Poster-1-24

Scanning Nitrogen-Vacancy Magnetometry to Study the Origin of Exchange Bias in 2D van der Waals Heterostructures

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2D van der Waals magnets are an interesting platform to explore new magnetic phenomena at a reduced dimensionality. Their atomically sharp and clean surfaces offer unique opportunities to investigate interface effects and utilize them in novel heterostructures, such as the exchange bias between a 2D ferromagnet (FM) and antiferromagnet (AFM). However, the origin of exchange bias is often poorly understood due to a lack of experimental tools that are sensitive to the exact magnetic state at the interface. Scanning nitrogen-vacancy magnetometry (S-NVM) can directly probe the magnetic order with high sensitivity and nanoscale spatial resolution of such an interface, providing unique insights into these heterostructures [1].
Here, we study a heterostructure between the 2D FM Fe_3GeTe_2 and AFM $MnPS_3$. Although $MnPS_3$ exhibits a perfectly compensated magnetic surface, anomalous Hall measurements reveal a strong exchange bias on Fe_3GeTe_2. Using S-NVM, we reveal that at temperatures well below its Néel temperature, $MnPS_3$ deviates from its ideal bulk magnetic structure and shows a non-zero remanent magnetic moment with easy-plane anisotropy. The correlation of the temperature dependence indicates that this anomalous moment is the underlying mechanism of the exchange bias in the heterostructure [2].

[1] Thiel et al., Science 364, 2019.
[2] Aravind et al., arXiv:2403.05383, 2024.