[QMS2020 invited talk]

Spin-Charge Coupled Transport in Iridate heterostructures

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Iridium compounds are a unique class of materials among transition-metal compounds in that strong electron correlation and spin-orbit interaction coexist with a variety of crystal structures. These properties would lead to the emergence of topologically nontrivial band structure with correlation. Additionally, the strong spin-orbit interaction can open possible applications utilizing strong spin-orbit interaction such as magnetization switching or oscillations. Here we present the transport properties of pyrochlore iridate thin films and heterostructures.

Owing to the frustrated crystal structure, pyrochlore iridates exhibit an interesting spin arrangement called all-in-all-out, where two distinct antiferromagnetic domains exist in spite of net zero magnetic moment. We found an unusual linear component in magnetoresistance and the sign is inverted when the magnetic domain is switched [1]. We concluded that the linear component originates from an interaction between the conducting electrons and the all-in-all-out magnetic structure. Then these properties can be used to detect the magnetic domains on a microscopic scale [2]. We also established a way to stabilize specific magnetic domains by combining magnetic field sweep and field cooling, which is detected by magnetoresistance [3] and scanning SQUID microscopy [4]. Utilizing this technique, domain boundaries are artificially created, which shows higher conductivity than that in the bulk, possibly reflecting the topological nature of the electronic states [5].

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