Antiferromagnetic Ordering in 2-Dimensional van der Waals Materials

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Magnetism in low dimensional systems is attracting much interest not only for the fundamental scientific interest but also as a promising candidate for numerous applications. Intense interest in 2 dimensional magentism has been stimulated by the discovery of ferromagnetism in atomically thin materials [1,2], but antiferromagnetic ordering is much more difficult to study because the lack of net magnetism hinders easy detection of such phenomena. Neutron scattering, which is a powerful tool to detect antiferromagnetic order in bulk materials, cannot be used for atomically thin samples due to the small sample volume. Raman spectroscopy has proven to be a powerful tool to detect antiferromagnetic ordering by monitoring the zone-folding due to the antiferromagnetic order [3,4] or the signal from two magnon scattering. In this talk, I will review recent achievements in the study of antiferromagnetism in 2 dimensions using Raman spectroscopy. $FePS_3$ exhibits an Ising-type antiferromagnetic ordering down to the monolayer limit, in good agreement with the Onsager solution for 2-dimensional order-disorder transition. The transition temperature remains almost independent of the thickness from bulk to the monolayer limit, indicating that the weak interlayer interaction has little effect on the antiferromagnetic ordering. [4] On the other hand, $NiPS_3$, which shows an XXZ-type antiferromagnetic ordering in bulk, exhibits antiferromagnetic ordering down to 2 layers, but the magnetic ordering is suppressed in the monolayer limit. [5]

REFERENCES

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