

Electronic structure of monolayer tetragonal CoSe/FeO_x/SrTiO₃

Zhihui Chen,¹ Haichao Xu,^{1,2*} Rui Peng,^{1,2*} and Donglai Feng^{3*}

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

²Shanghai Research Center for Quantum Sciences, Shanghai 201315, China

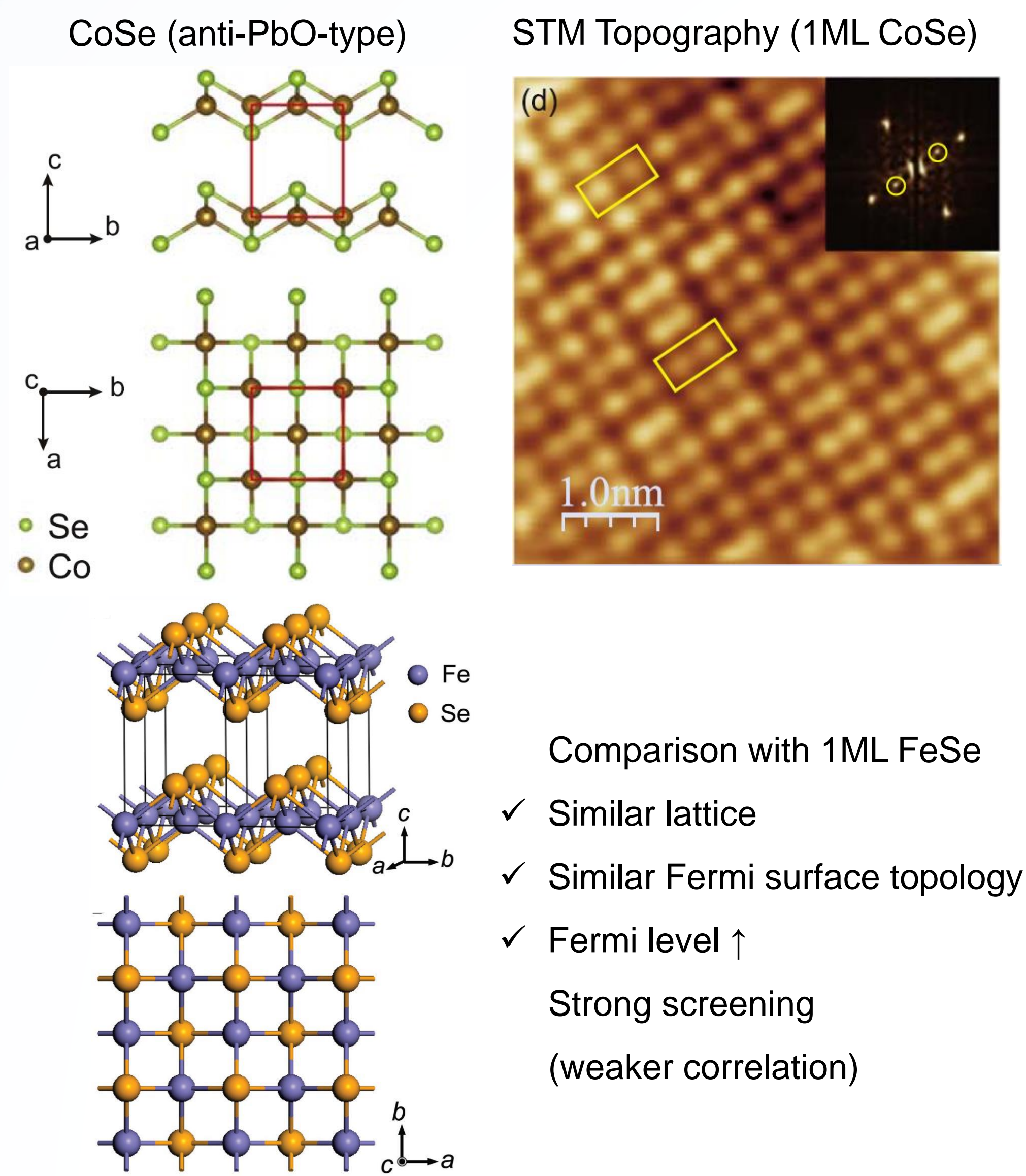
³National Synchrotron Radiation Laboratory, School of Nuclear Science and Technology and New Cornerstone Science Laboratory, University of Science and Technology of China, Hefei, 230026, China.

Please contact: zhihuichen21@m.fudan.edu.cn and pengrui@fudan.edu.cn



Background: From Tetragonal CoSe to Superconducting Monolayer

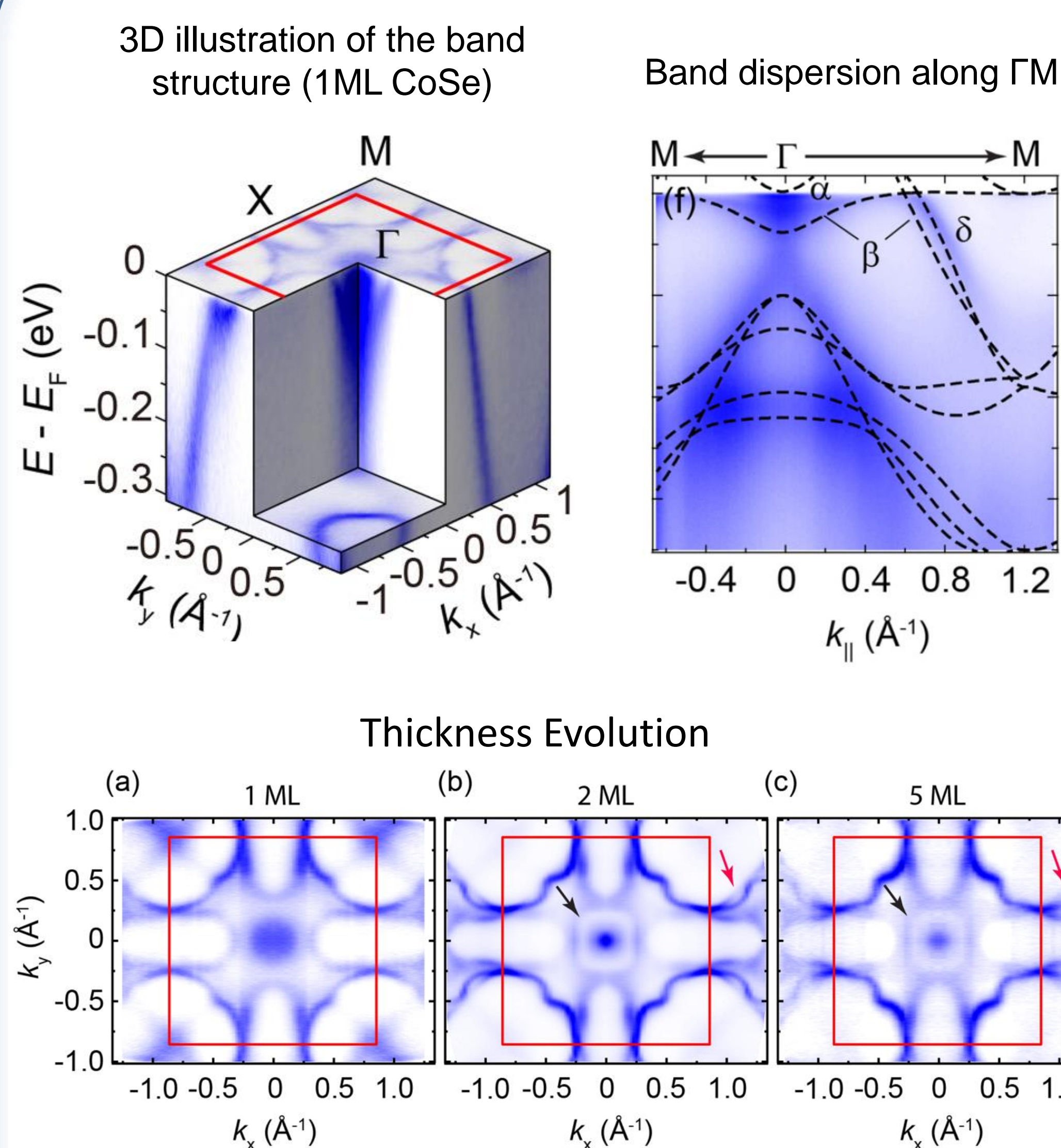
1. Tetragonal CoSe as an FeSe Analog



- Anti-PbO-type CoSe films are stabilized on SrTiO₃(001).
- Monolayer CoSe shows a tetragonal lattice, 2×1 modulation, and moire patterns.

C. Liu et al., *Sci. Technol.* **31**, 115011 (2018).
F.-C. Hsu et al., *Proc. Natl. Acad. Sci.* **105**, 14262 (2008).

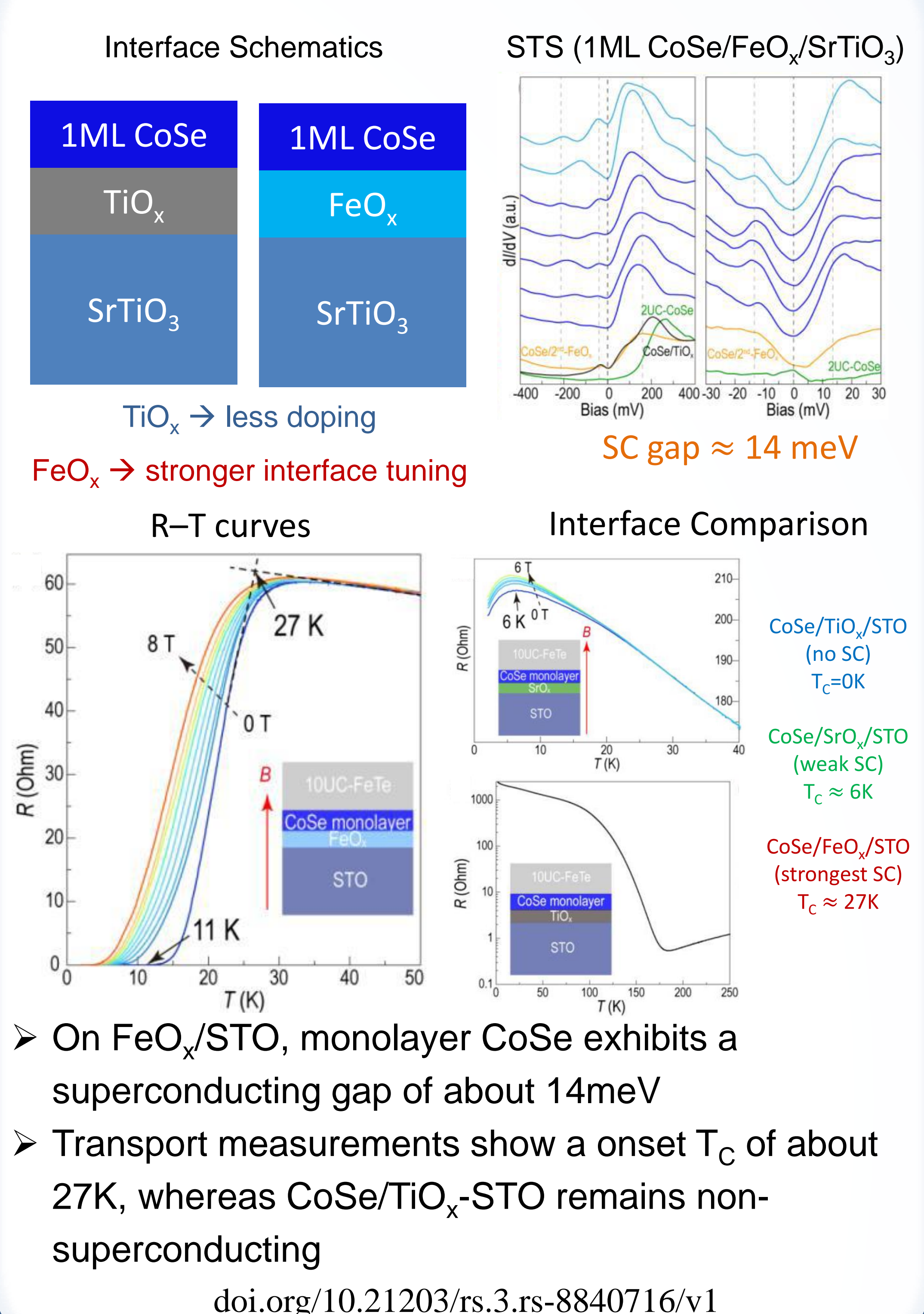
2. Electronic Structure and Thickness Evolution



- Monolayer CoSe exhibits multiple Fermi pockets and symmetry-protected Dirac-like features.
- Its electronic structure resembles monolayer FeSe, but with an upward Fermi level shift and weaker electronic correlation

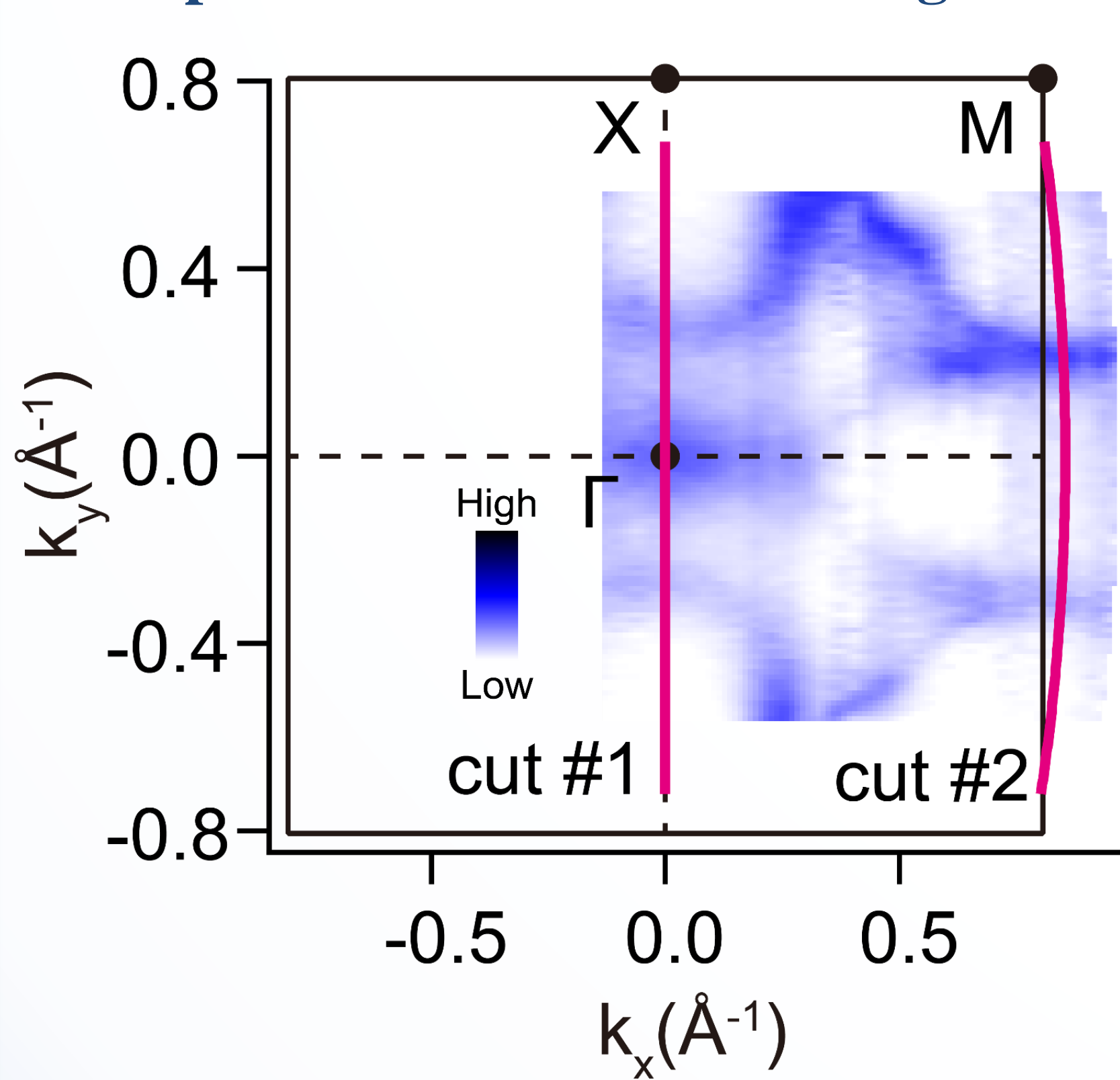
L. Shen et al., *Phys. Rev. Mater.* **2**, 114005 (2018)

3. Interface Engineering Enables Superconductivity



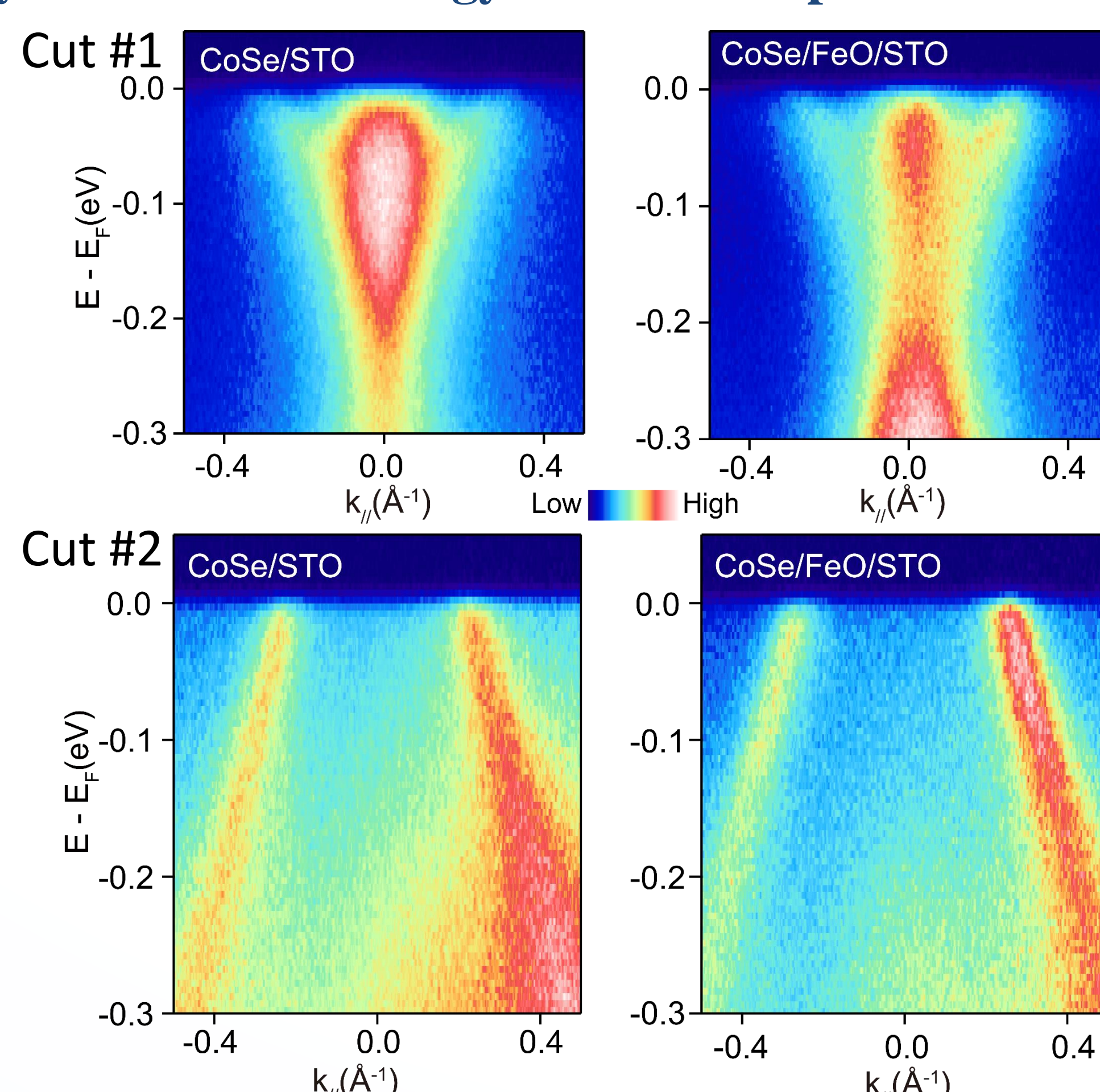
FeO_x interface tunes monolayer CoSe toward a hole-doped regime

Map result and measurement geometry

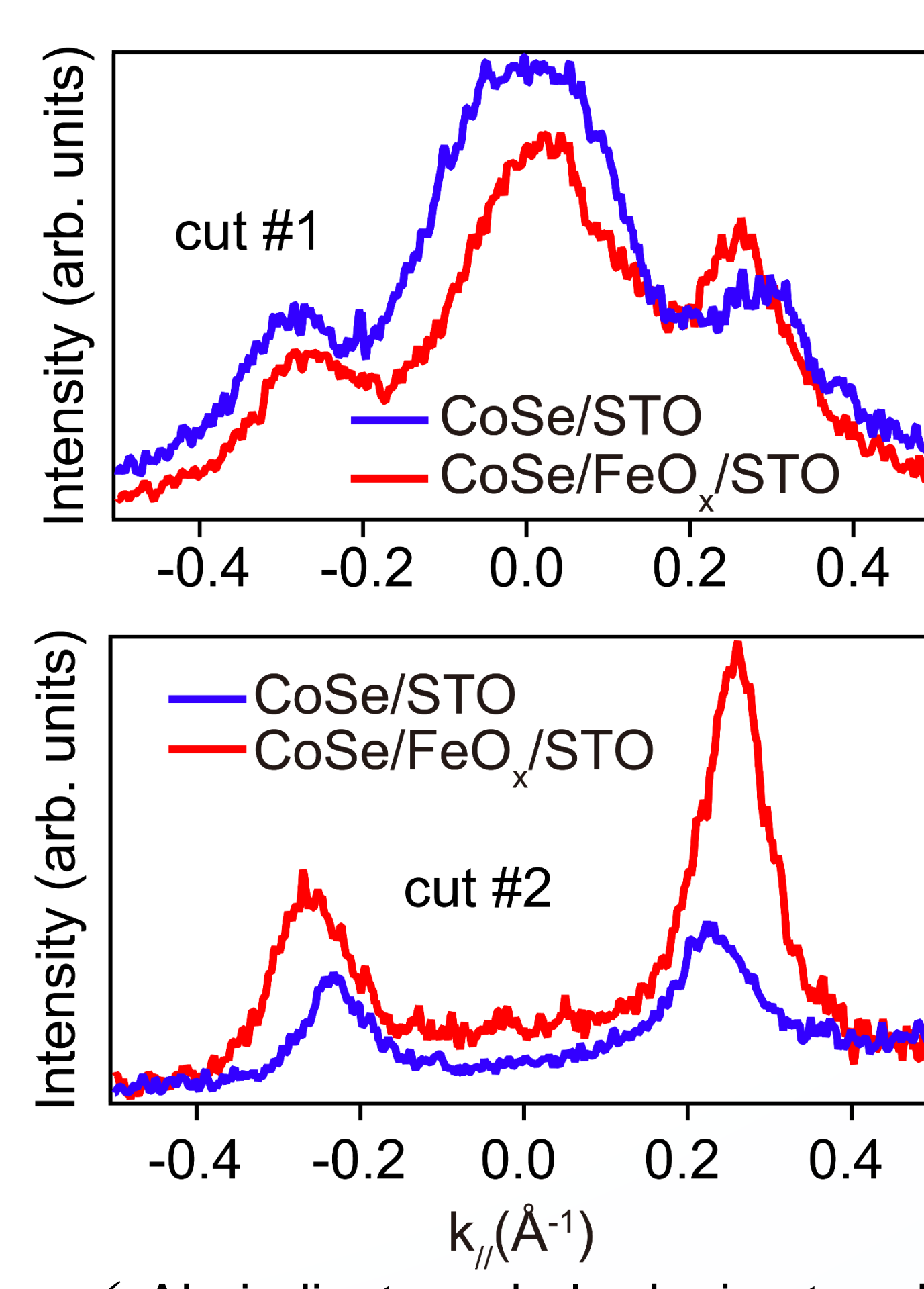


- Cut #1: Γ -centered electron pocket
- Cut #2: X-centered hole pocket

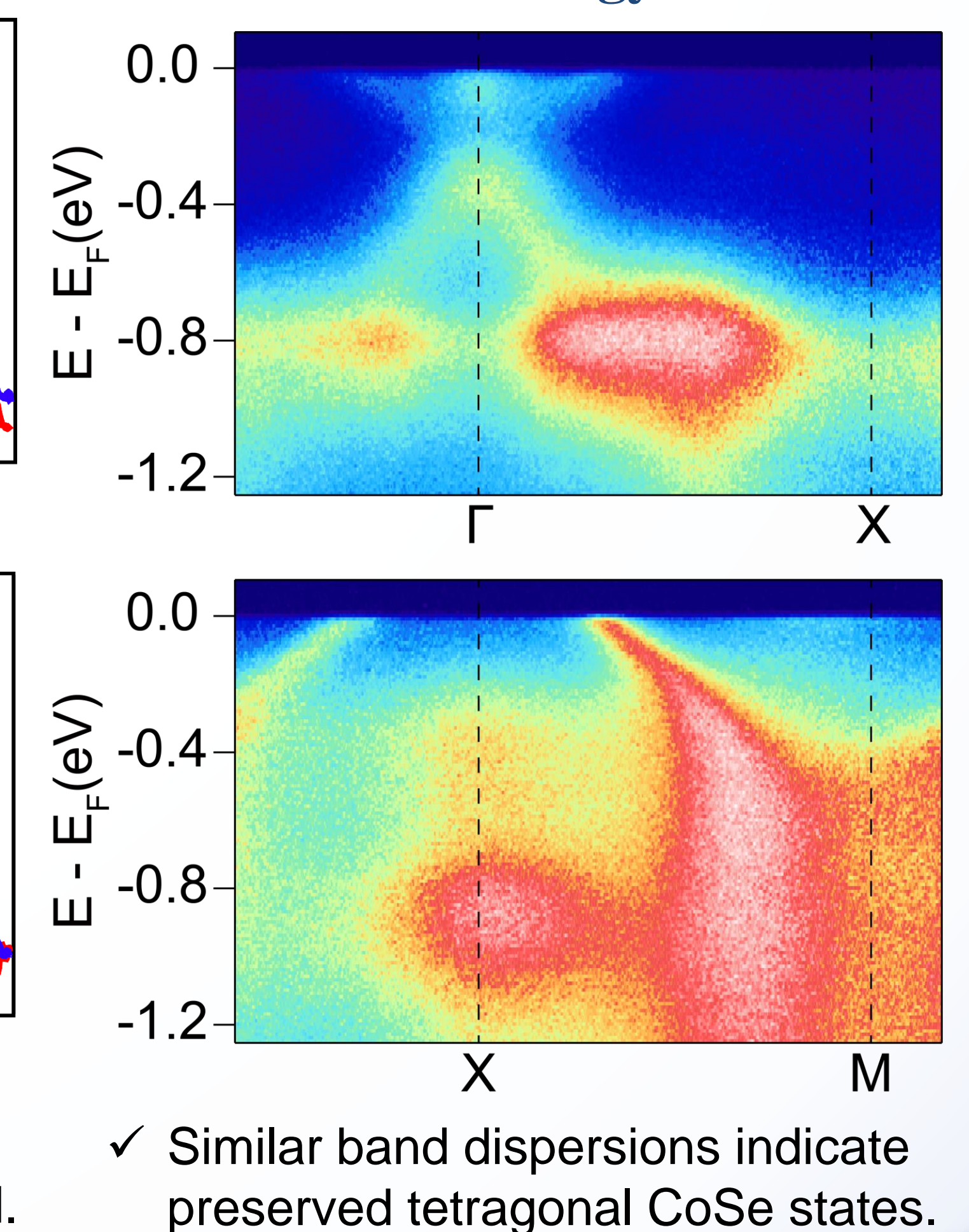
Low-energy ARPES comparison



MDC evidence for Fermi-level shift



Band dispersion over a wide energy window



Summary and conclusion

- ❖ The main tetragonal CoSe band structure is preserved on FeO_x/SrTiO₃.
- ❖ The Γ -centered electron pocket shrinks, whereas the X-centered hole pocket expands.
- ❖ These changes indicate a hole-doping trend induced by the FeO_x-modified interface.