Magnetic ordering in the transition-metal phosphorous trichalcogenides probed via Raman scattering

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The world of 2D materials is diverse and can be characterized with different physical properties. In early 2017, intrinsic ferromagnetism was observed down to a single layer in layered materials $Cr_2Ge_2Te_3$ and CrI_3, opening many avenues in fundamental physics and potential applications of these fascinating materials. **[1,2]**

Transition-metal phosphorus trichalcogenides MPX_3 (M denotes transition metal; X = S or Se) composed of two-dimensional layers bonded to one another through weak van der Waals interactions often exhibit strongly anisotropic behaviours, giving rise of magnetic ordering in the structure. Interest in these magnetic materials is driven by the study of low dimensional physics and the possible design of functional magnetic heterostructures. **[3]**

The appearance of magnetic order below a critical temperature may influence the strength of inter-atomic bonds or a reconfiguration of the atom's arrangement into a new crystallographic structure. **[4]** The investigation of these notions based on the measurements of Raman spectra of bulk transition-metal provide a direct insight into the adaptation of the crystal structure as well as to the emergence of magnetic interactions. MPX_3 is a group of materials that display antiferromagnetic/ferromagnetic in-plane/out of plane coupling between magnetic moments of neighbouring metal ions with different Néel temperature. **[5]**

The systematic optical study of MPX_3 crystals will be demonstrated with the emphasis on Raman scattering. The tentative interpretation of the experimental data will be used to discuss the interplay between the existence of magnetic order and the optical response of the samples.

References

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Figures

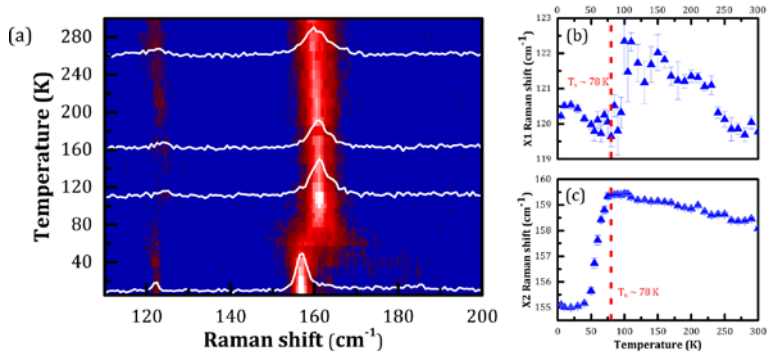

Figure 1: Colour map of Raman scattering of bulk $MnPS_3$ measured as a function of temperature, with focus on low frequency modes.