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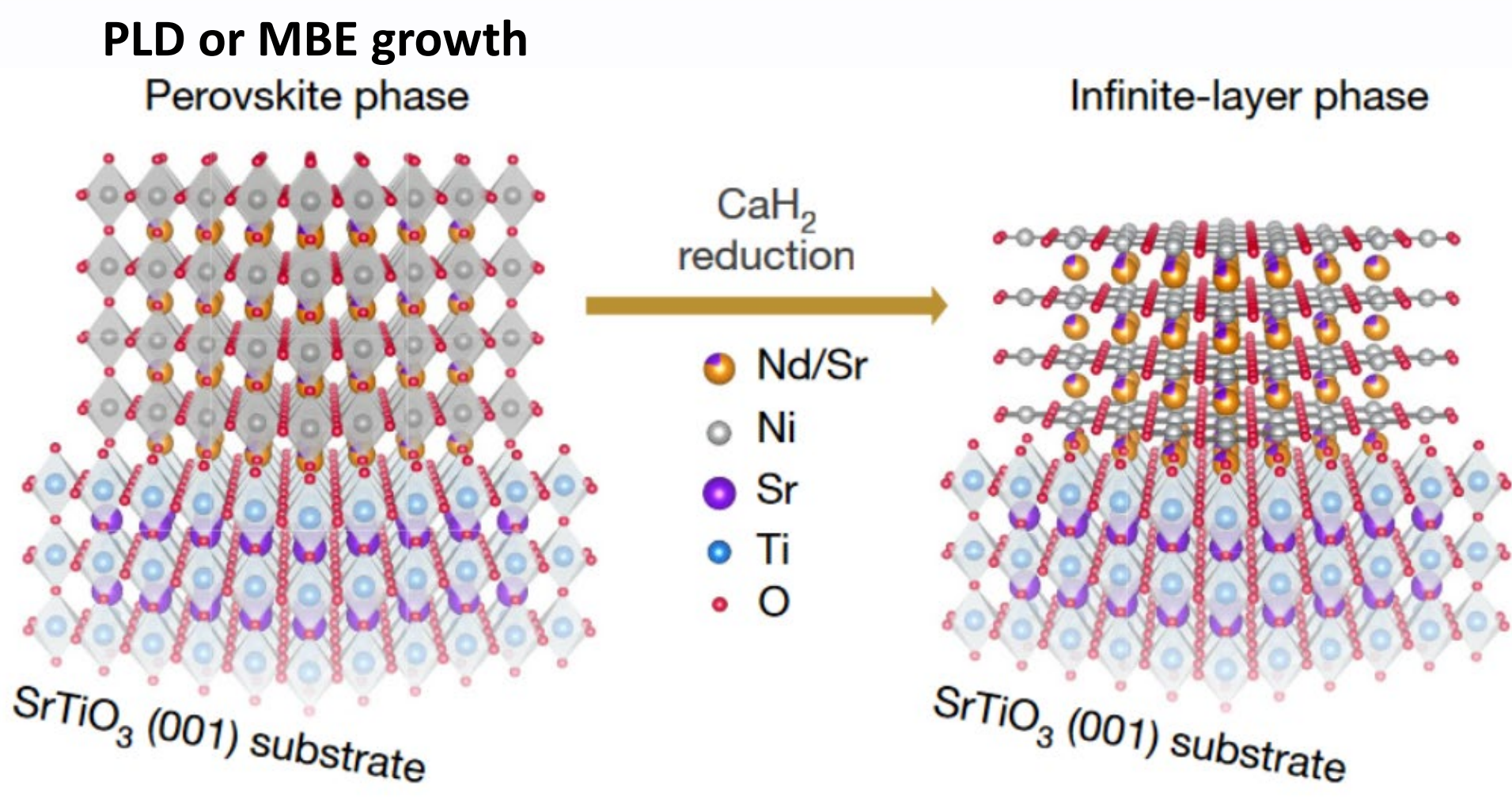
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We welcome your valuable suggestions and feedback: lich23@m.fudan.edu.cn

## Infinite-layer nickelates: a new perspective on unconventional superconducting mechanism

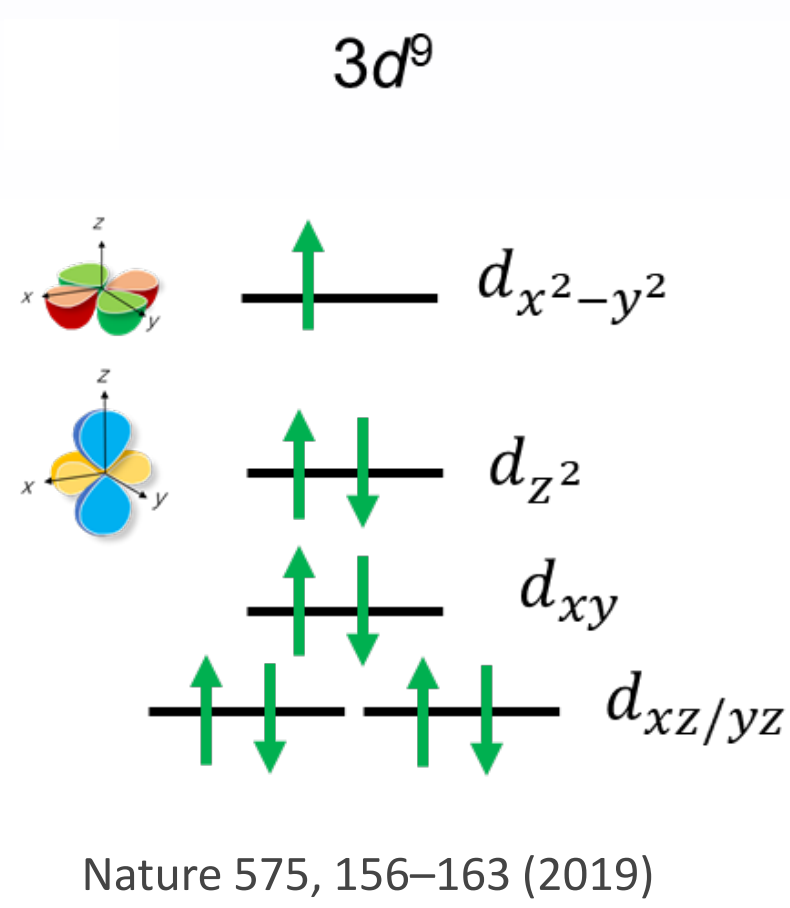
### Preparation of infinite-layer nickelates



Nature 572, 624–627 (2019).

❖ Infinite layer nickelates report superconductivity: (Nd,Sr)NiO<sub>2</sub>, (La,Sr)NiO<sub>2</sub>, (La,Ca)NiO<sub>2</sub>, (Pr,Sr)NiO<sub>2</sub>, ...

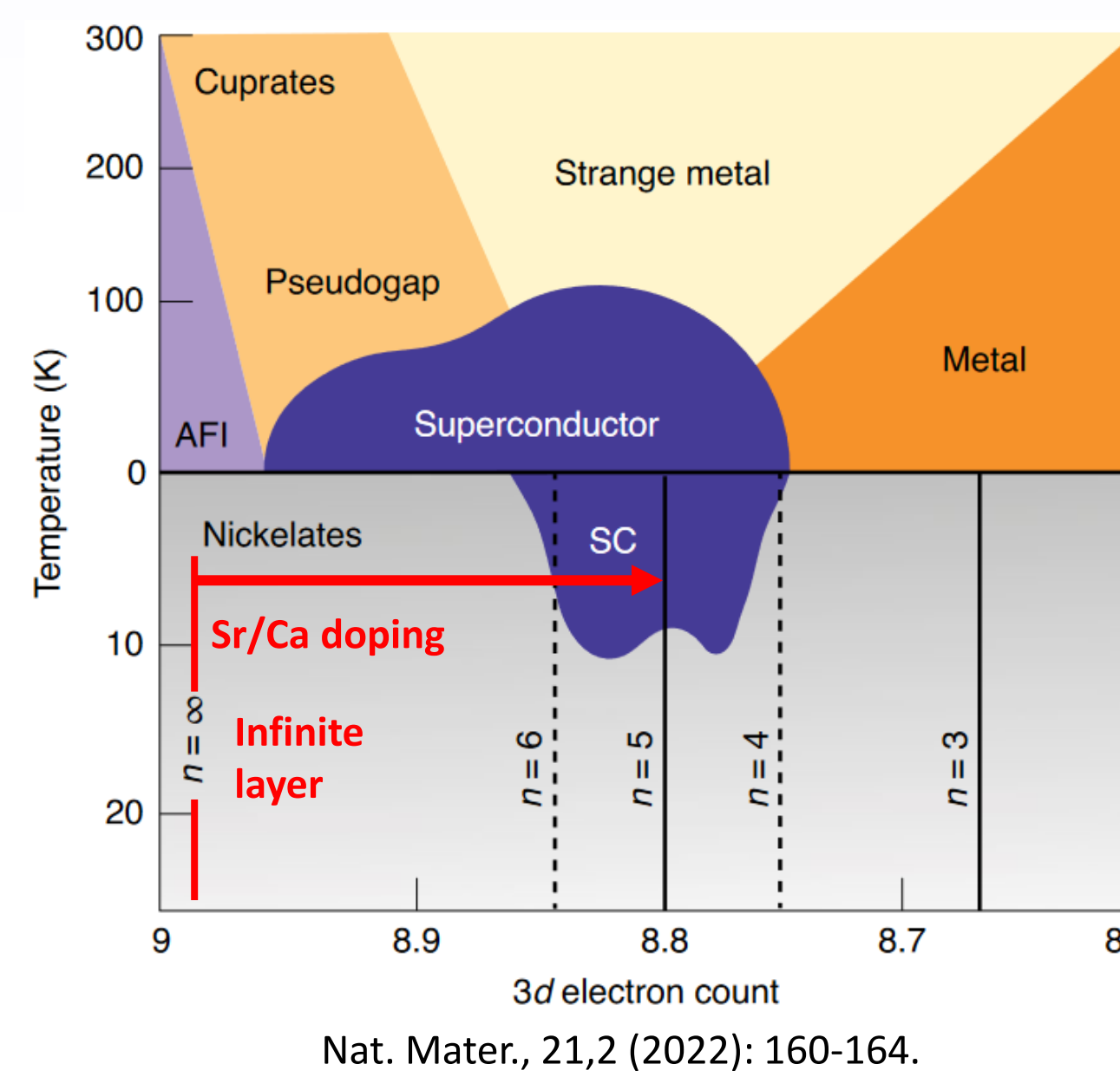
### Electron configuration of parent nickelates



Nature 575, 156–163 (2019)

❖ same with parent cuprates

### Similar electron configuration with optimal doped cuprate superconductors



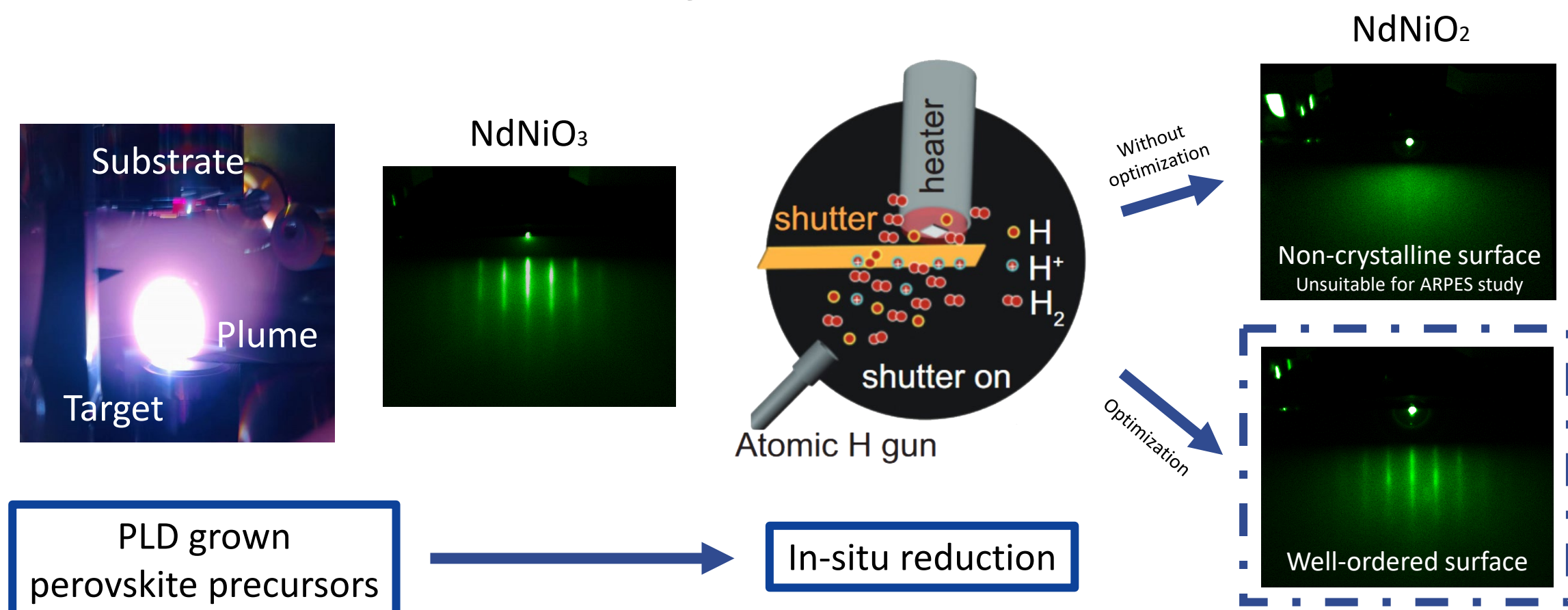
Nat. Mater., 21,2 (2022): 160-164.

### Motivation

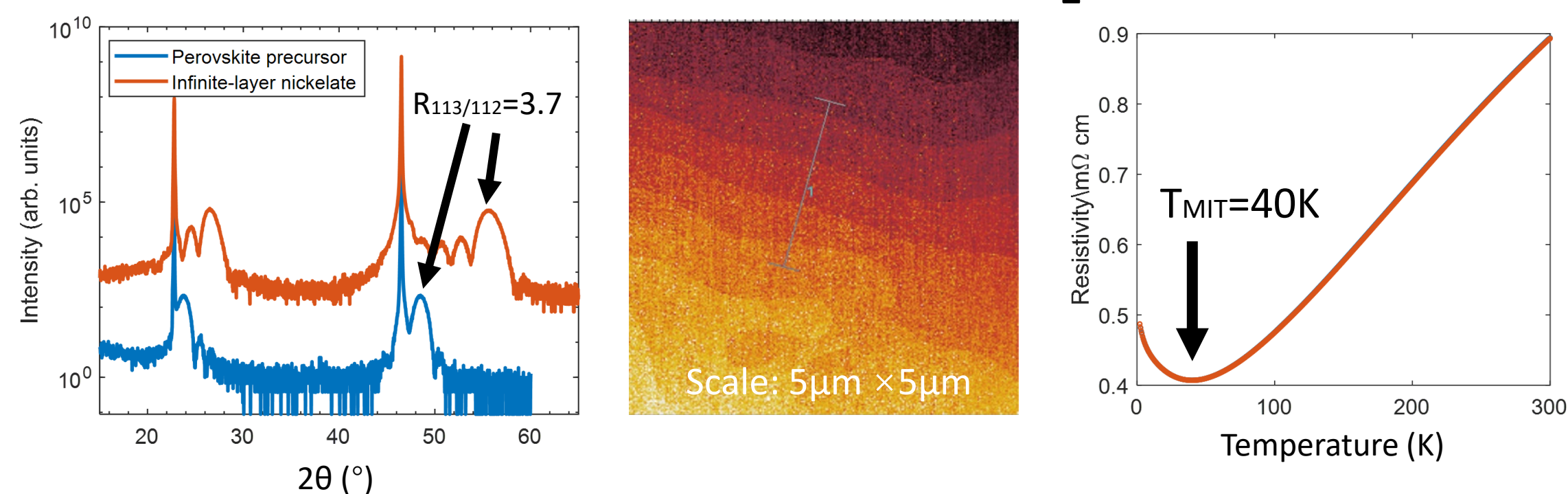
- ❖ In-situ well-ordered films are needed for surface-sensitive ARPES measurement!
- ❖ Possible new clues to unveil the pairing mechanism of unconventional superconductors.
- ❖ Nd-Nickelates are still lack of directly experimental clues on electronic structure!
- ❖ Whether Nd-4f electrons participate in the Fermi pockets?

## In-situ synthesis & electronic structure study

### In-situ synthesis routine



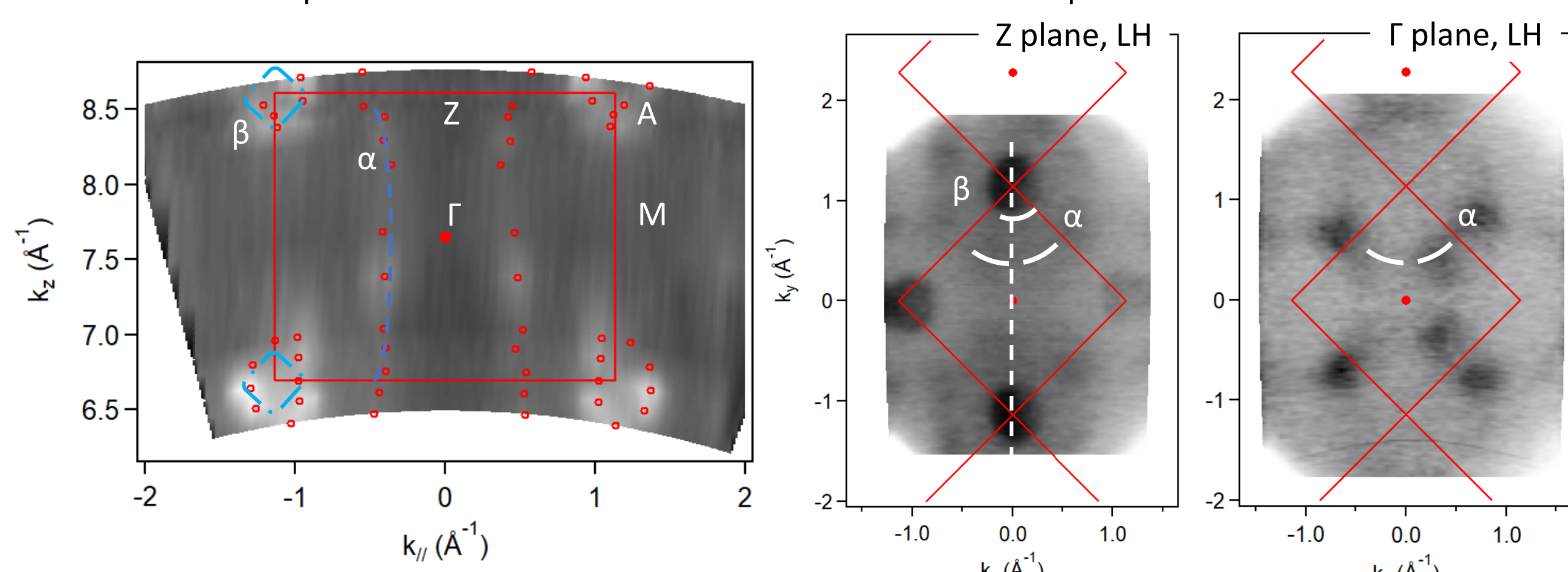
### Characterization: well ordered NdNiO<sub>2</sub> were prepared



### 3D Electronic structure and the cuprate-like hole band

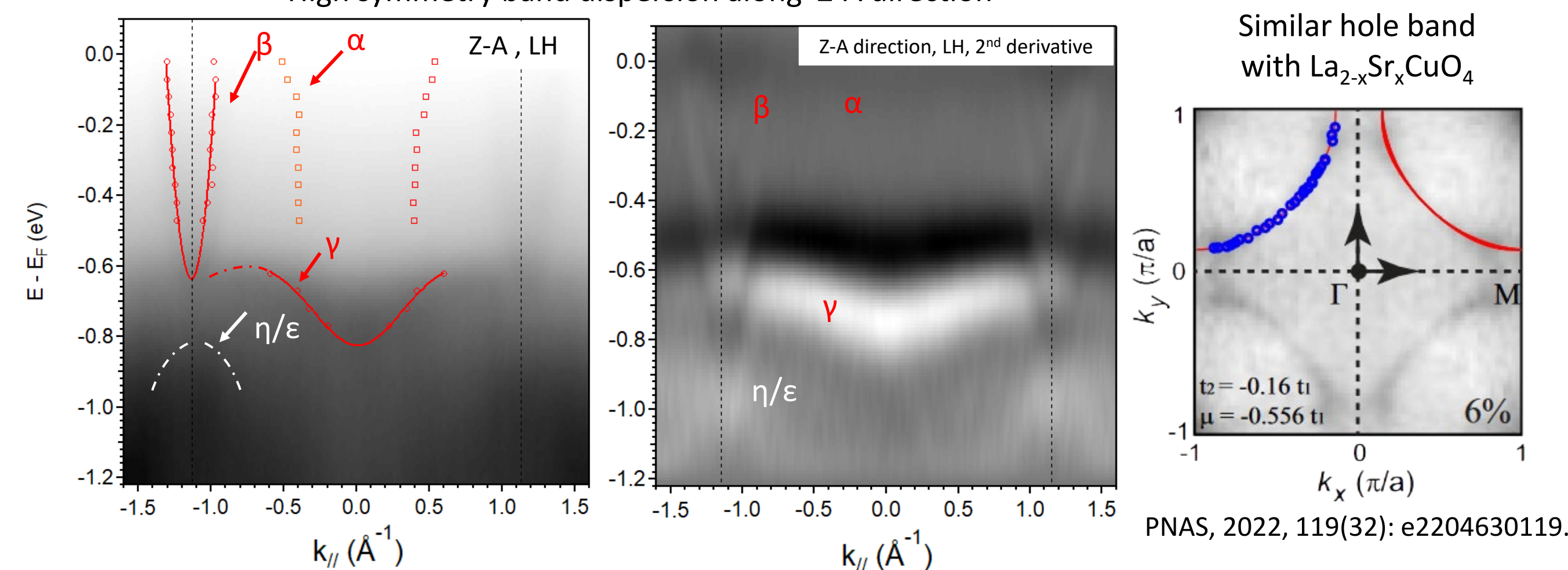
K<sub>z</sub> dependent band structure

In-plane band structure



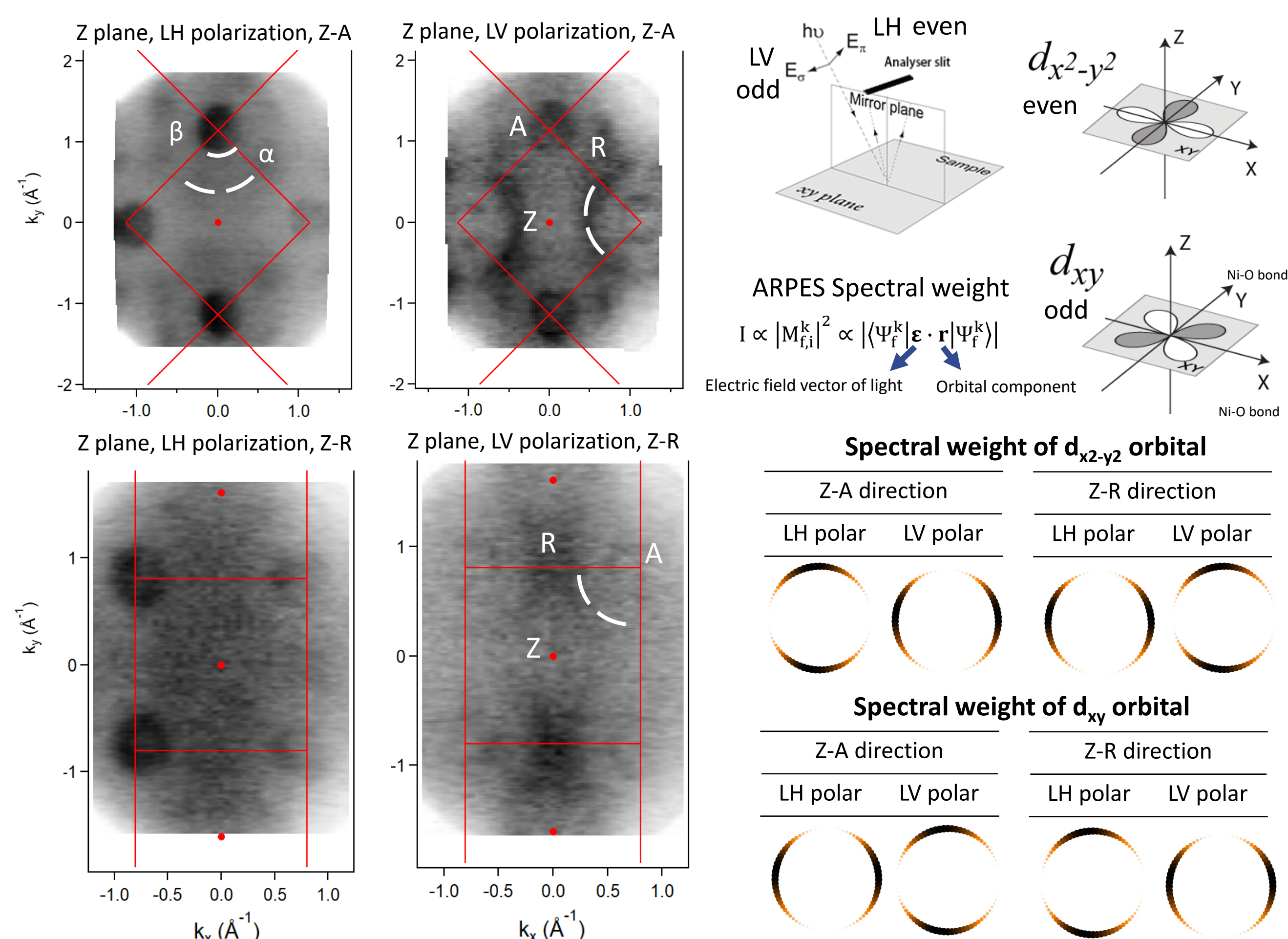
High symmetry band dispersion along Z-A direction

Similar hole band with La<sub>2-x</sub>Sr<sub>x</sub>CuO<sub>4</sub>



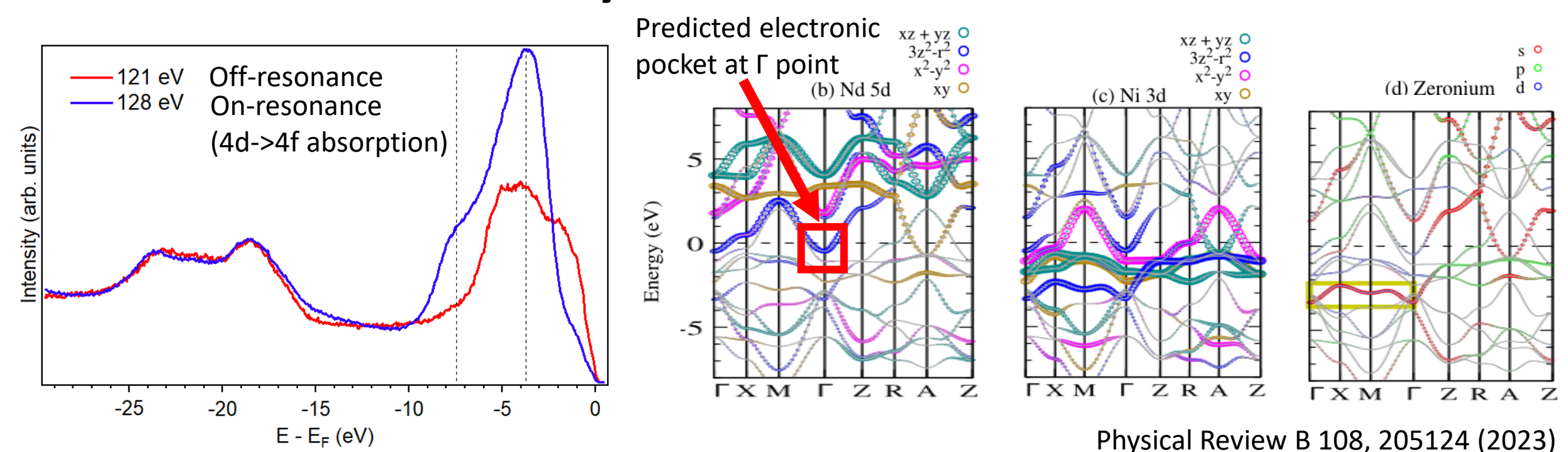
PNAS, 2022, 119(32): e2204630119.

### Orbital component of the α and β pockets



❖ The α hole pocket consists d<sub>x<sup>2</sup>-y<sup>2</sup></sub> orbital; the β electron pocket consists part of d<sub>xy</sub> orbital.

### Element resonance study: Nd electrons would far from Fermi level



Physical Review B 108, 205124 (2023)

## Conclusions & outlook

- ❖ Well-ordered nickelates NdNiO<sub>2</sub> are firstly in-situ prepared.
- ❖ The α hole pocket and β electron pocket around A/M points cross the Fermi level. No pocket cross the Z/Γ pocket.
- ❖ The α band consists of d<sub>x<sup>2</sup>-y<sup>2</sup></sub> orbital and its band dispersion is closely resemble in hole-doped cuprates.
- ❖ The Fermi level would be lack of participation of the Nd electrons.
- ❖ The cause of deviation with theory at Γ point? Possible magnetic transition happens at Metal-Insulator transition?