Anomalous spin and charge response in antiferromagnetic $SrIrO_3/SrTiO_3$ superlattices

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While manipulation of antiferromagnetic (AFM) order arises to the forefront of spintronics, it is a long-standing fundamental problem of correlated electron physics. In this talk, I will present couple exciting findings in the strong spin-orbit coupled correlated system, layered iridates. A series of artificial layered iridates $[(SrIrO_3)_1/(SrTiO_3)_m]$ were prepared to engage with a staggered magnetic field effect due to the strong spin-orbit interaction. By tuning the $SrTiO_3$ spacer, the AFM structure of the Mott insulating state can be engineered [1]. Upon driving the AFM structure to the two-dimensional limit at m = 2, a hidden SU(2) symmetry is achieved, which was first proposed in cuprates but never experimentally realized. As a result, while the ordering temperature is significantly reduced by strong critical fluctuations, the staggered magnetic field effect allows an external field to greatly suppress the AFM fluctuations and enable a giant response of the AFM order [2]. With a partially released charge degree of freedom at m = 1, the staggered magnetic field effect leads to an intriguing positive anomalous magnetoresistance that probes the AFM susceptibility, because of the strong interplay between charge and longitudinal spin fluctuations [3,4].

[1] Lin Hao, et.al, Phys. Rev. Lett. 119, 027204 (2017)
[2] Lin Hao, et.al, Nat. Phys. 14, 806 (2018)
[3] Lin Hao, et.al, Nat. Commun. 10, 5301 (2019)
[4] J. Yang*, Lin Hao*, et.al, Phys. Rev. Lett. 124, 177601 (2020)

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