Multiferroic rotated CrI_3 bilayers with a three-dimensional intrinsic electric dipole

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Abstract

Magnetic bilayers can have their magnetoelectric multiferroic properties enhanced by the removal of a center of inversion through a relative rotation. Working with a prototypical CrI_3 bilayer, we have increased its intrinsic out-of-plane polarization by an order of magnitude through this procedure [1]. Surprisingly, we are also observing a robust and even larger in-plane polarization—similar to that observed in group-IV monochalcogenide monolayers [2]—which has not been reported to date. We also lay out a process to calculate the magnetoelectric tensor. Those results speak of the versatility of 2D bilayer magnets to become viable materials for novel and engineered magnetoelectric couplings.

References

[1] S. P. Poudel, J. Marmolejo-Tejada, J. Roll, M. Mosquera and S. Barraza-Lopez. "The in-plane intrinsic electric dipole of rotated CrI_3 bilayers. Under revision (2023).
[2] S. Barraza-Lopez, B. M. Fregoso, J. W. Villanova, S. P. P. Parkin, and K. Chang. *Rev. Mod. Phys.* **93**, 011001 (2021).

Figures

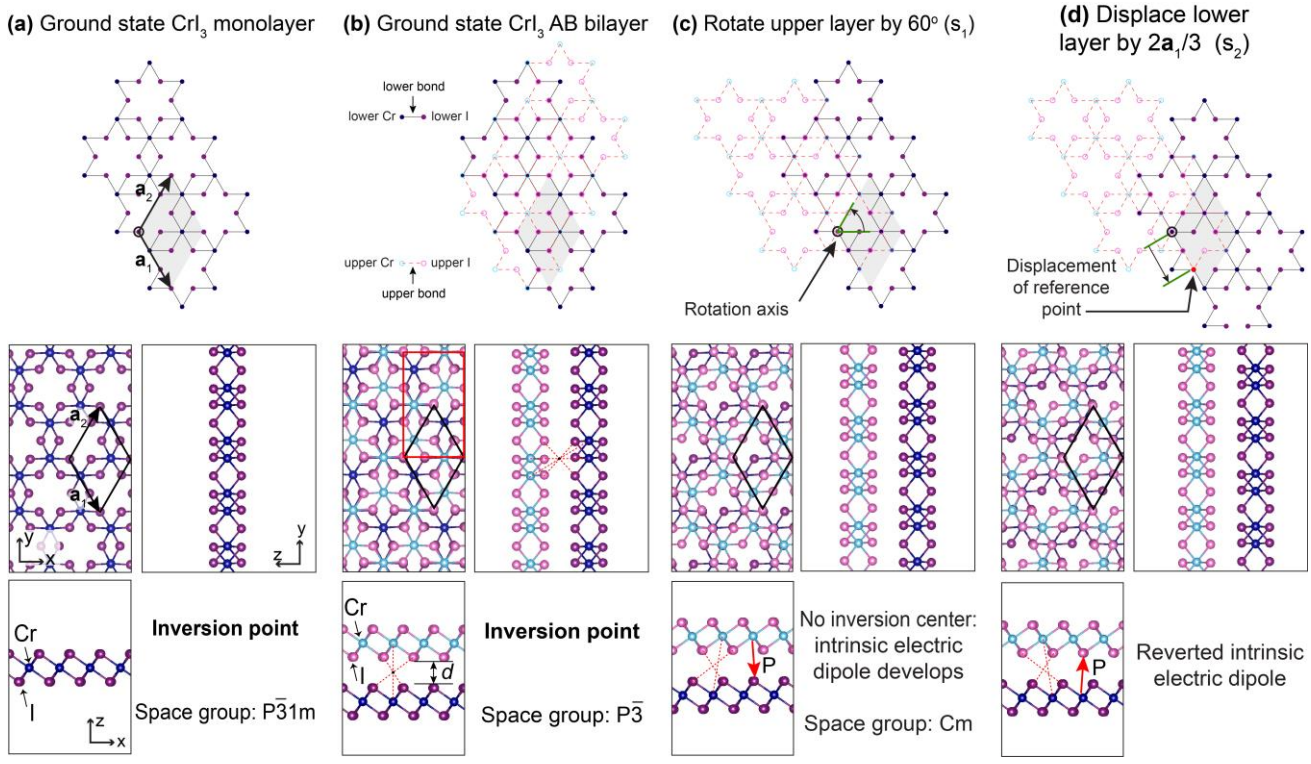

Figure 1: Process to enhance the magnetoelectric coupling on a CrI_3 bilayer.