Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Delafossite oxides: natural, ultra-pure metal-insulator heterostructures"

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Abstract: 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 $PtCoO_2$ and $PdCoO_2$, maximal Rashba-like spin-splitting[2] on the transition metal terminated surfaces of $PtCoO_2$, $PdCoO_2$ and $PdRhO_2$, Stoner ferromagnetism[3] on the Pd-terminated surface of $PdCoO_2$ and, perhaps most remarkably, an intertwined spin-charge response due to a Kondo coupling between metallic and Mott insulating layers in $PdCrO_2$. Our group has investigated all of these states experimentally with 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.

[1] Kushwaha, P., Sunko, V., Moll, P.J.W., Bawden, L., Riley, J.M., Nandi, N., Rosner, H., Schmidt, M.P., Arnold, F., Hassinger, E., Kim, T.K., Hoesch, M., Mackenzie, A.P., King, P.D.C., 2015, Science Advances 1, e1500692.
[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., Marković, I., Kim, T.K., Hoesch, M., Mackenzie, A.P., King, P.D.C., 2017., arXiv:1710.05392

12:00pm noon
Tuesday, September 25, 2018
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Host: Nuh Gedik and Senthil Todadri