

Spin-resolved Fermi Surface of "Half-Metallic" FePd Alloy Monolayers

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Ultrathin FePd Ferromagnet

Ferromagnetism in low dimensions /
Surface ferromagnetism

Reduced Dimensionality

+

Exchange interaction

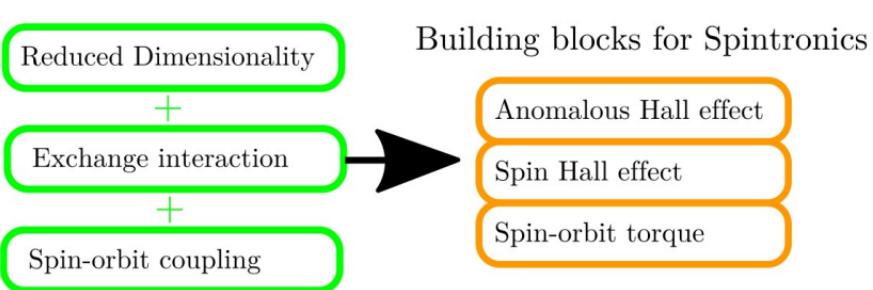
+

Spin-orbit coupling



Ultrathin FePd Ferromagnet

Ferromagnetism in low dimensions /
Surface ferromagnetism



Ultrathin FePd Ferromagnet

Ferromagnetism in low dimensions /
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Reduced Dimensionality

+

Exchange interaction

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Spin-orbit coupling

Building blocks for Spintronics

Anomalous Hall effect

Spin Hall effect

Spin-orbit torque

Challenges

Low Tc

Structural defects

Complex stoichiometry

Tunability

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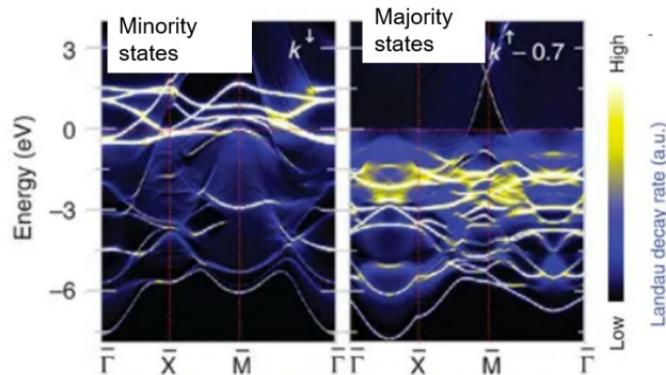
Tunability

↓
Ultrathin Hybrid Ferromagnet

1.8 ML of FePd alloy on Pd(001)

The Thinnest Known Half Metallic System

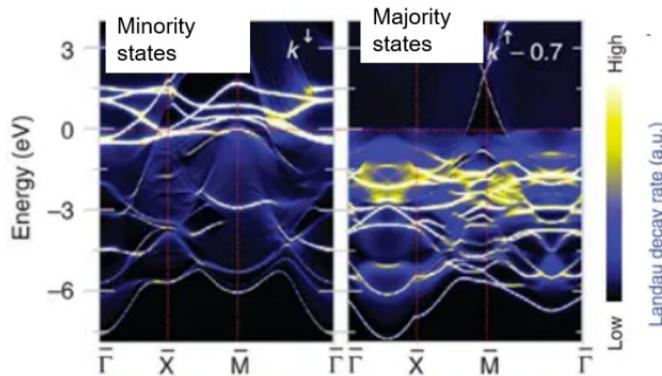
2ML FePd alloy on Pd(100)



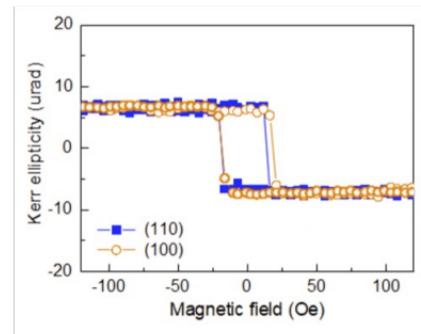
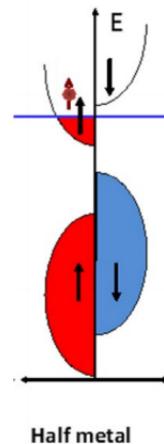
H. J. Qin, J. Kirschner, et al. Nature Communications
volume 6, Article number: 6126 (2015)

The Thinnest Known Half Metallic System

2ML FePd alloy on Pd(100)



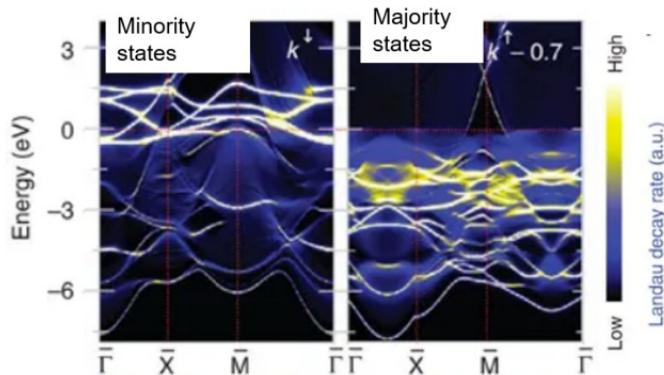
H. J. Qin, J. Kirschner, et al. Nature Communications volume 6, Article number: 6126 (2015)



MOKE of 2ML FePd/Pd(100).
Courtesy of Dr. Y.J. Chen

The Thinnest Known Half Metallic System

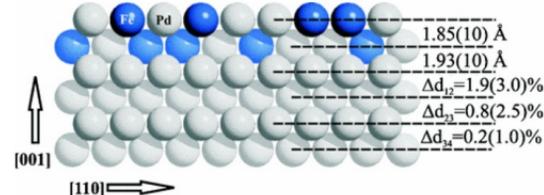
2ML FePd alloy on Pd(100)



H. J. Qin, J. Kirschner, et al. Nature Communications volume 6, Article number: 6126 (2015)

Highly controllable and tunable

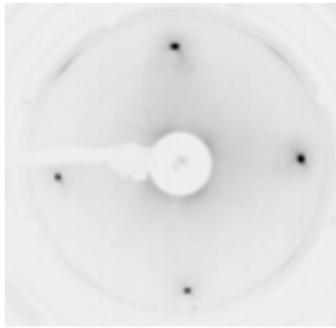
$T_{\text{curie}} \sim 370\text{K}$



H. L. Meyerheim, R. Popescu, and J. Kirschner
Phys. Rev. B 73, 245432 (2006)

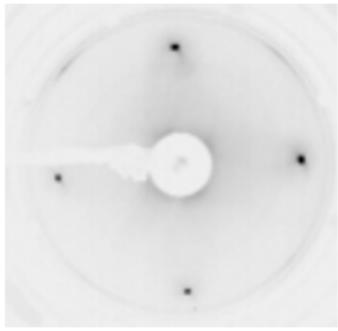


Preparation of 1.8 monolayers FePd on Pd(100)

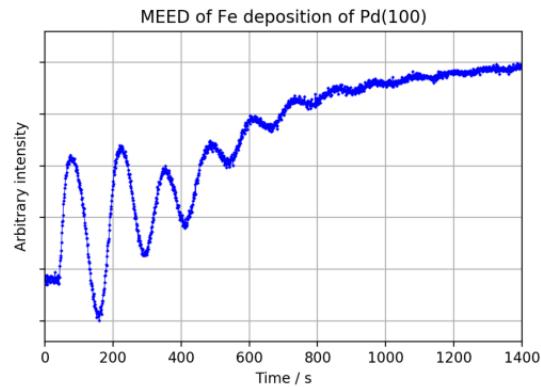


LEED Pd(100) at 56eV

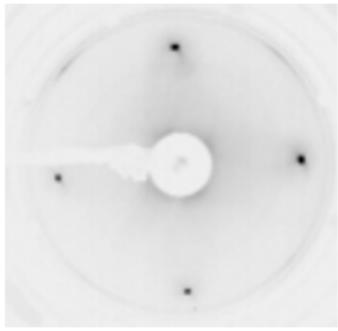
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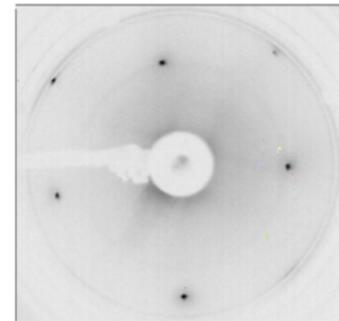
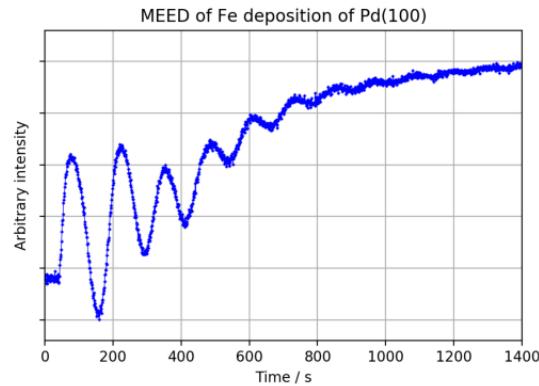
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Preparation of 1.8 monolayers FePd on Pd(100)

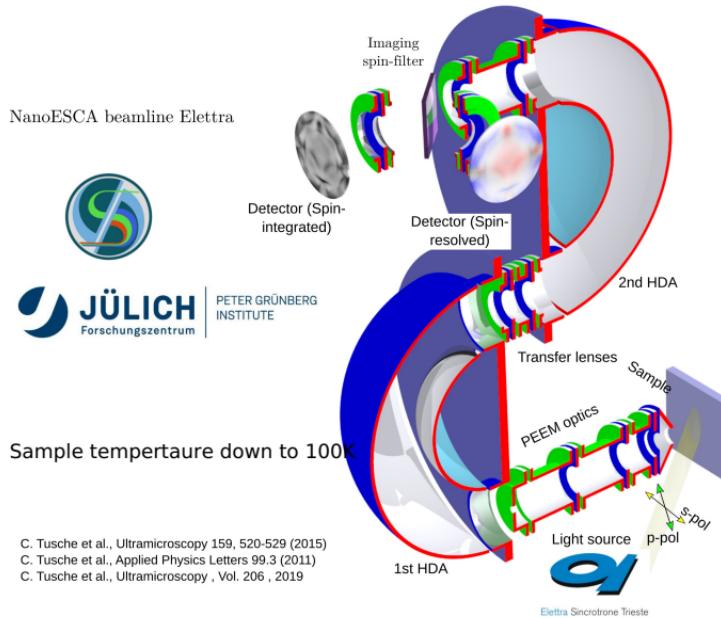


LEED Pd(100) at 56eV

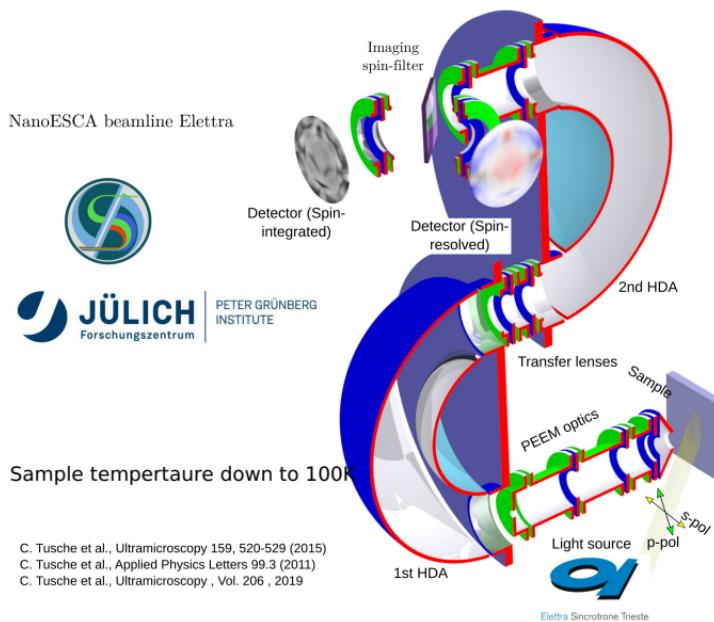


LEED 1.8ML FePd/Pd(100)
at 70eV

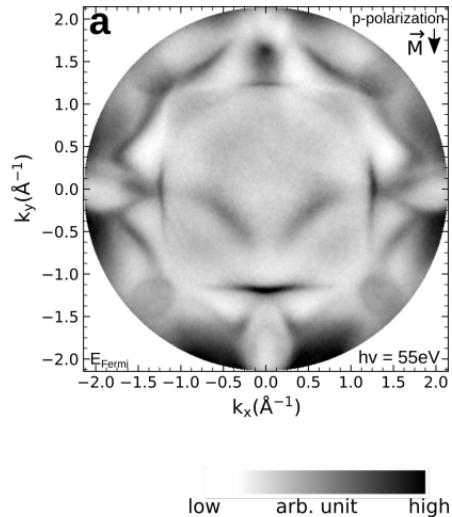
Spin-resolved Momentum Microscopy



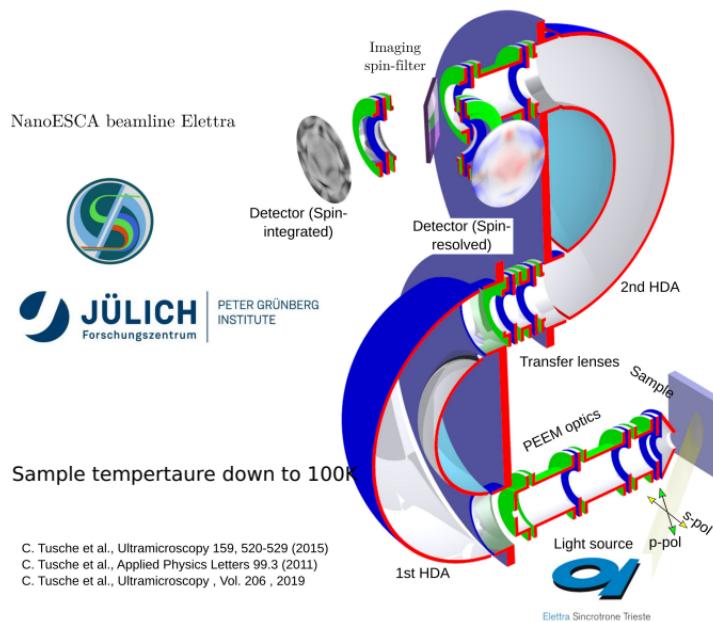
Spin-resolved Momentum Microscopy



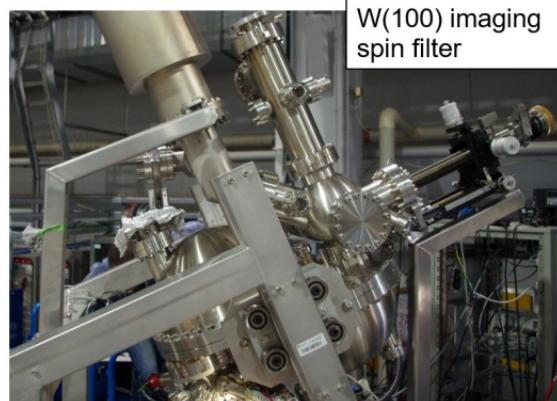
Fermi Surface of 12ML Fe/Pd(100)



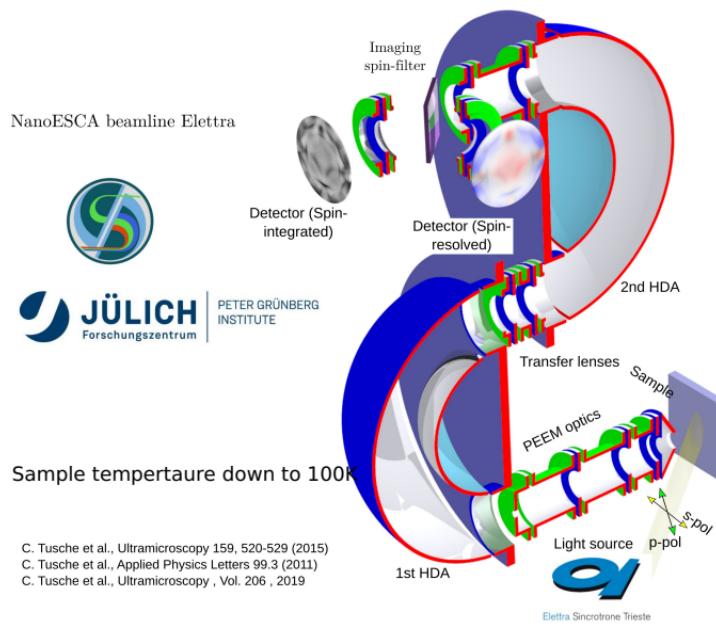
Spin-resolved Momentum Microscopy



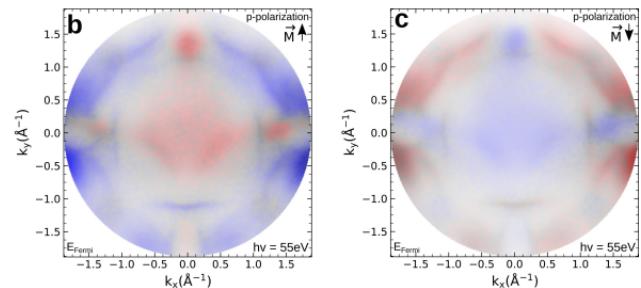
$F\epsilon$



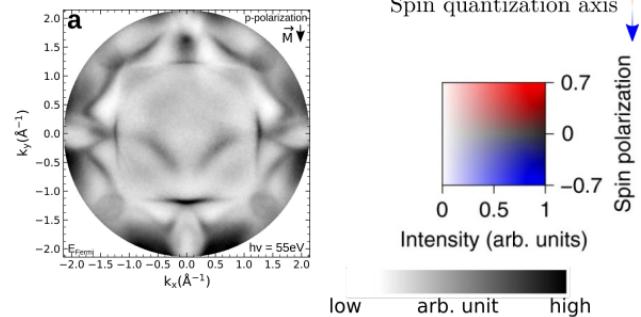
Spin-resolved Momentum Microscopy



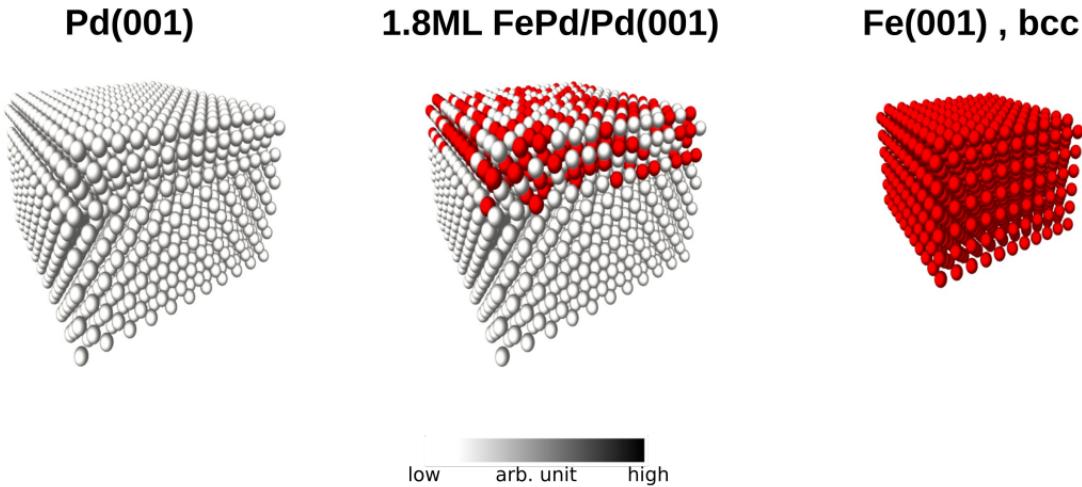
Spin-resolved Fermi Surface of
12ML Fe/Pd(100)



Spin-integrated Fermi Surface

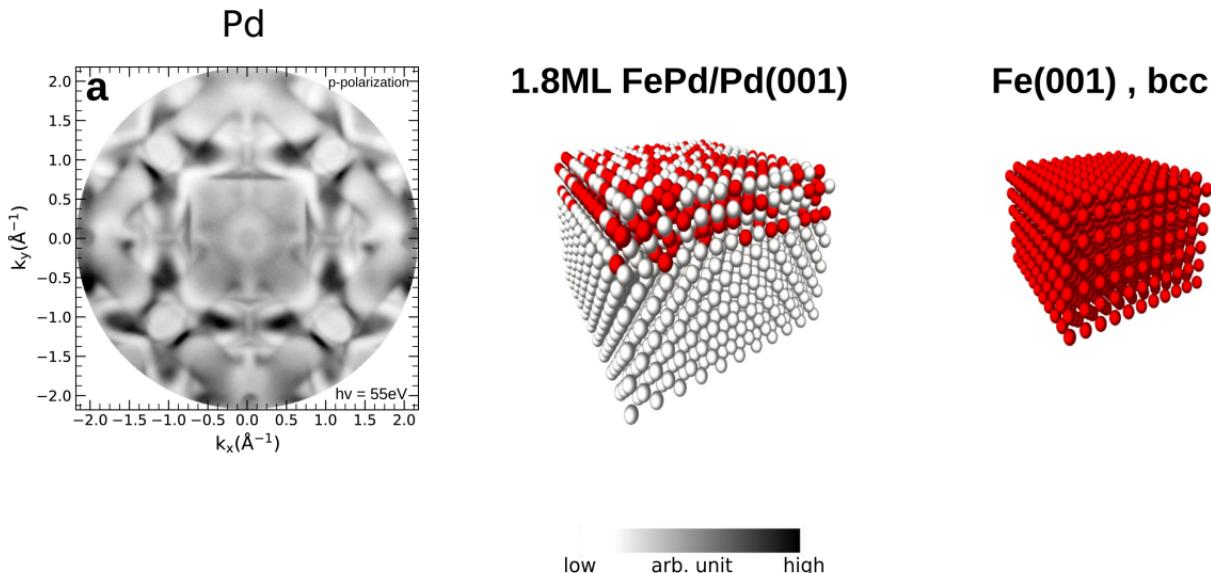


Fermi Surface of 1.8ML FePd/Pd(100)



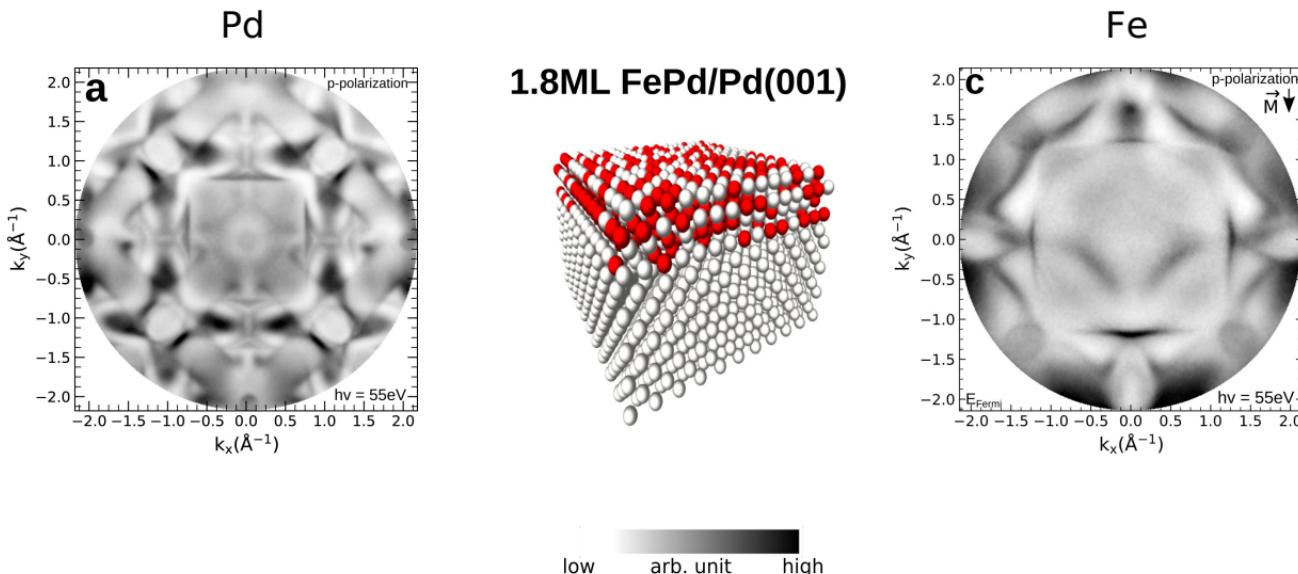
Fermi Surface of 1.8ML FePd/Pd(100)

Fermi surfaces of Pd, 1.8ML FePd/Pd(100) and Fe



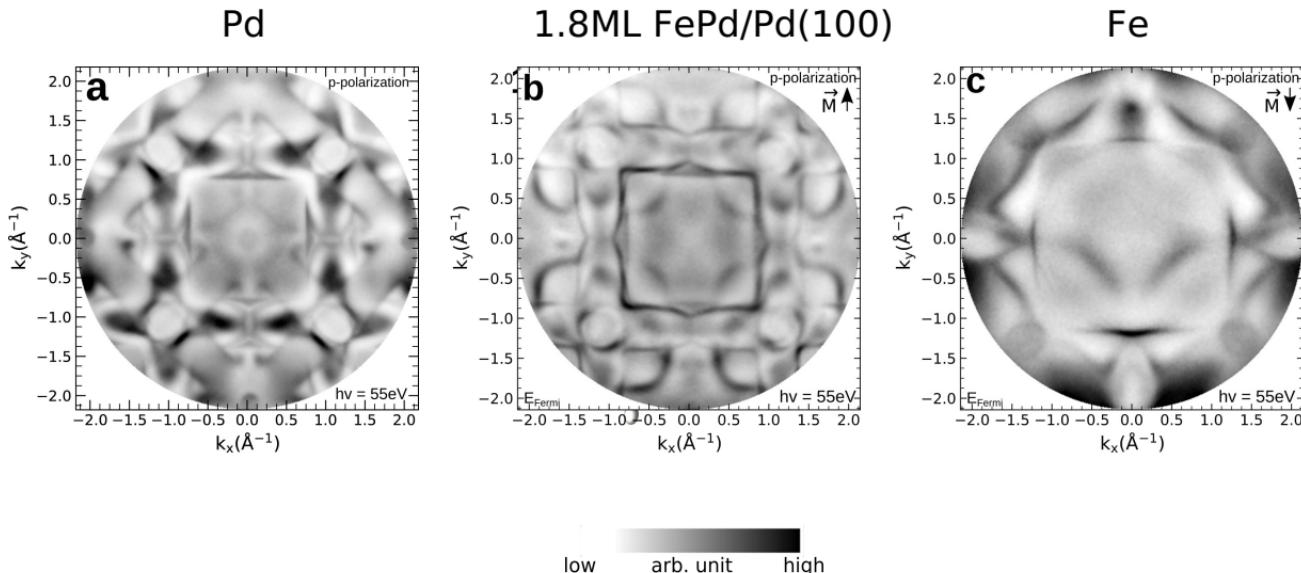
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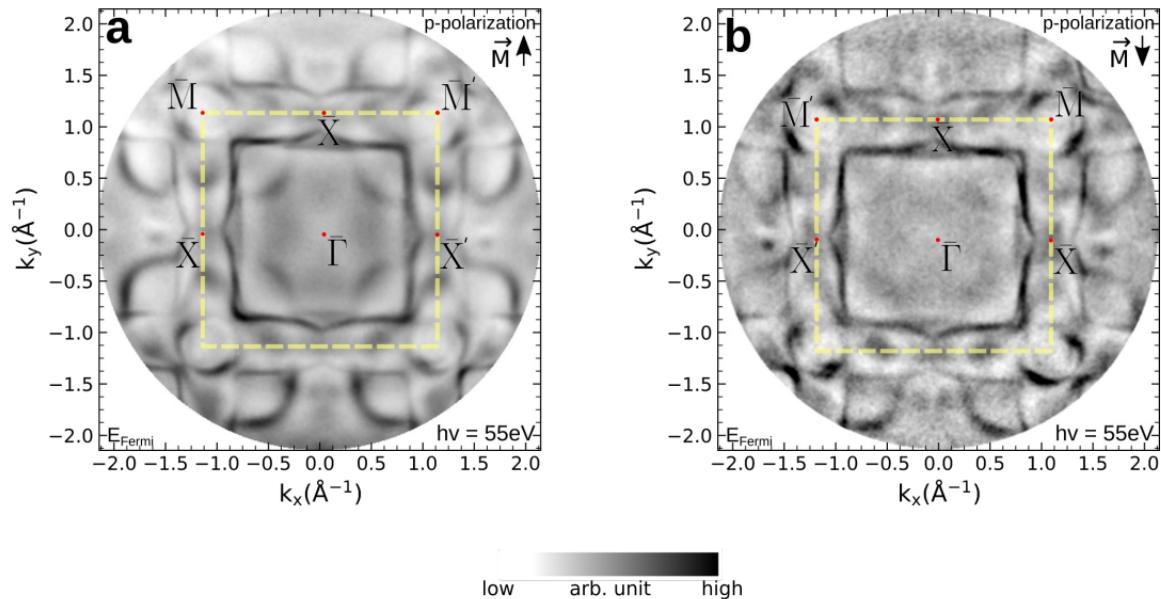


Fermi Surface of 1.8ML FePd/Pd(100)

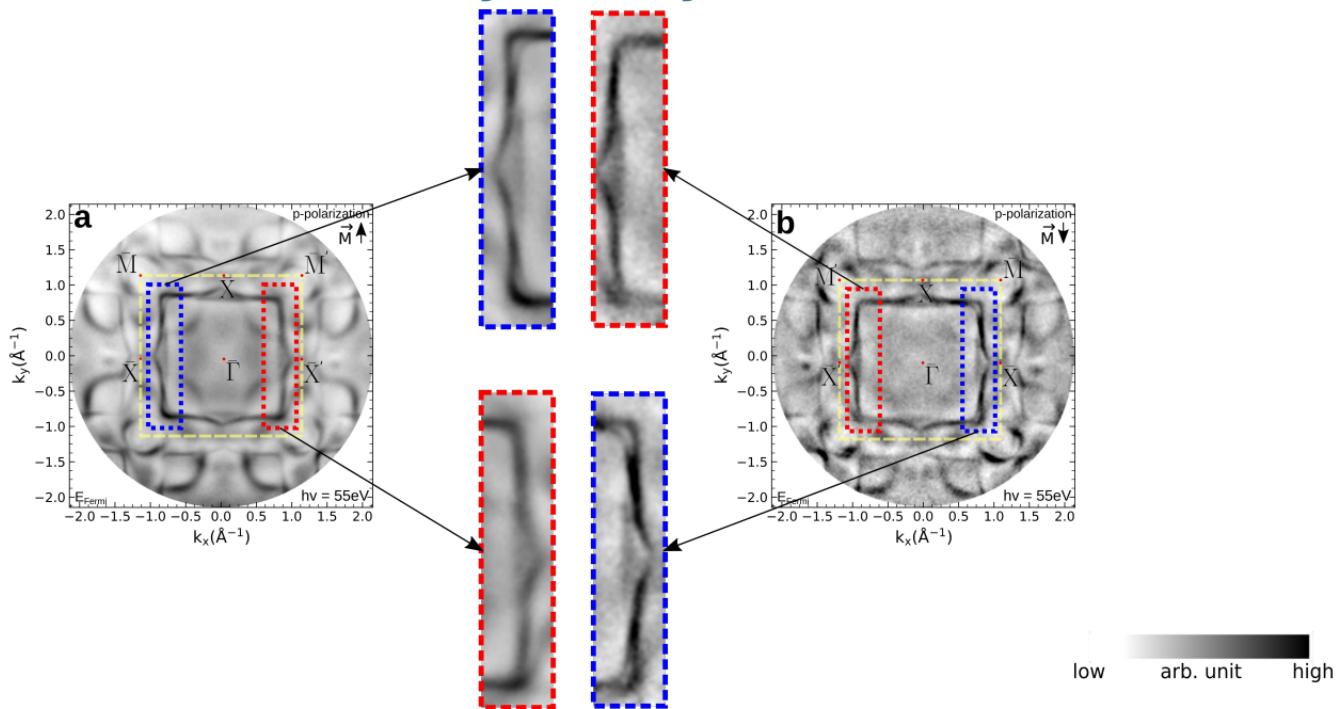
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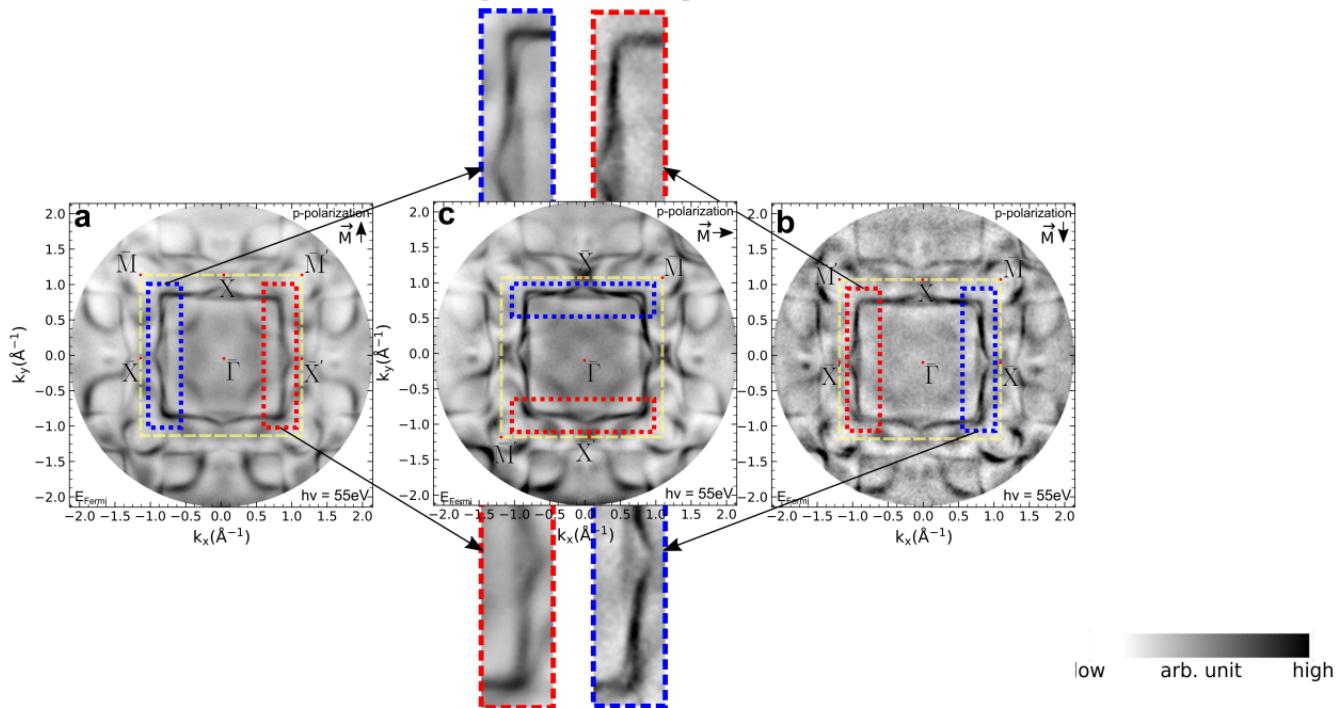
Broken Time-reversal Symmetry across Fermi Surface



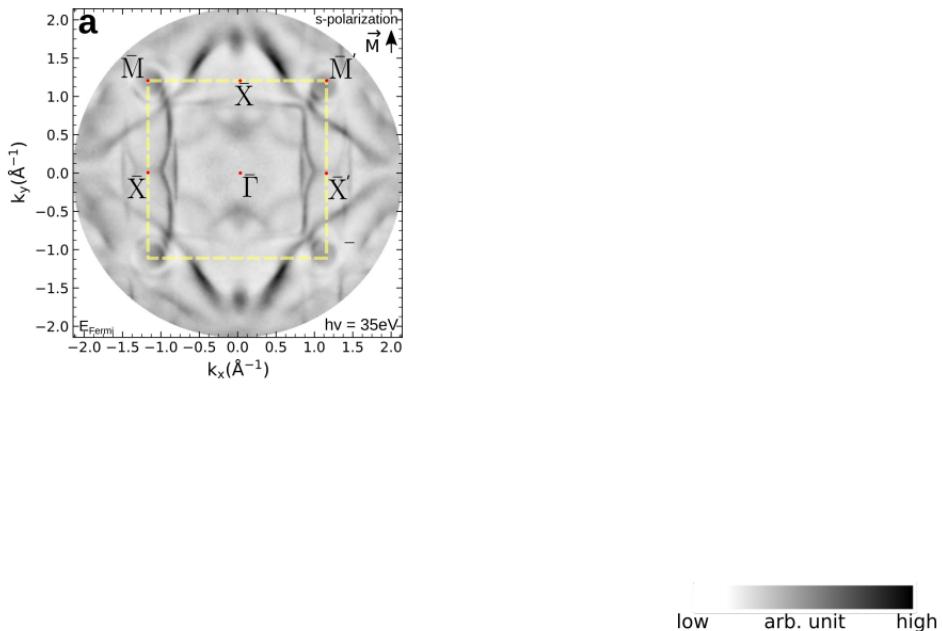
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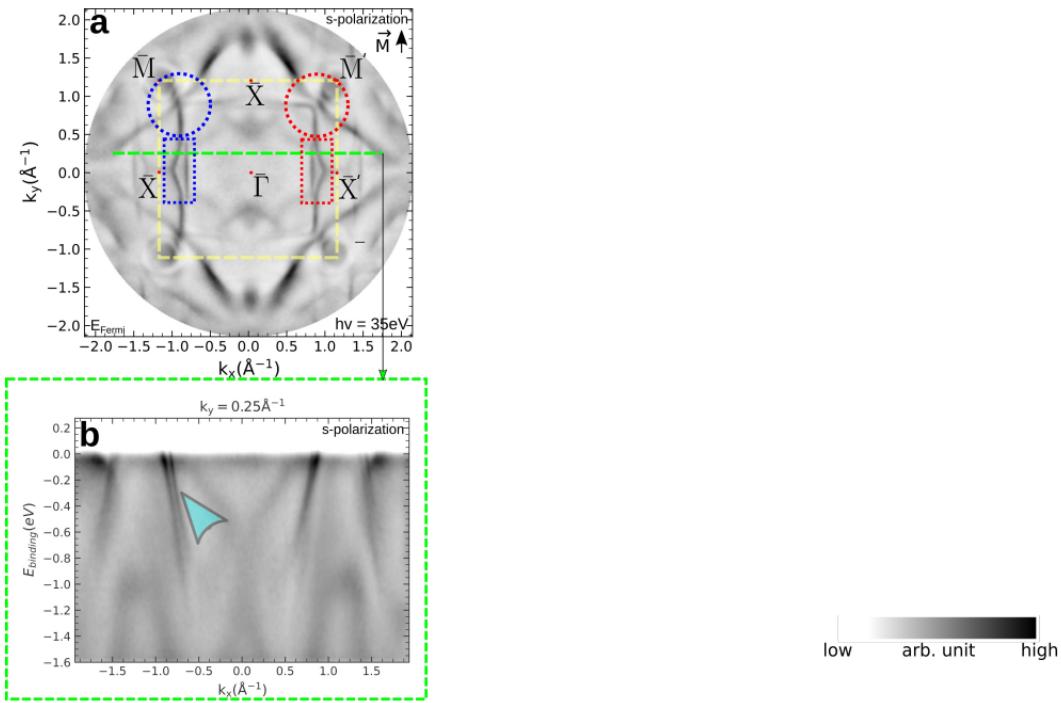
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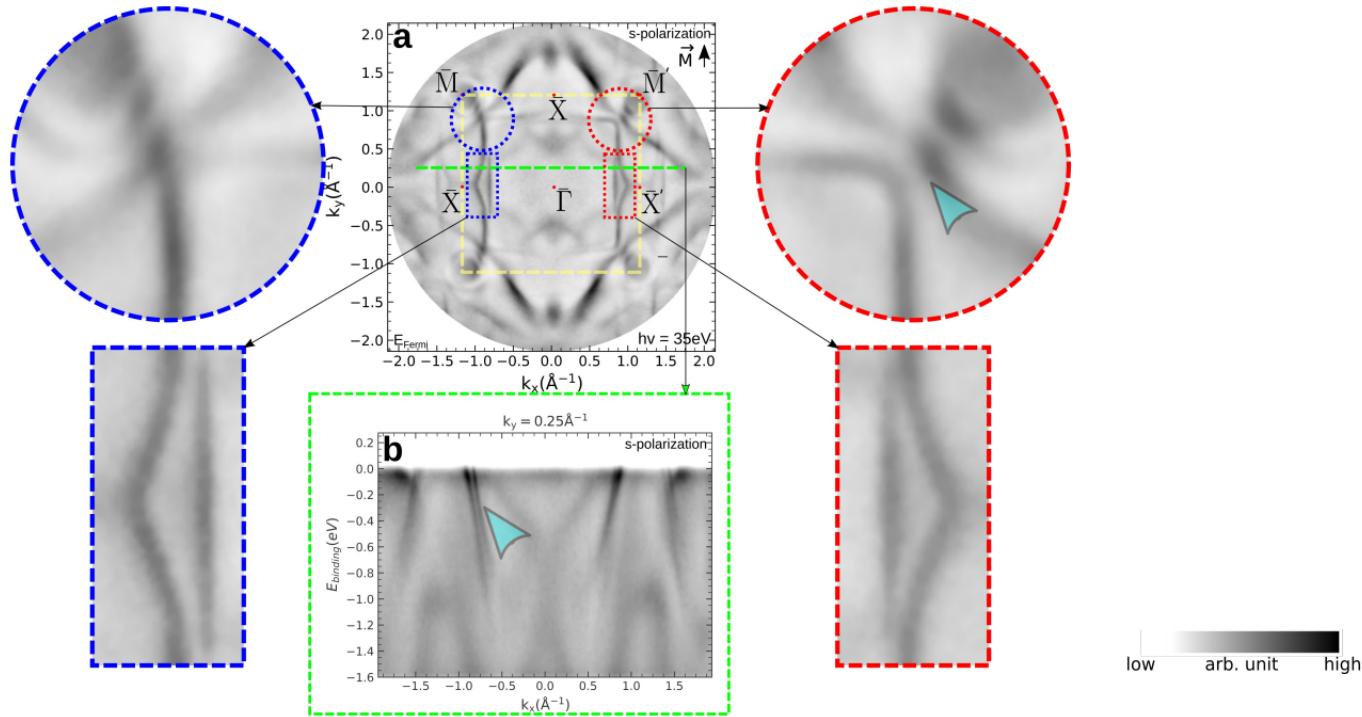
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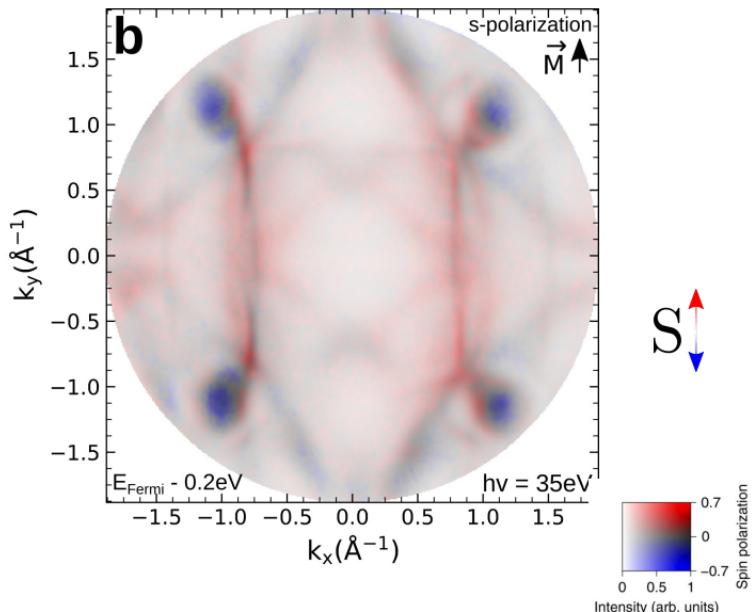
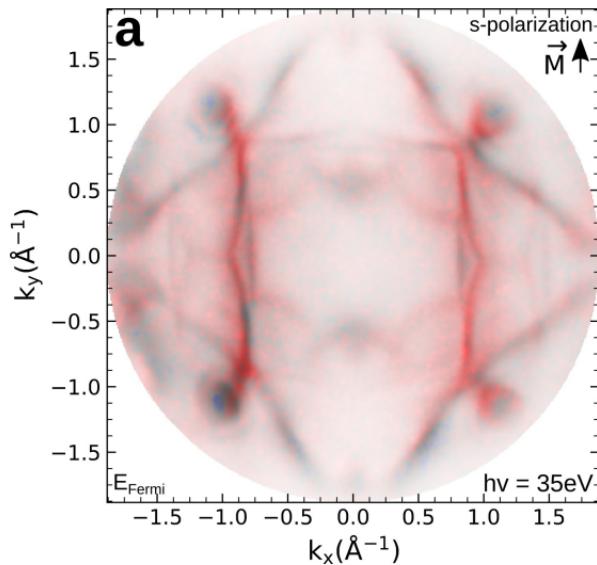
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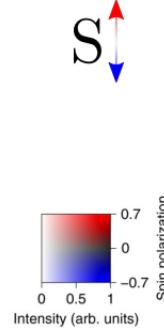
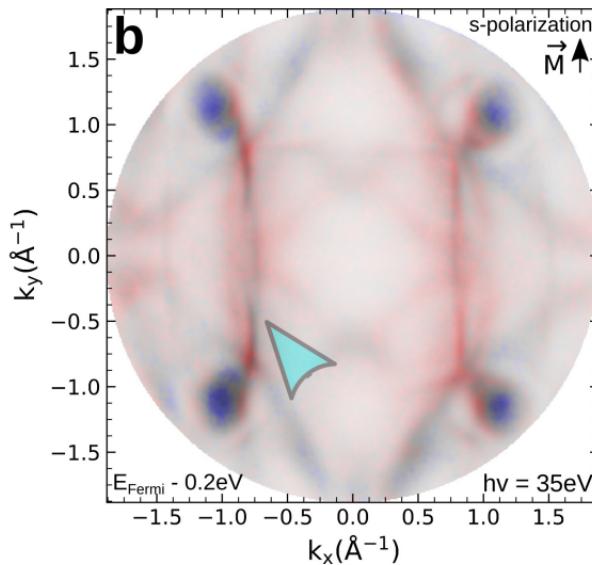
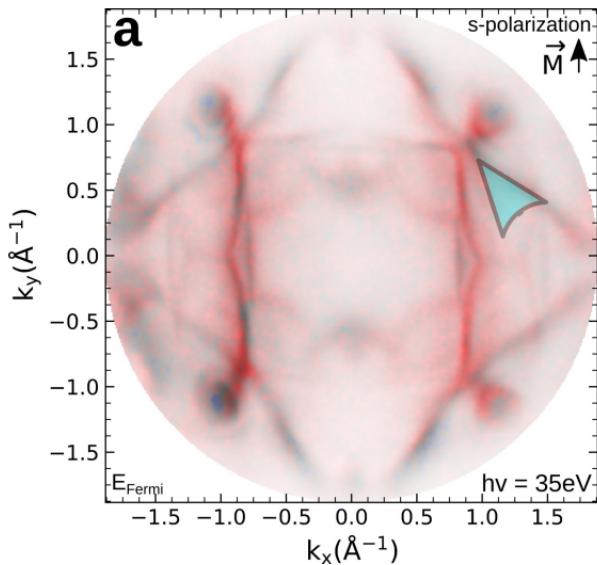
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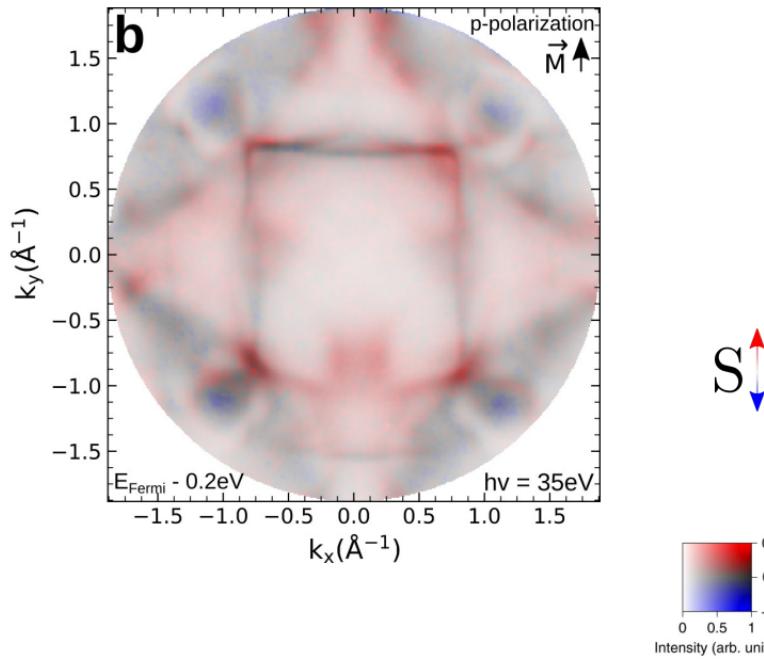
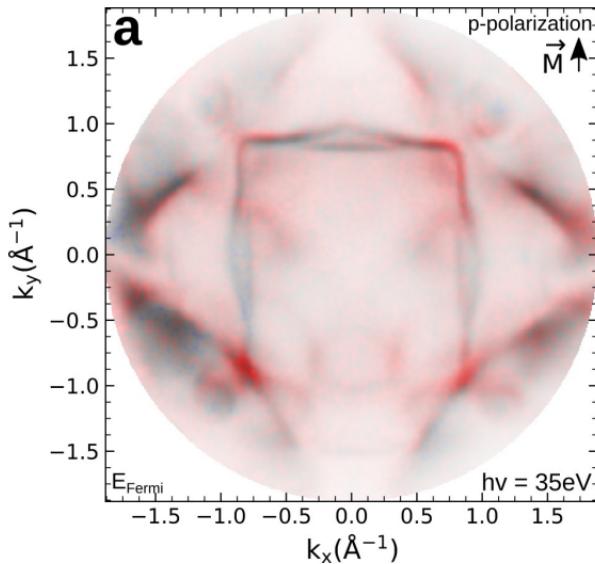
Band Hybridizations of 1.8ML FePd/Pd(100) Fermi Surface



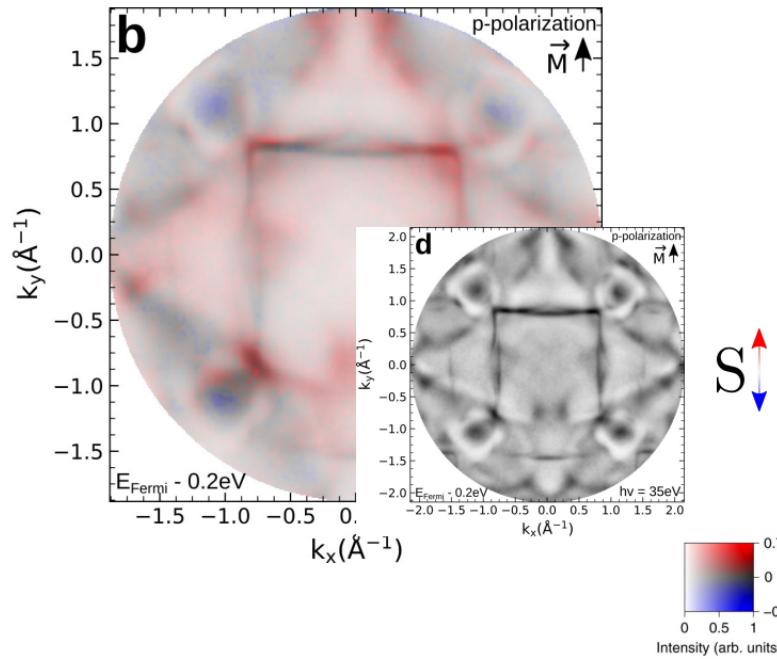
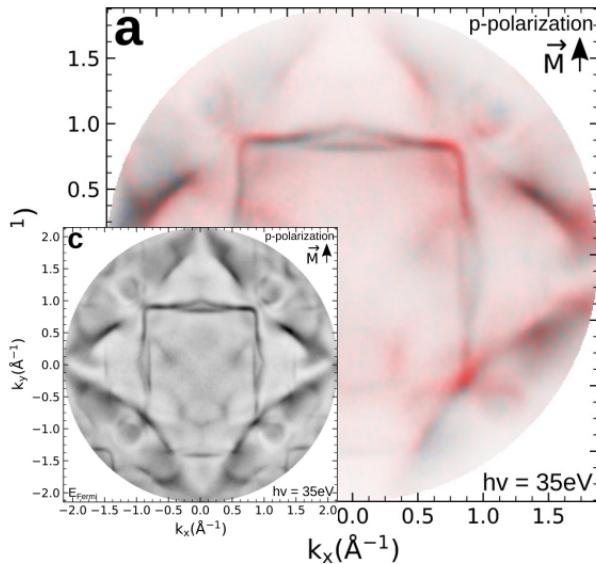
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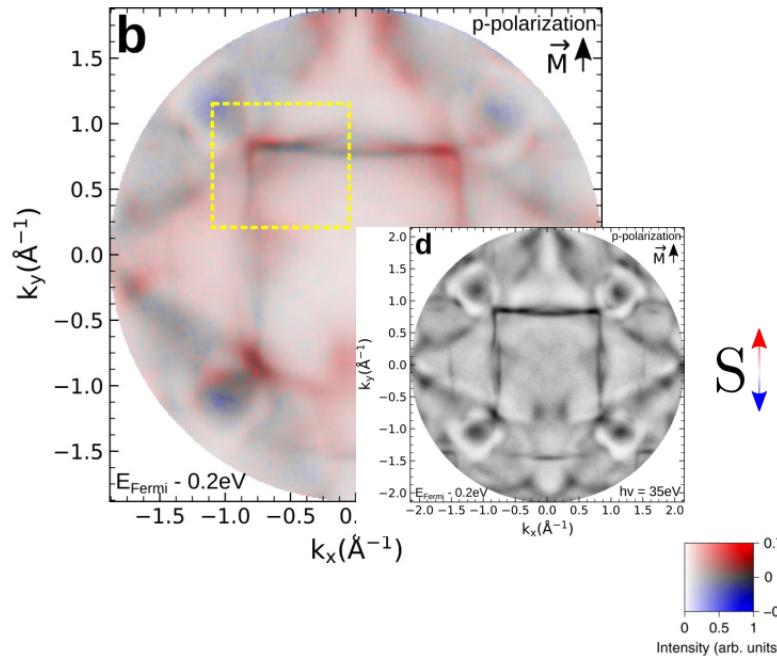
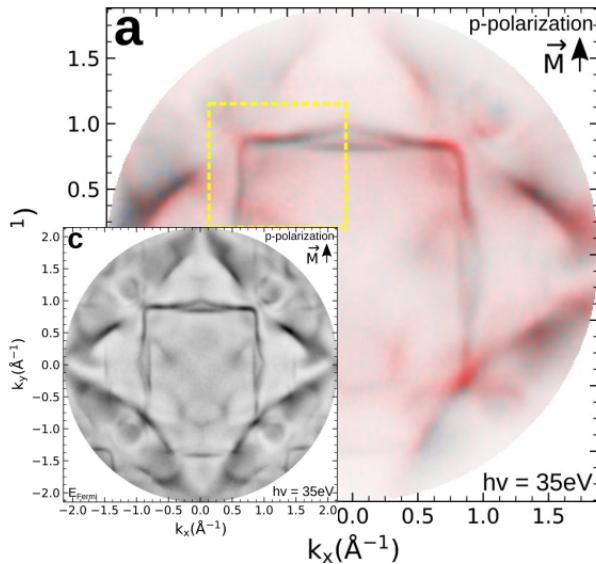
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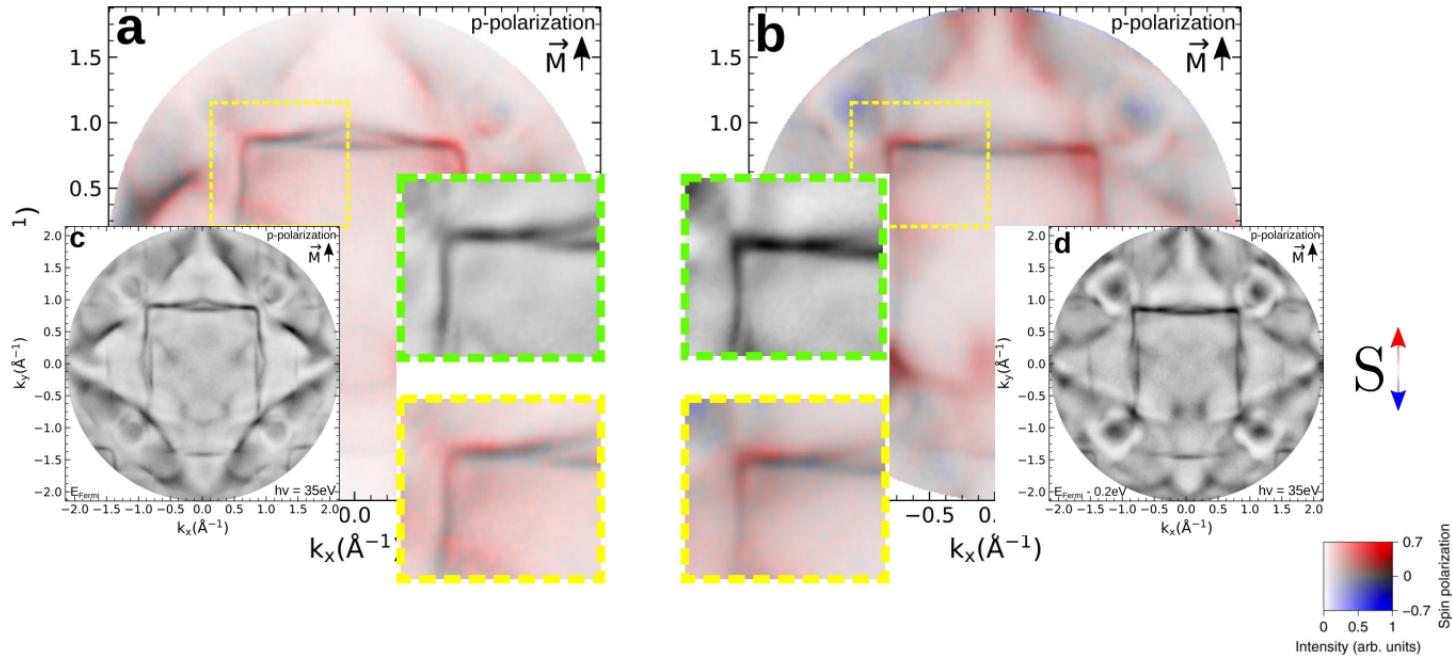
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Band Hybridizations of 1.8ML FePd/Pd(100) Fermi Surface





Summary

- Fermi surface Topology of 1.8ML FePd/Pd(100), compared to Pd(100) and bulk Fe.
- Explicit breaking of time-reversal symmetry across FePd Fermi surface.
- Hybridization of electronic states of FePd due to strong spin-orbit coupling.



Thank you for your attention!

<https://momentum-microscopy.fz-juelich.de/>