

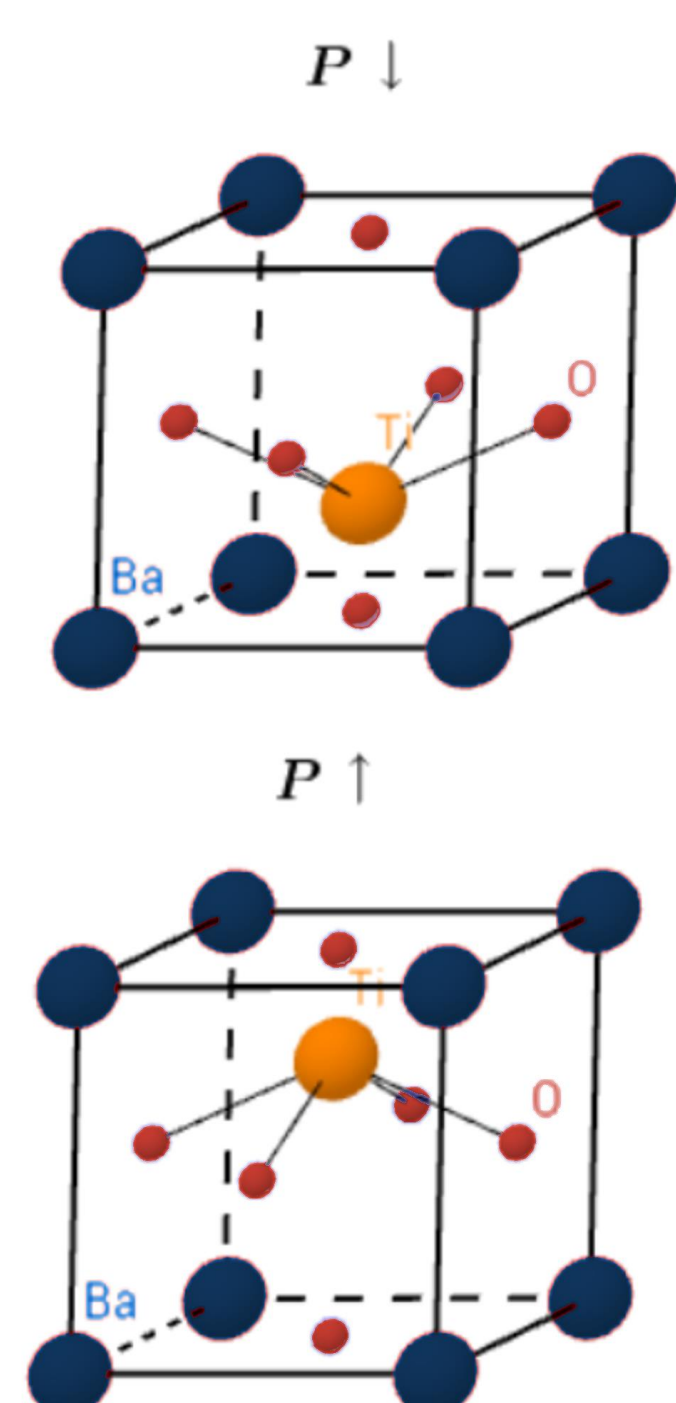
Electric TORNADOES with memory?

Vortex & antivortex architectures in 2D rotated ferroelectric sheets

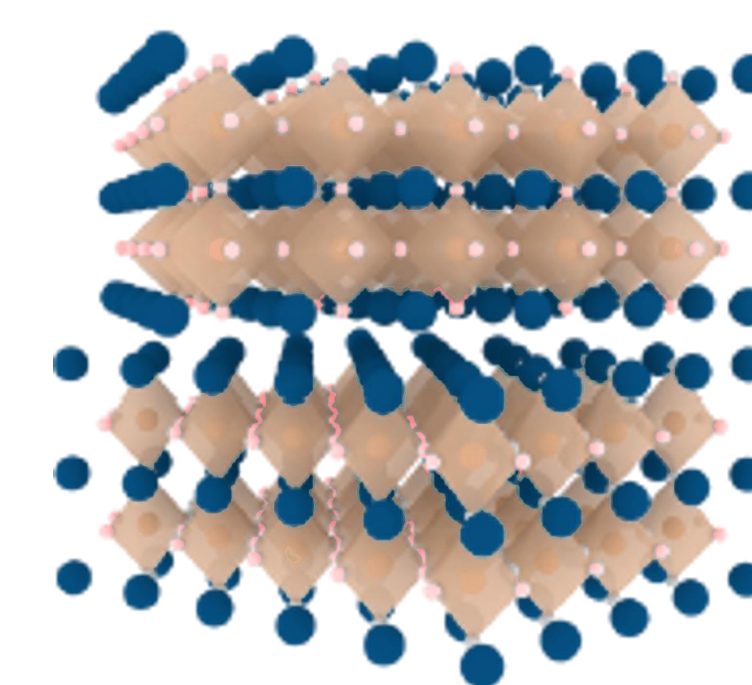
Víctor Zamora, Gabriel Sánchez, Víctor Rouco, Carlos León & Jacobo Santamaría

INTRODUCTION

Barium titanate BaTiO_3 is a well-known ferroelectric

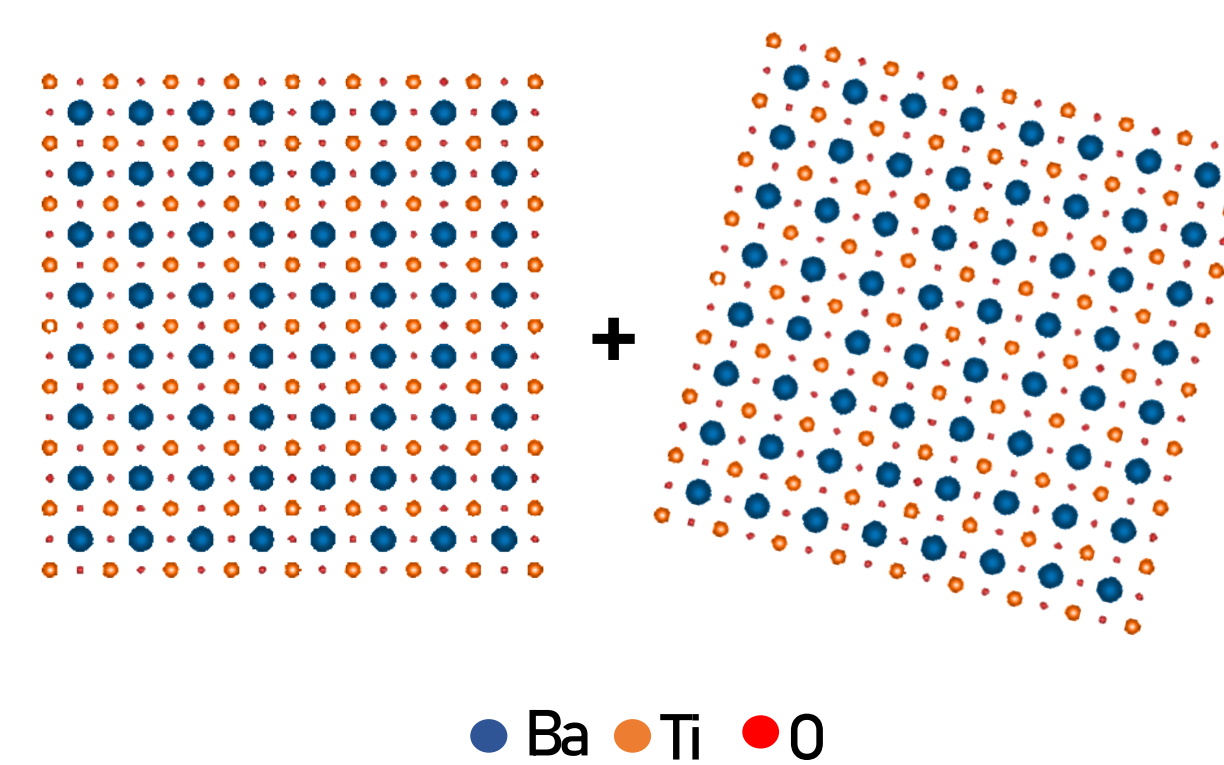


Recent success in the fabrication of freestanding oxide layers enable new material combinations

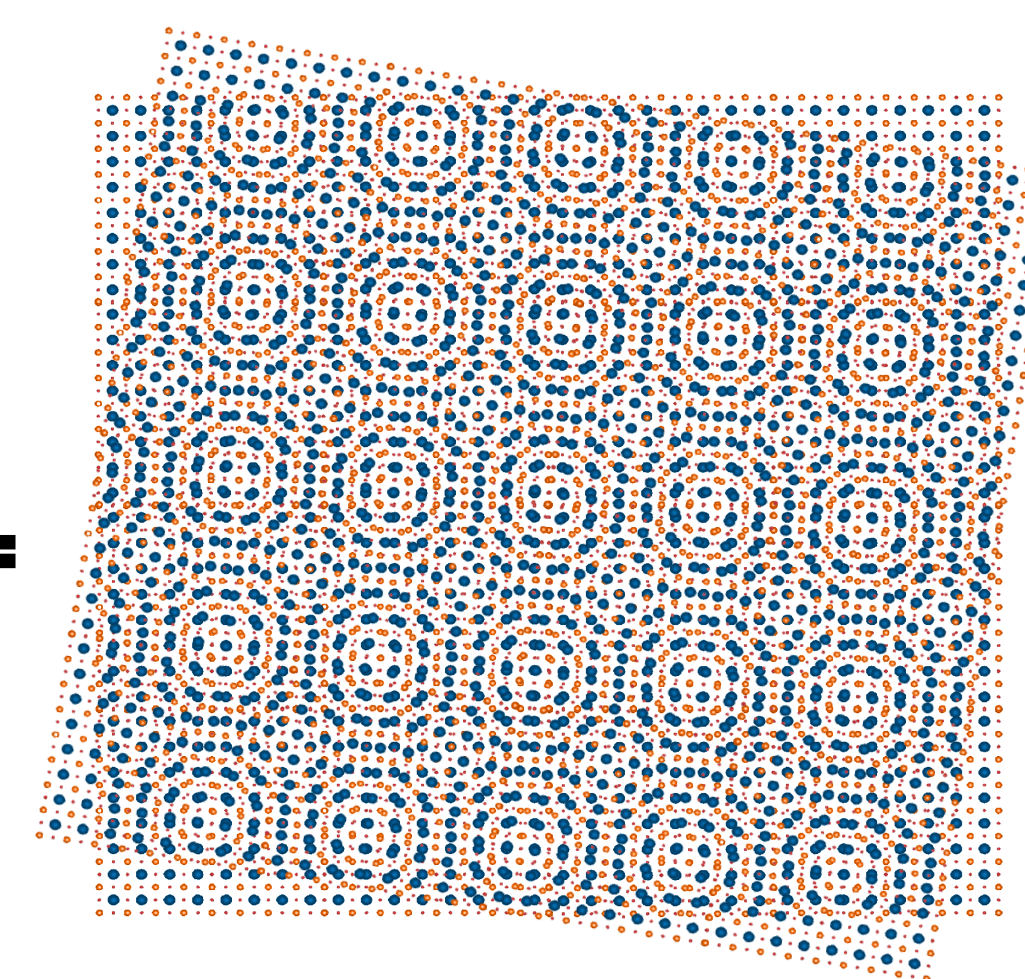


J. Shen et al. Appl. Mater. Interfaces 7, 50386 (2022)

What about twisting?



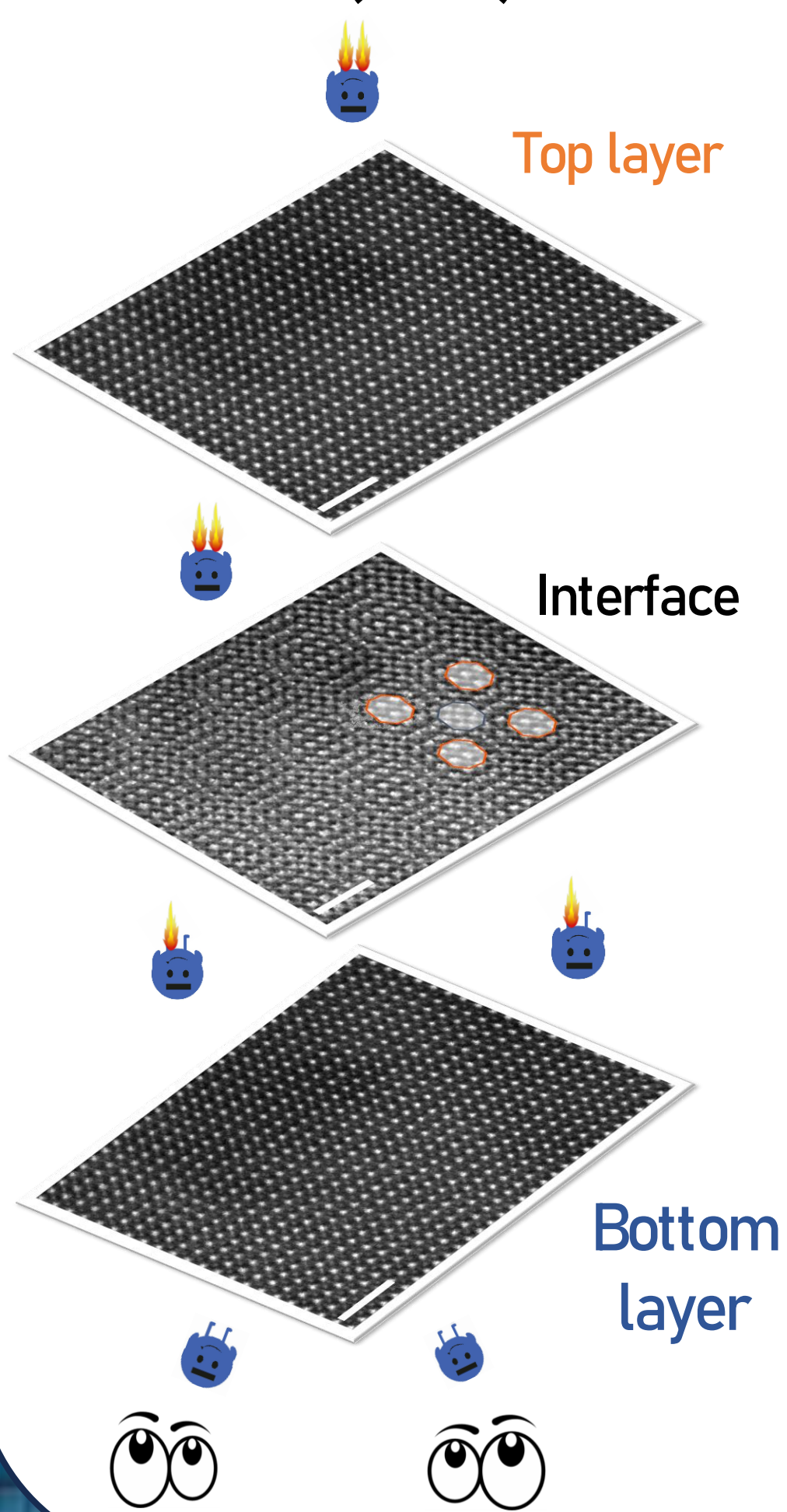
● Ba ● Ti ● O



Moiré pattern

RESULTS

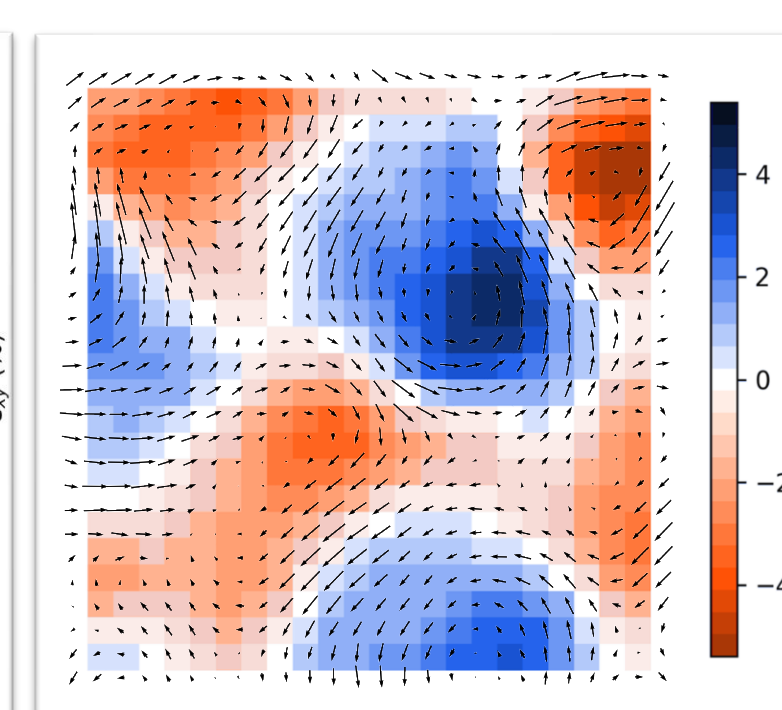
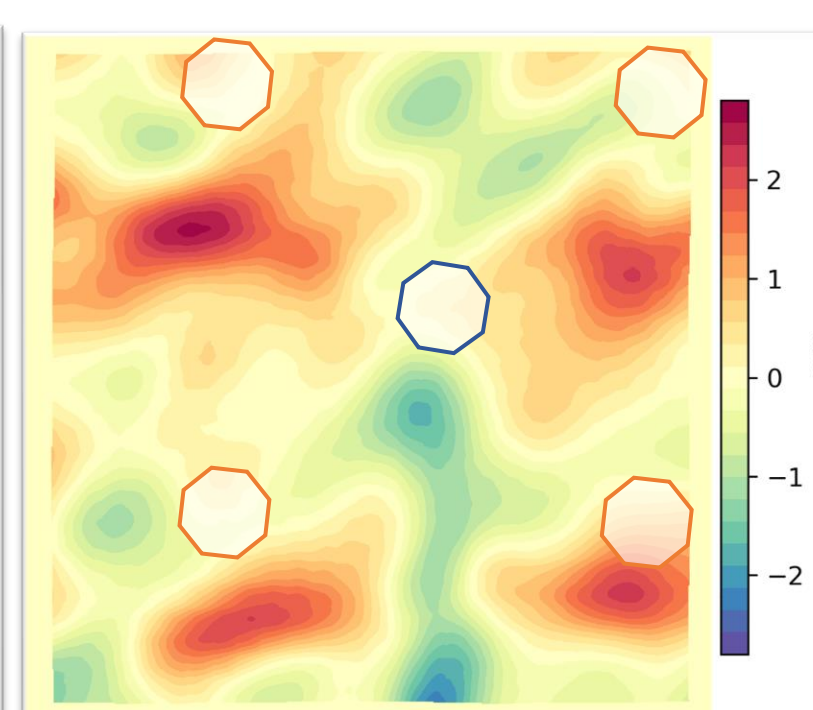
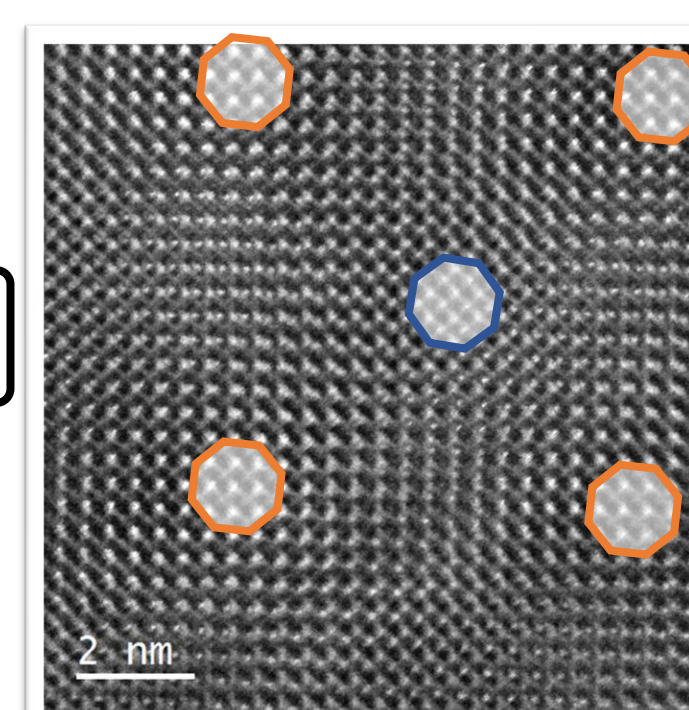
Depth sectioning scanning transmission microscopy (STEM)



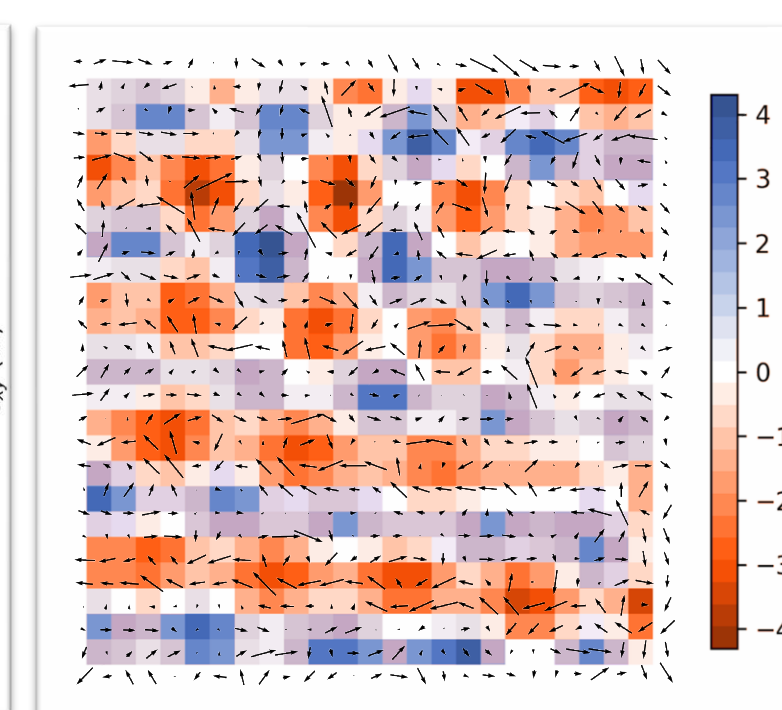
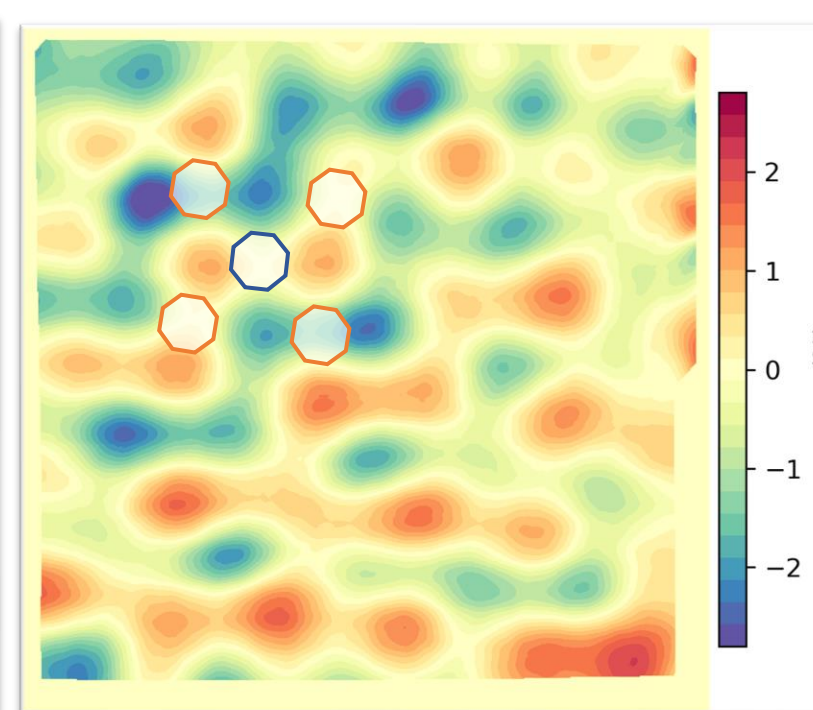
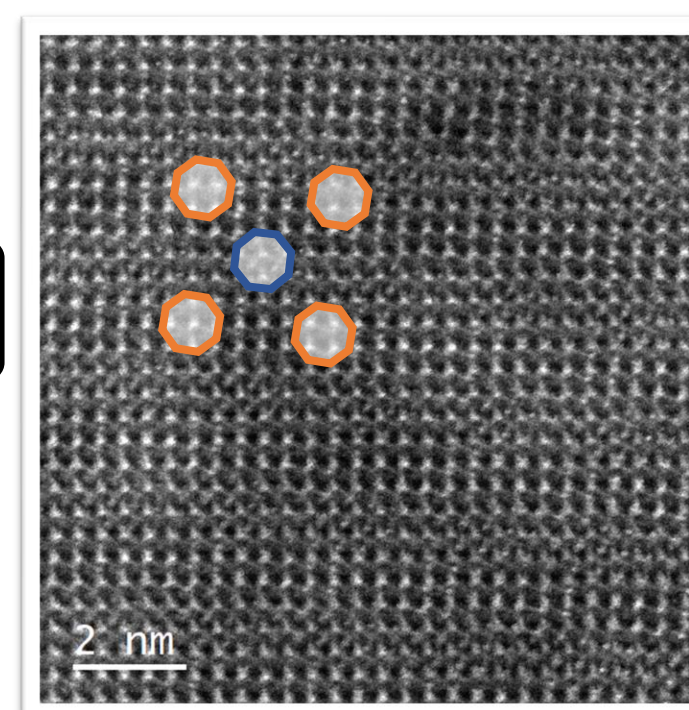
Interfacial STEM image

Top layer shear strain map (ϵ_{xy})

Top layer Ti displacement (~electric dipoles) map superimposed to the toroidal moment (Q)



$\theta = 3^\circ$



$\theta = 10^\circ$

arXiv:2301.04438

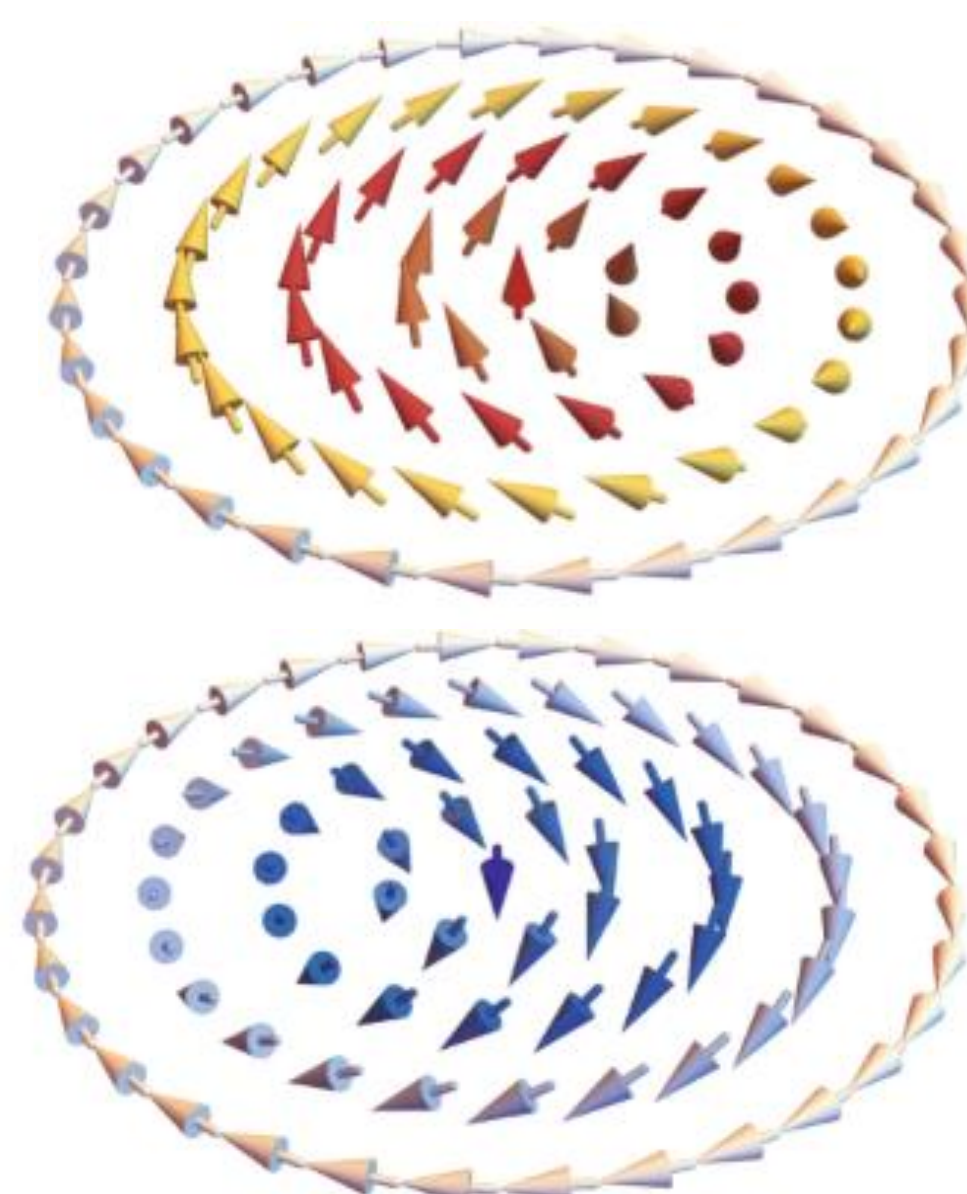


CONCLUSIONS & FUTURE PERSPECTIVES

- Twisted freestanding ferroelectric layers features non-trivial ferroelectric textures driven by mechanical boundary conditions imposed by the interface
- Tunability by controlling the twisting angle
- What about the dipole in the center of each vortex?

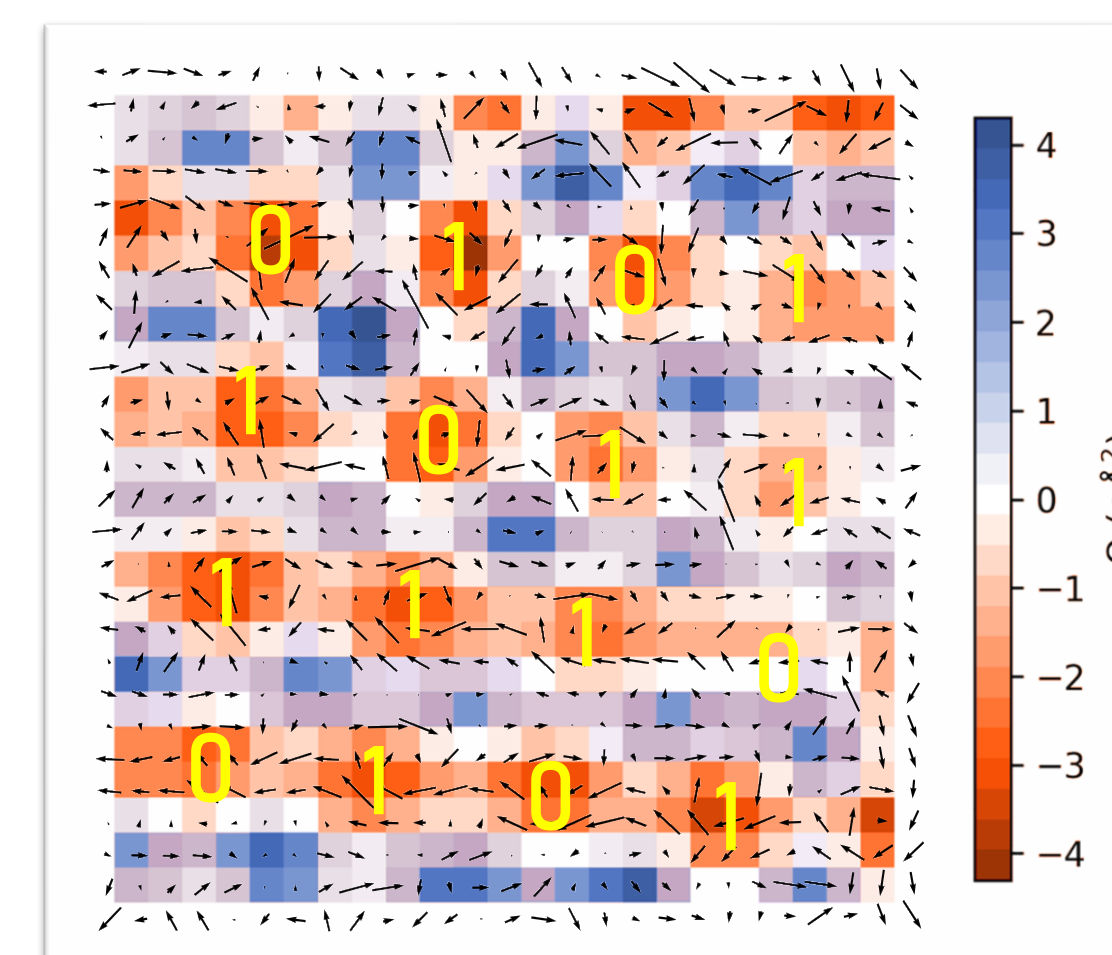
↑ ≡ 1

↓ ≡ 0



It must be either UP or DOWN

Wait! We might be able to store bits (0 & 1) in these tornadoes



A few atoms per bit ⇒ 3 orders of magnitude more information density than present technologies