.J., Riley, J.M., Kasinathan, D., Haverkort, M.W., Kim, T.K., Hoesch, M., Fujii, J., Vobornik, I., Mackenzie, A.P., King, P.D.C., 2017, Nature 549, 492
(3) Mazzola, F., Sunko, V., Khim, S., Rosner, H., Kushwaha, P., Clark, O.J., Bawden, L., Markovi?, I., Kim, T.K., Hoesch, M., Mackenzie, A.P., King, P.D.C., 2017., PNAS 51, 12956
(4) Sunko, V., Mazzola, F., Kitamura, S., Khim, S., Kushwaha, P., Clark, O. J. , Watson, M., Markovi?, I., Biswas, D., Pourovskii, L., Kim, T. K., Lee, T.-L. , Thakur, P. K., Rosner, H., Georges, A., Moessner, R., Oka, T. , Mackenzie, A. P., and King, P. D. C., 2018, arXiv:1809.08972, to be published in Science Advances

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IST Austria Campus Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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