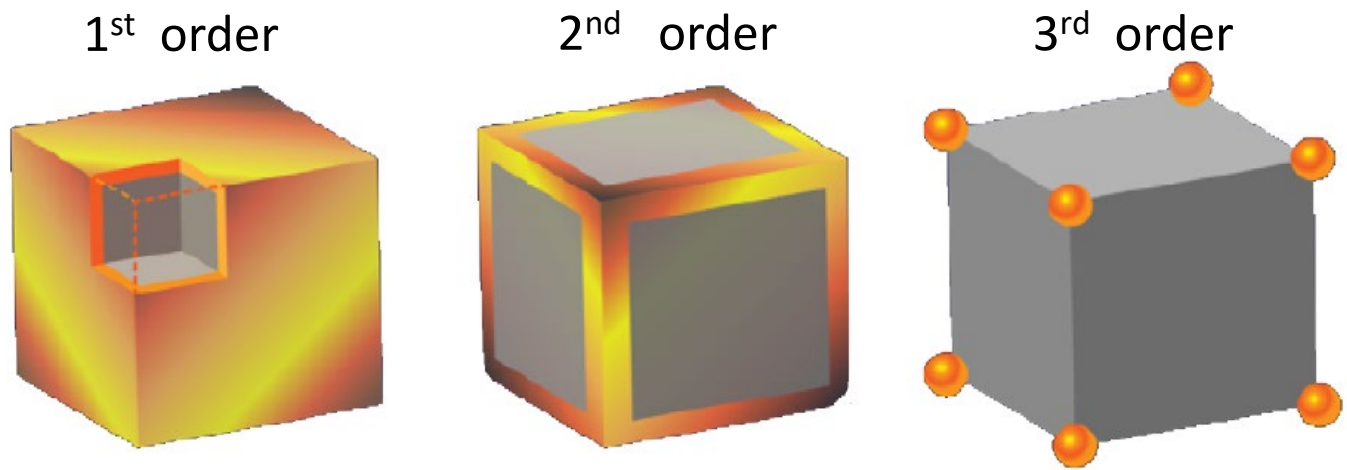


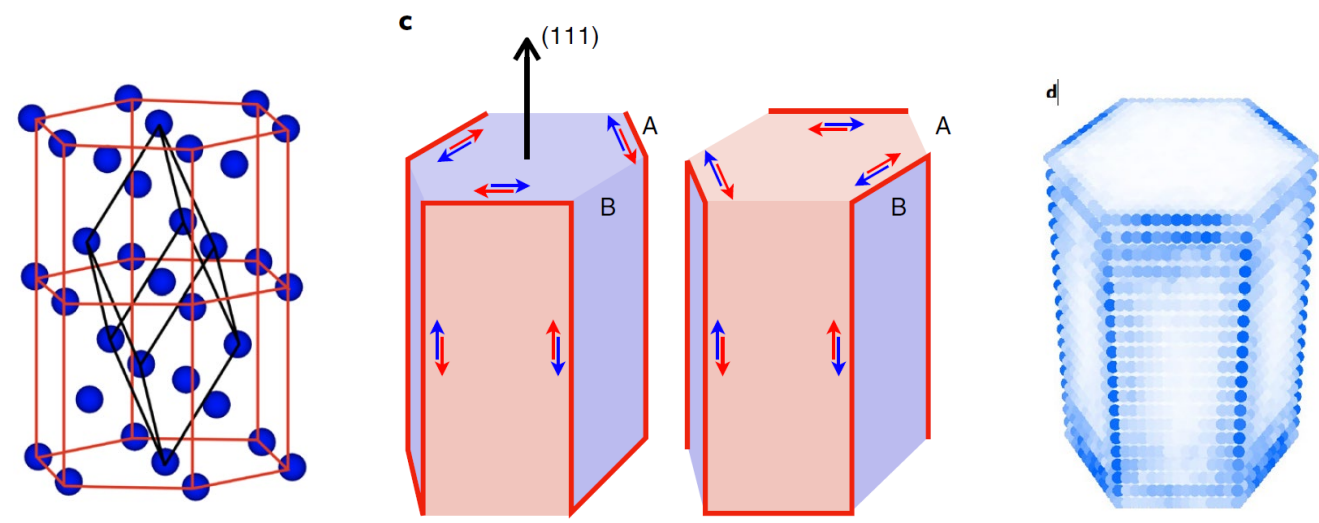
Introduction

Higher-order topology in Bi

HOTI: higher-order topological insulator



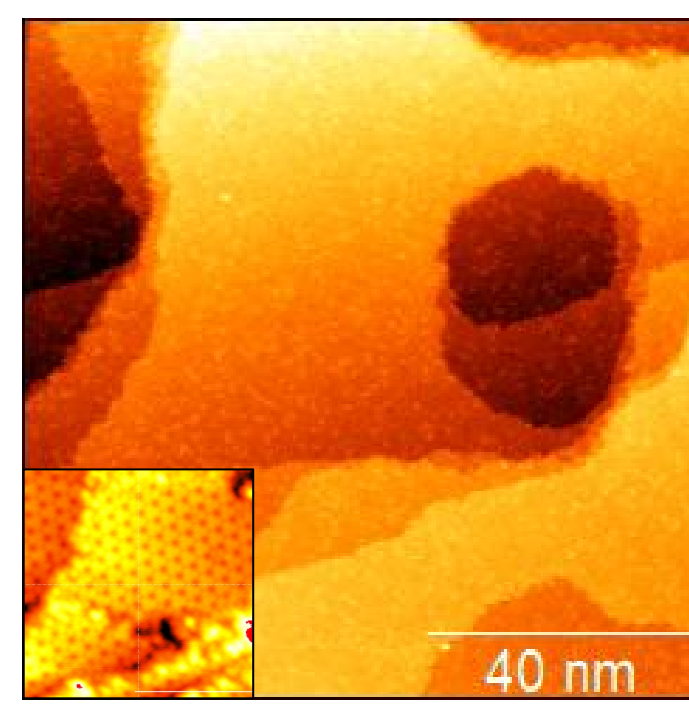
Bismuth is predicted to be a **2nd order TI** with non-trivial hinge states.



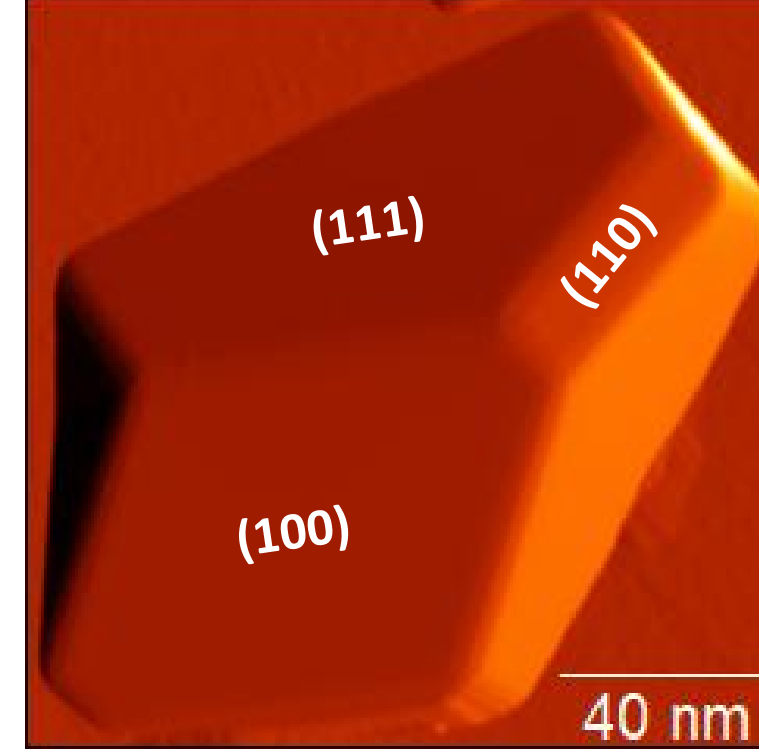
Schindler, F., et al. (2018). Nat Phys 14(9): 918-924.

Bi Nanocrystal

V₃Si(111) Substrate



Without Fe Clusters

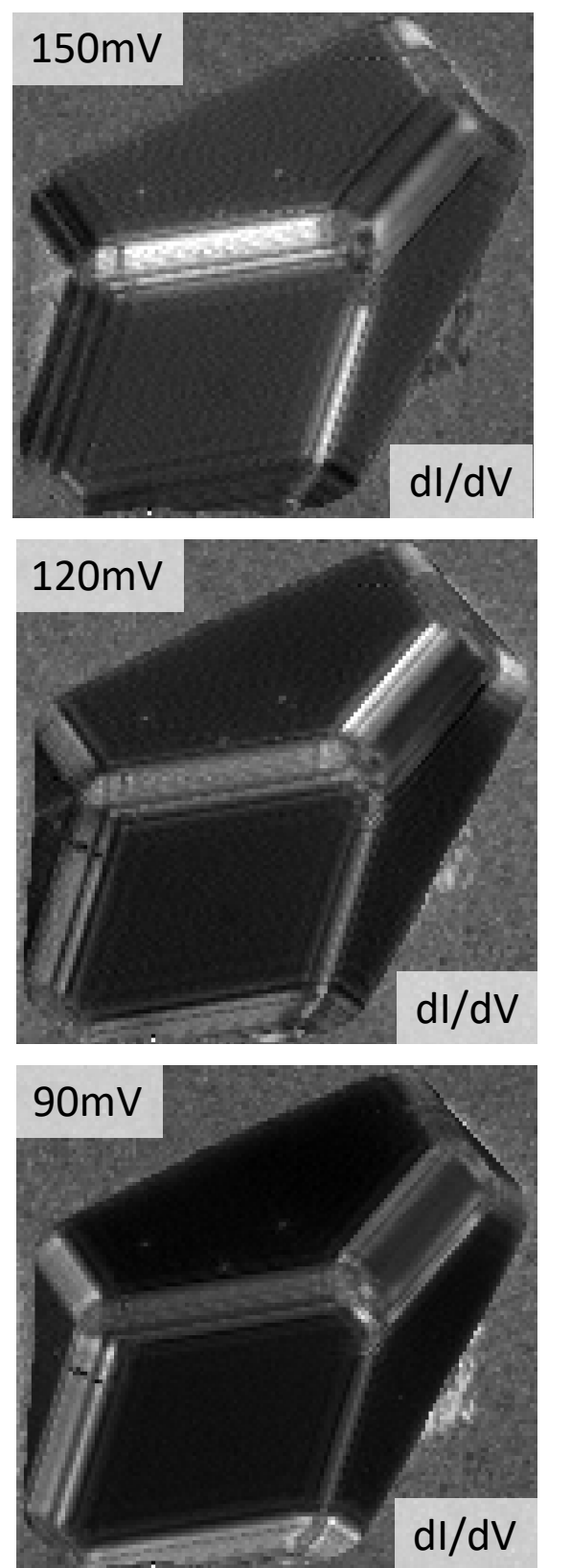
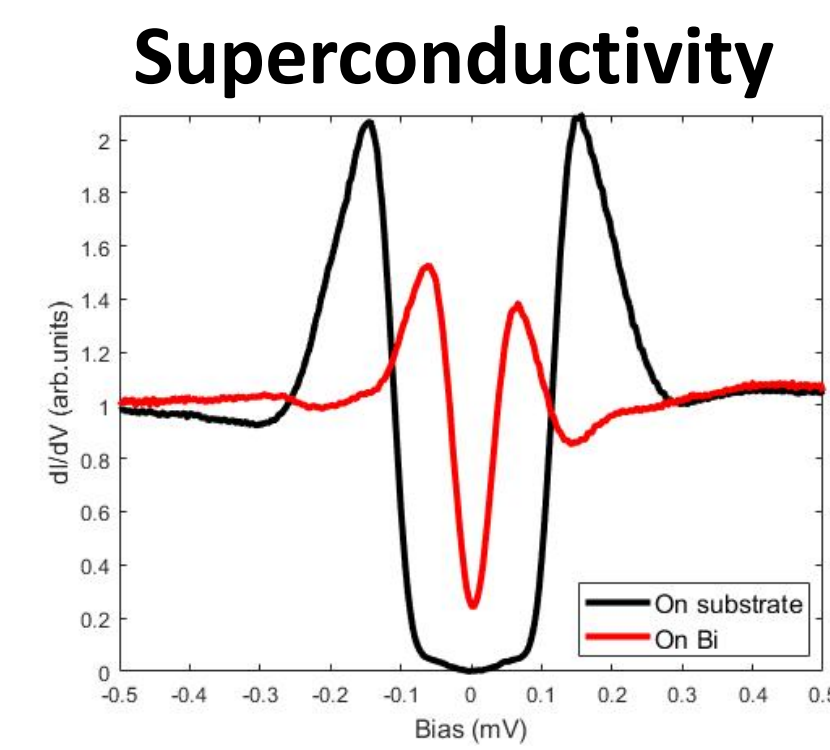
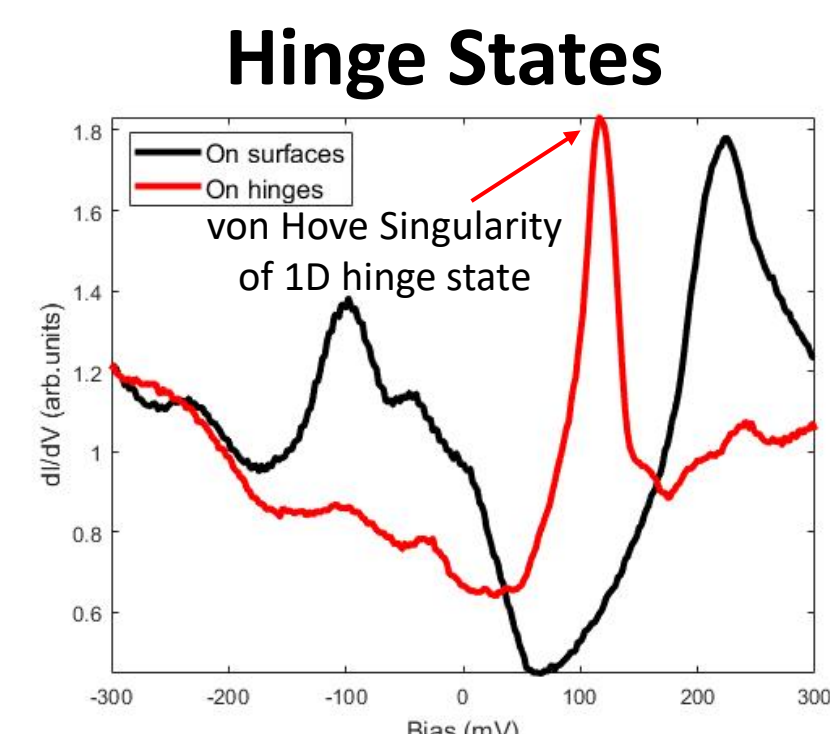
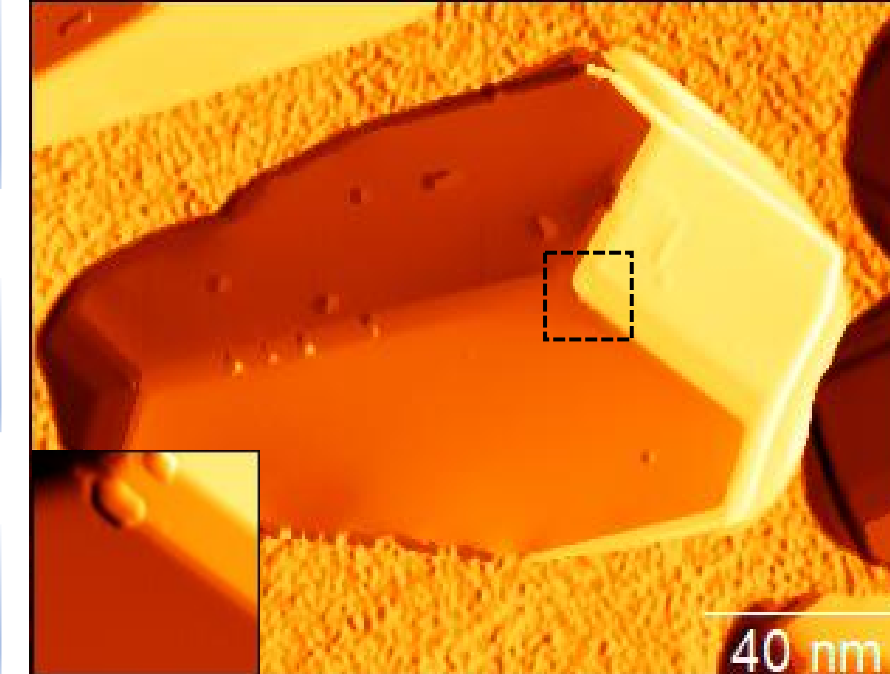


treat V₃Si(111) substrate

grow Bi nanocrystal

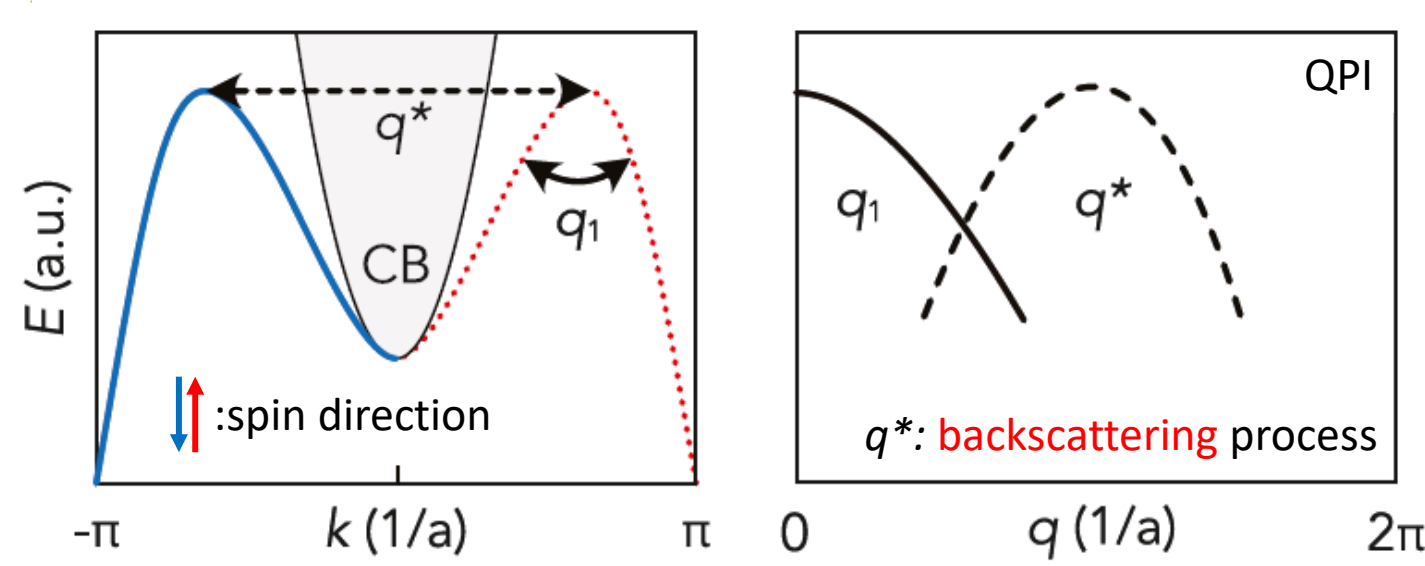
deposit Fe clusters

With Fe Clusters

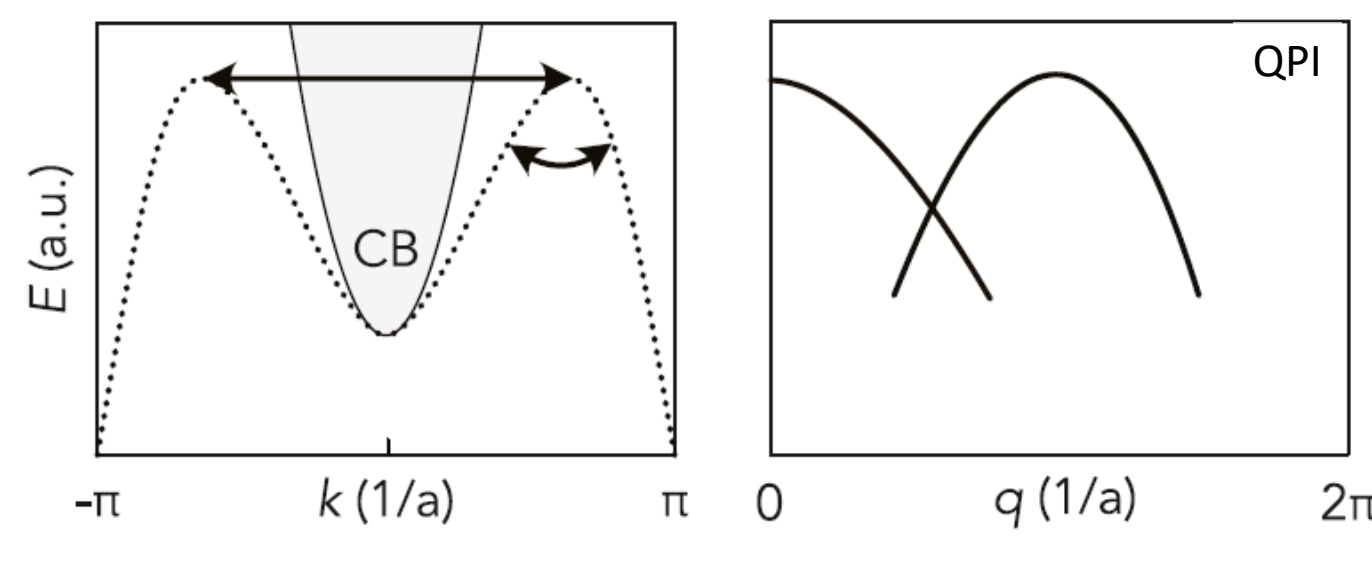


QPI Measurement

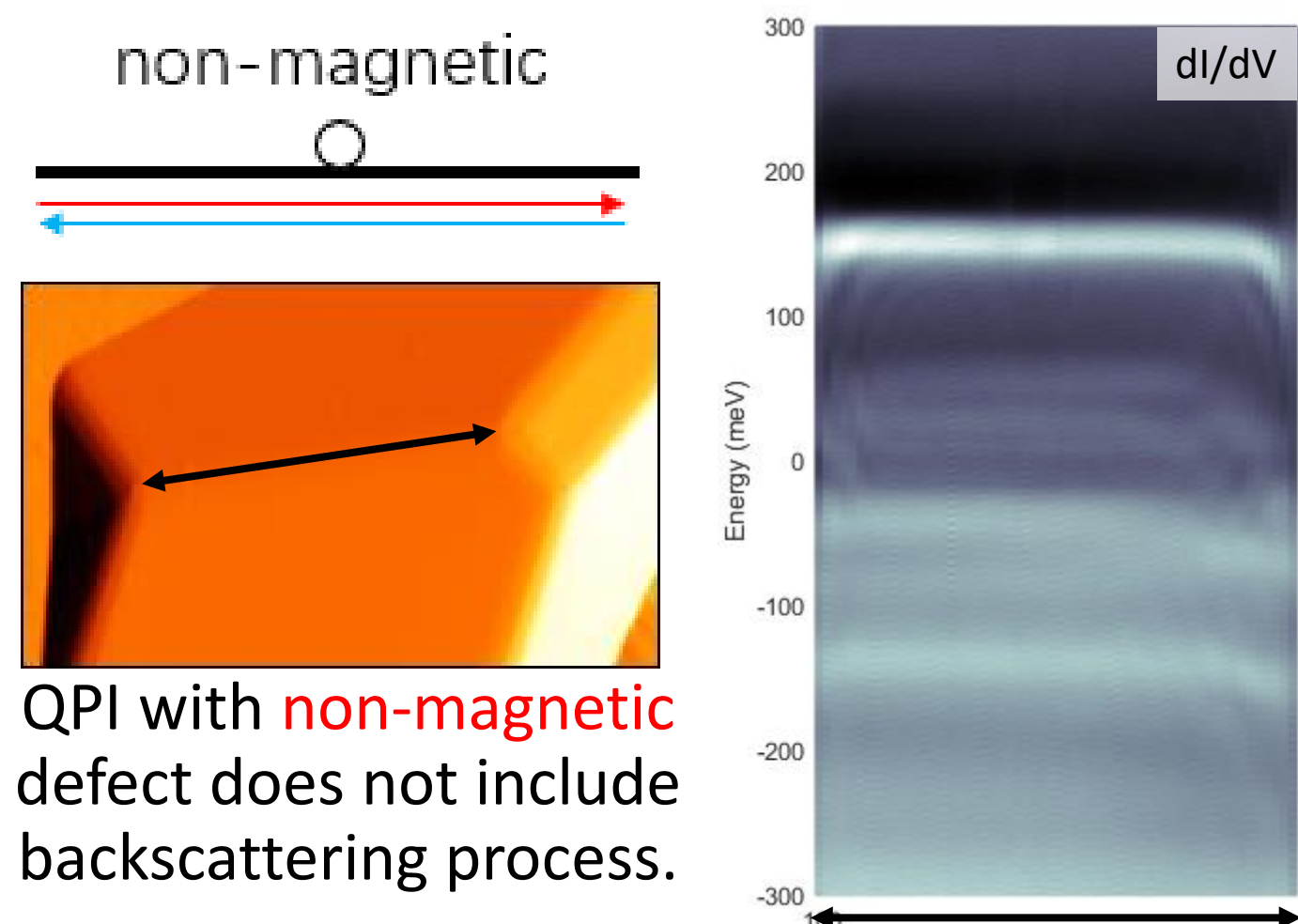
Topological Hinge State



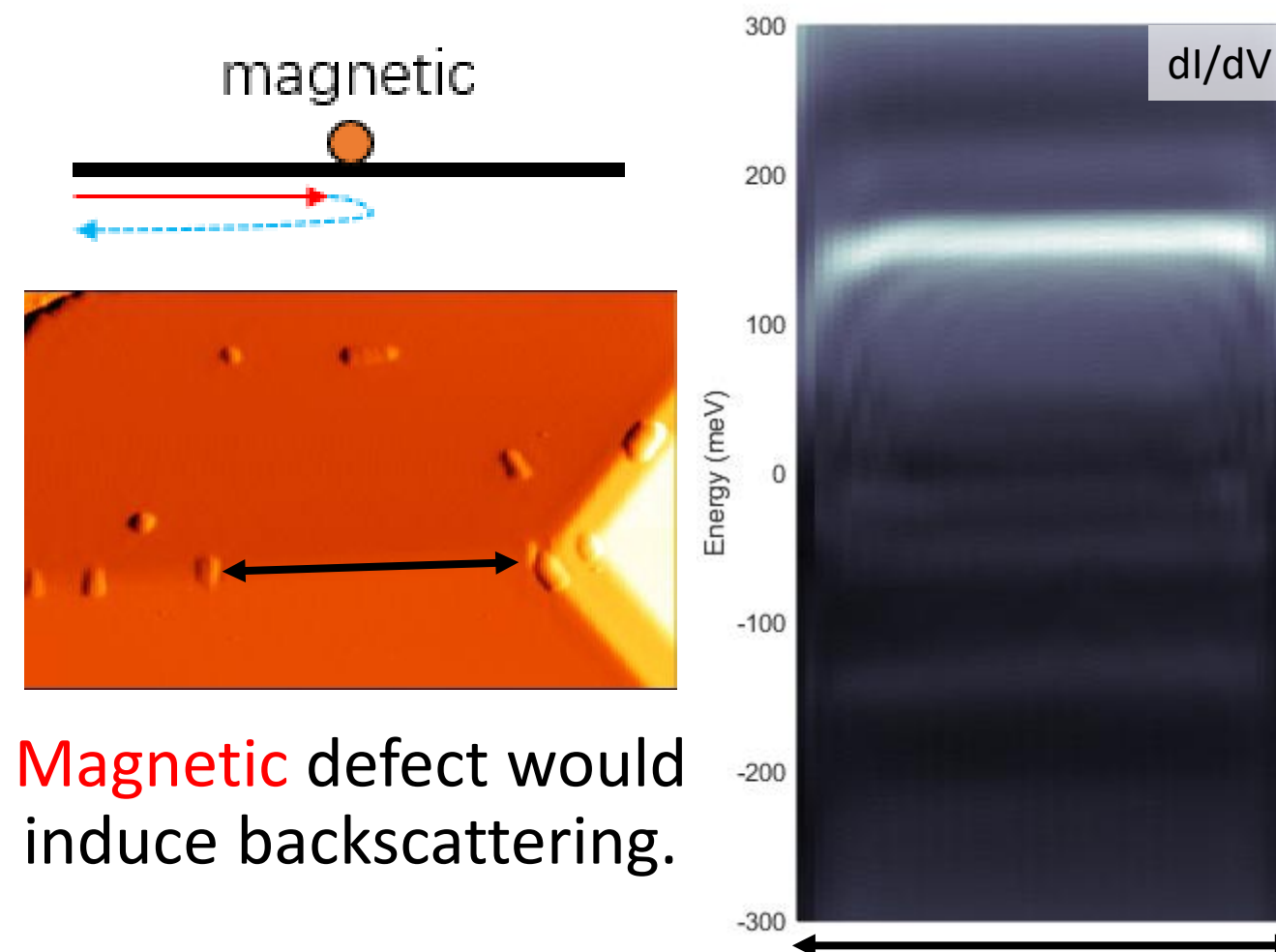
Trivial Hinge State



Jack, B., et al. (2020). Proc Natl Acad Sci U S A 117(28): 16214-16218.



QPI with **non-magnetic** defect does not include backscattering process.



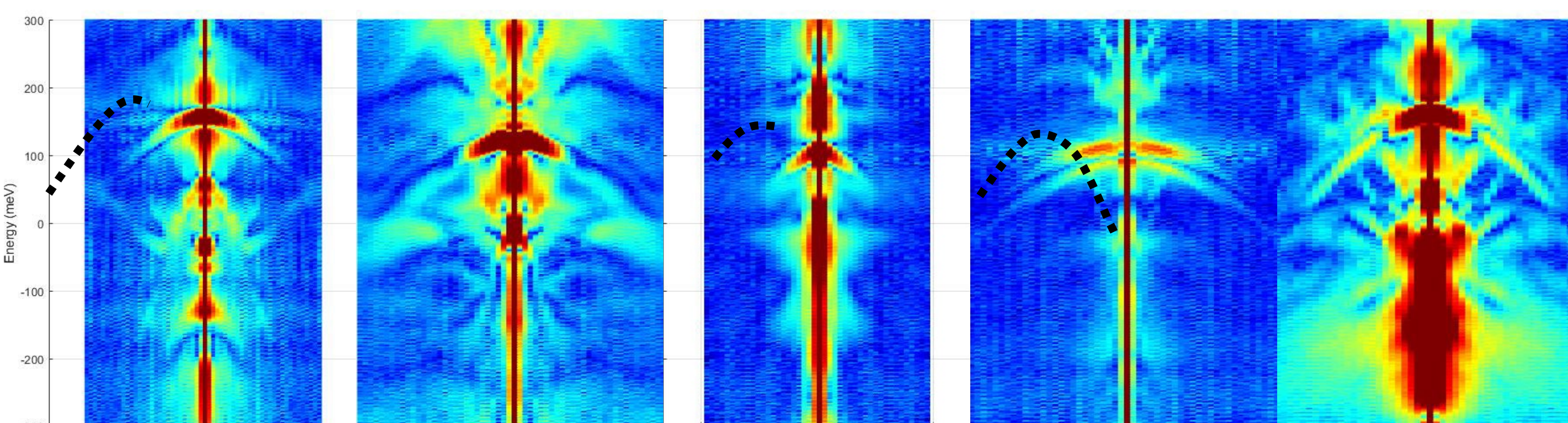
Magnetic defect would induce backscattering.

New QPI dispersion branches (**backscattering channels**) would appear in **topological non-trivial** hinge states with **magnetic** defects.

FFT: 1D QPI dispersion

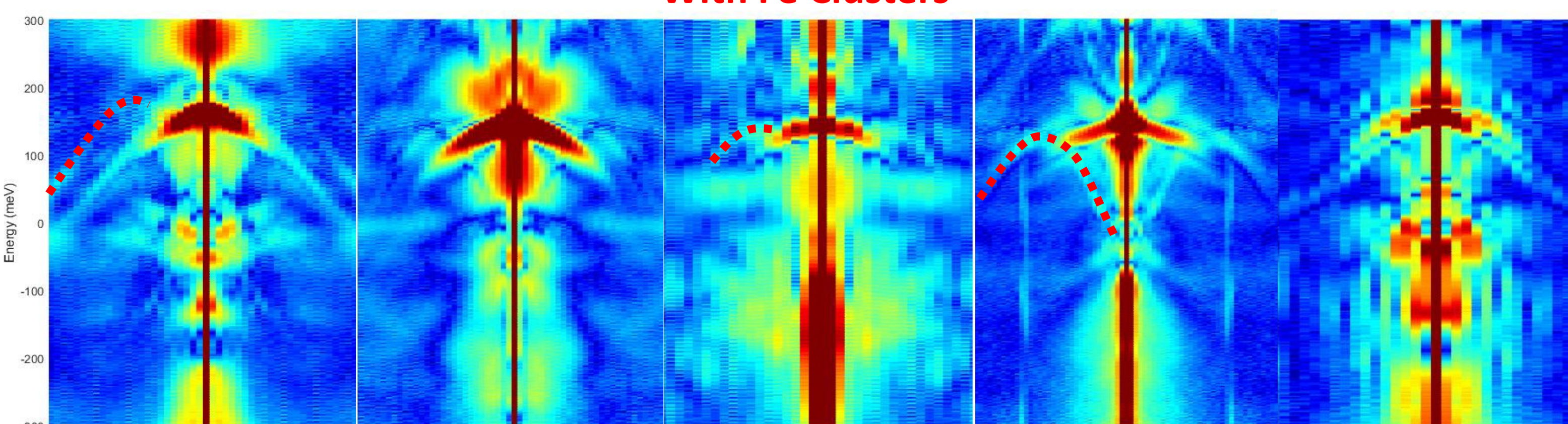
Type1★ Type2 Type3★ Type4★ Type5

Without Fe Clusters



.....: missing backscattering channel

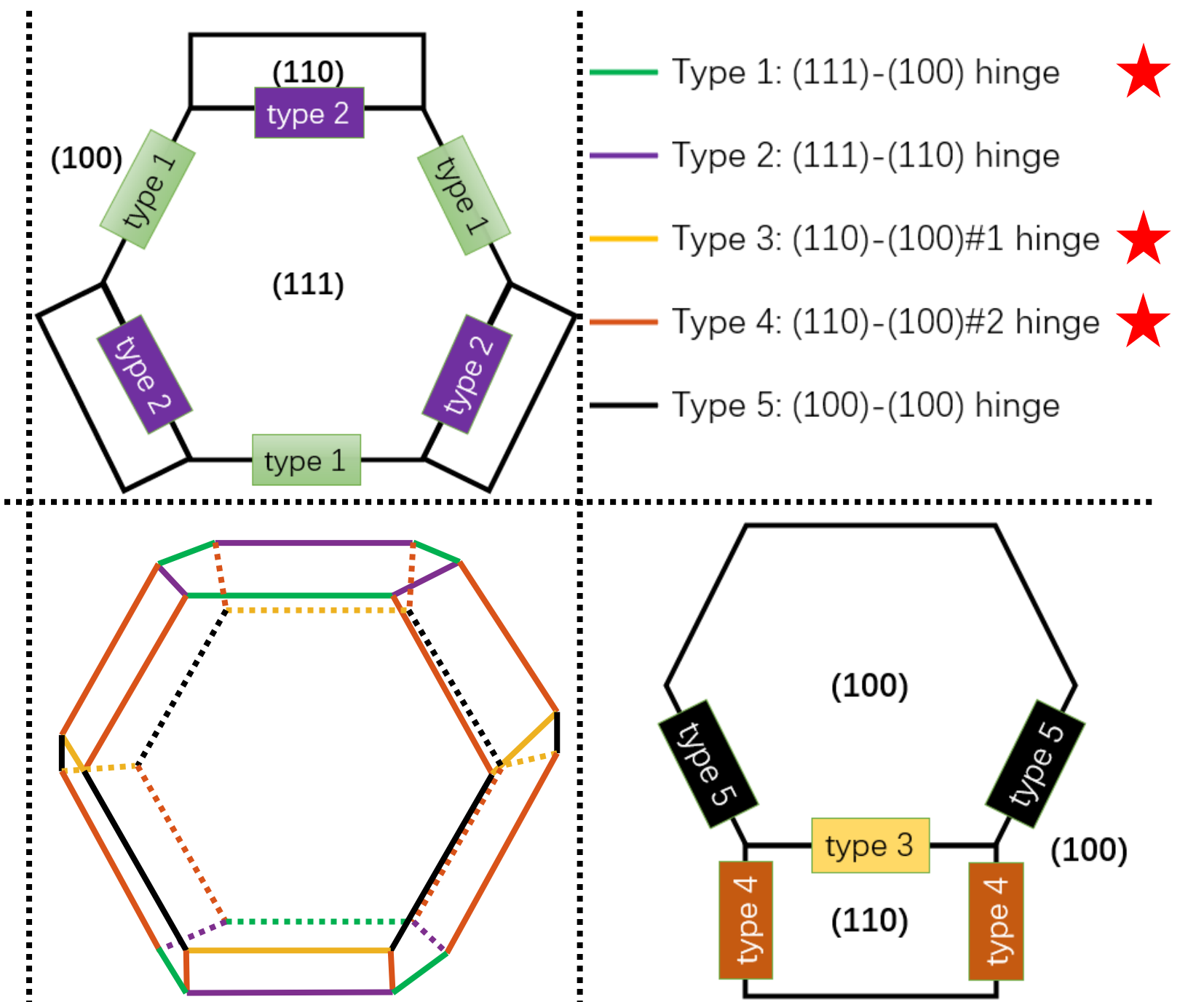
With Fe Clusters



.....: backscattering channel

$q(\text{\AA}^{-1}) \in [-0.4, 0.4]$

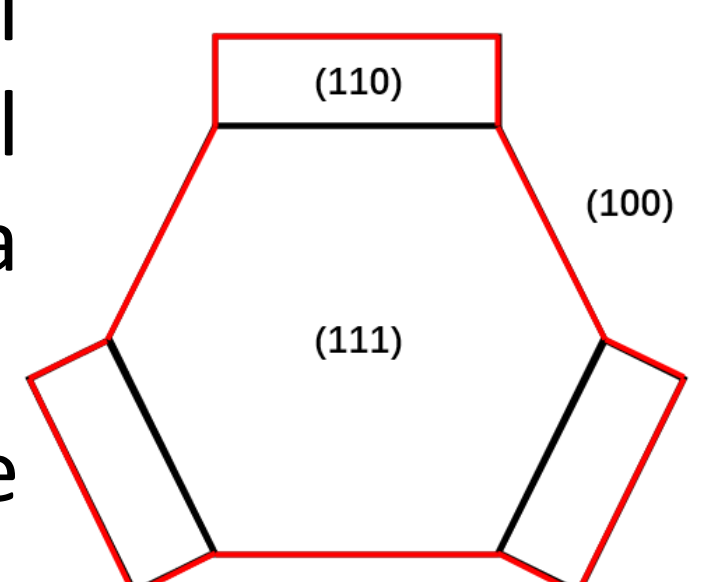
5 Types of Hinges



★: possible topological non-trivial hinge states

Summary

1. Bismuth **nanocrystals** are grown on V₃Si(111) substrate.
2. Hinge states are observed on all **5 types** of hinges and proximity induced superconductivity is preserved on Bi nanocrystals.
3. Iron clusters induced **backscattering** channels are observed on the 1D QPI, dispersion of some types of hinges indicating the **topological non-trivial** nature of these hinges.
4. These potential topological non-trivial hinge states form a **close loop**, which is in consistent with the prediction of **higher-order topology** in Bi.



¹ State Key Laboratory of Surface Physics, Department of Physics, and Advanced Materials Laboratory, Fudan University, Shanghai 200438, China

² Hefei National Laboratory for Physical Science at Microscale and Department of Physics, University of Science and Technology of China, Hefei, Anhui 230026, China

³ Collaborative Innovation Center of Advanced Microstructures, Nanjing 210093, China

⁴ Shanghai Research Center for Quantum Sciences, Shanghai 201315, China