# Moiré patterns and induced ferroelectricity in the $NiBr_2$/HOPG heterostructure

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In this work we use scanning tunneling microscopy (STM) and spectroscopy (STS) to study $NiBr_2$ monolayers grown on Highly Oriented Pyrolytic Graphite (HOPG). It has been previously shown that $NiBr_2$ monolayers grown on HOPG host a multiferroic spin spiral [1]. We report the presence of a reversible bias-induced switch in the apparent height of the $NiBr_2$ islands at room temperature that is preserved at low temperature. Positive bias pulses ~2 V switch NiBr2 islands from an ON state (~8 Å apparent height) to an OFF (~2 Å) state (Fig.1a) and negative pulses switch them back. Since bulk $NiBr_2$ orders magnetically only below 52 K [2] we attribute this switching to a substrate induced ferroelectric state as reported for GaSe [3] and β-$In_2Se_3$ [4]. At low temperature we identify several Moiré patterns formed between the overlayer and the substrate which we characterize with a geometric model (Fig. 1b) and through the Moiré magnification of an edge dislocation [5]. Finally, at 300 mK we also resolve the multiferroic spin spiral (Fig.1c).

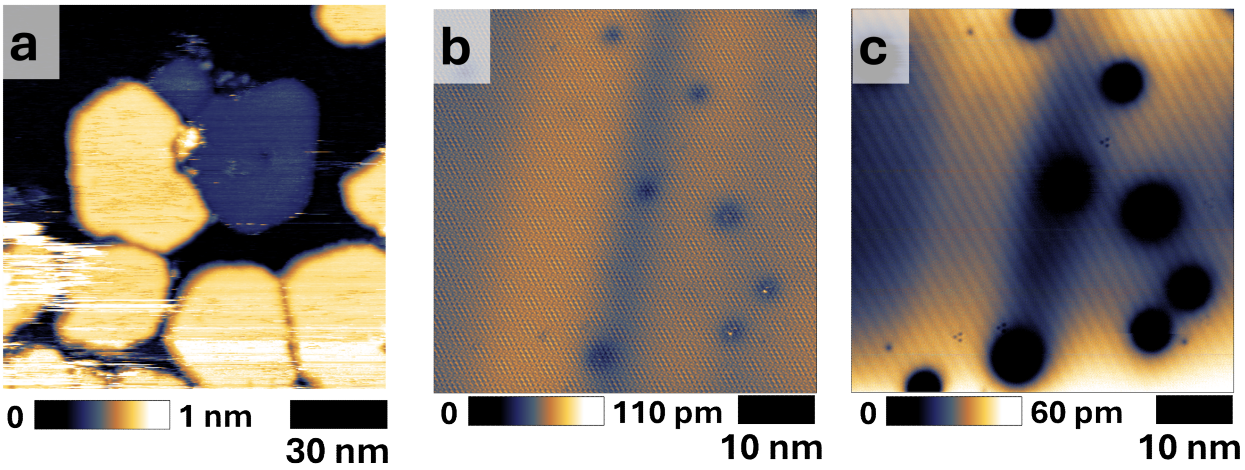


**Fig.1** STM topographies of NiBr2/HOPG. (a) OFF island next to ON islands. (b) Moiré pattern (twist angle of 12.5°) at 0.1 V and (c) spin spiral contrast at 0.7 V on the same area at 300 mK.

## REFERENCES

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