# Proximity Effect of Emergent Magnetic Field

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Recent research has established that specific magnetic spin textures generate emergent magnetic fields ($b_{em}$) through the Berry phase defined both in real and reciprocal spaces. This fictitious field produces numbers of emergent magnetotransport phenomena, as exemplified by an unconventional anomalous Hall effect (AHE) that does not scale with macroscopic magnetization. While research on this type of AHE has conventionally focused on magnetic metals, many insulating magnets potentially host $b_{em}$ through their spin textures. However, their insulating nature prevents direct electrical transport measurements. Heterointerface structures with non-magnetic conducting compounds offer a solution, as mobile electrons in the conducting layer can detect microscopic spin textures in adjacent magnetic insulating layers through proximity effects. Our research has successfully demonstrated that such proximity effects can indeed trigger the unconventional AHE in both pyrochlore ($Bi_2Rh_2O_7/Dy_2Ti_2O_7$) and perovskite ($CaRuO_3/DyFeO_3$) oxide-based heterointerface structures [1,2].

Here we present our recent progress in elucidating these interfacial emergent magnetotransport phenomena. By fabricating heterointerfaces with various compounds, we have determined the decay length of the proximity effect, revealed that the unconventional AHE consistently emerges in magnetic layers with similar spin textures, and enhanced the Hall angle of the unconventional AHE [3-5]. These findings establish epitaxial oxide heterointerfaces as ideal platforms for expanding our understanding of emergent interfacial phenomena, providing insights into more efficient manipulation of $b_{em}$ for future applications.

**References:**

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