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Uniaxial stress tuning of the anomalous Hall effect in Mn_3Ge

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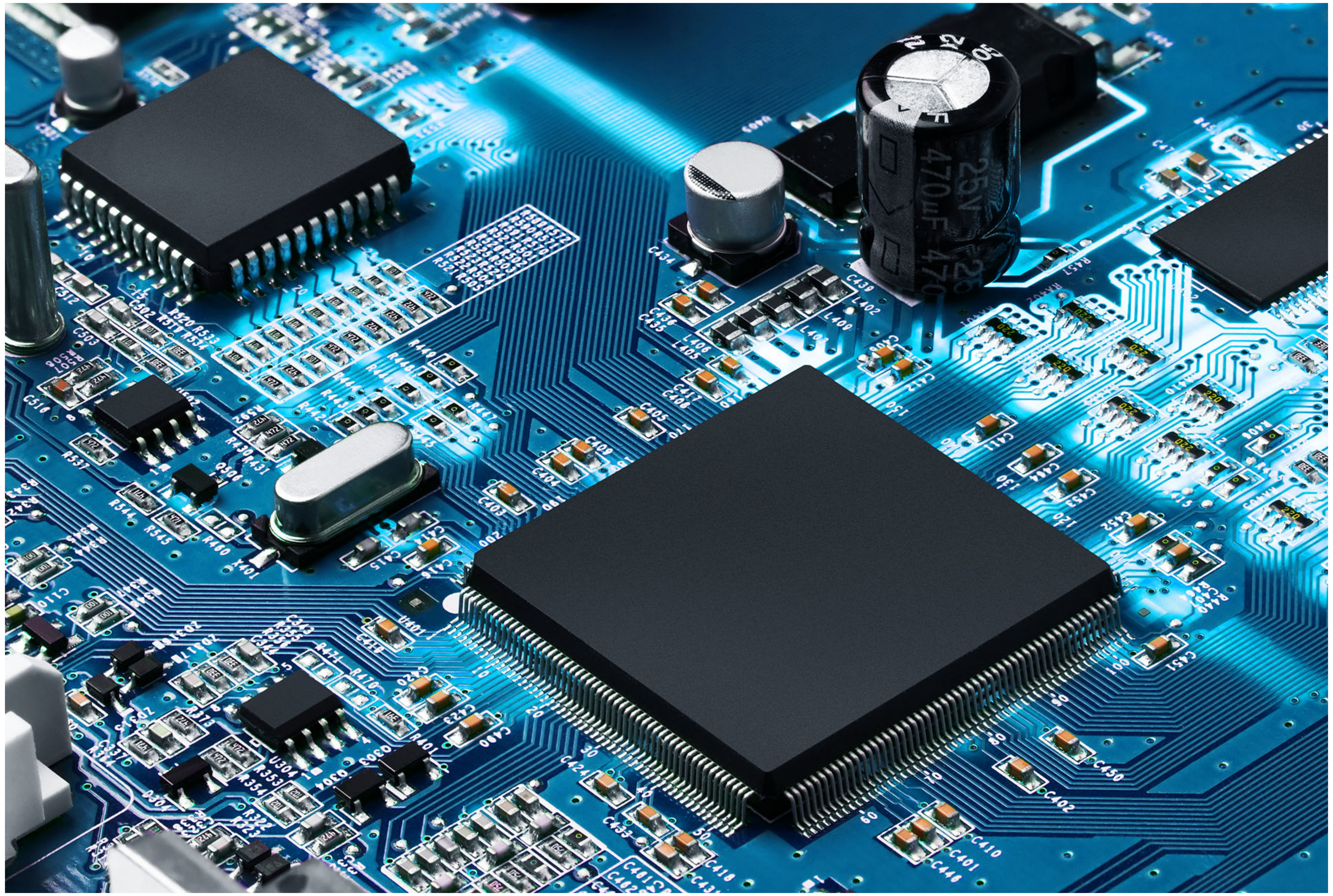
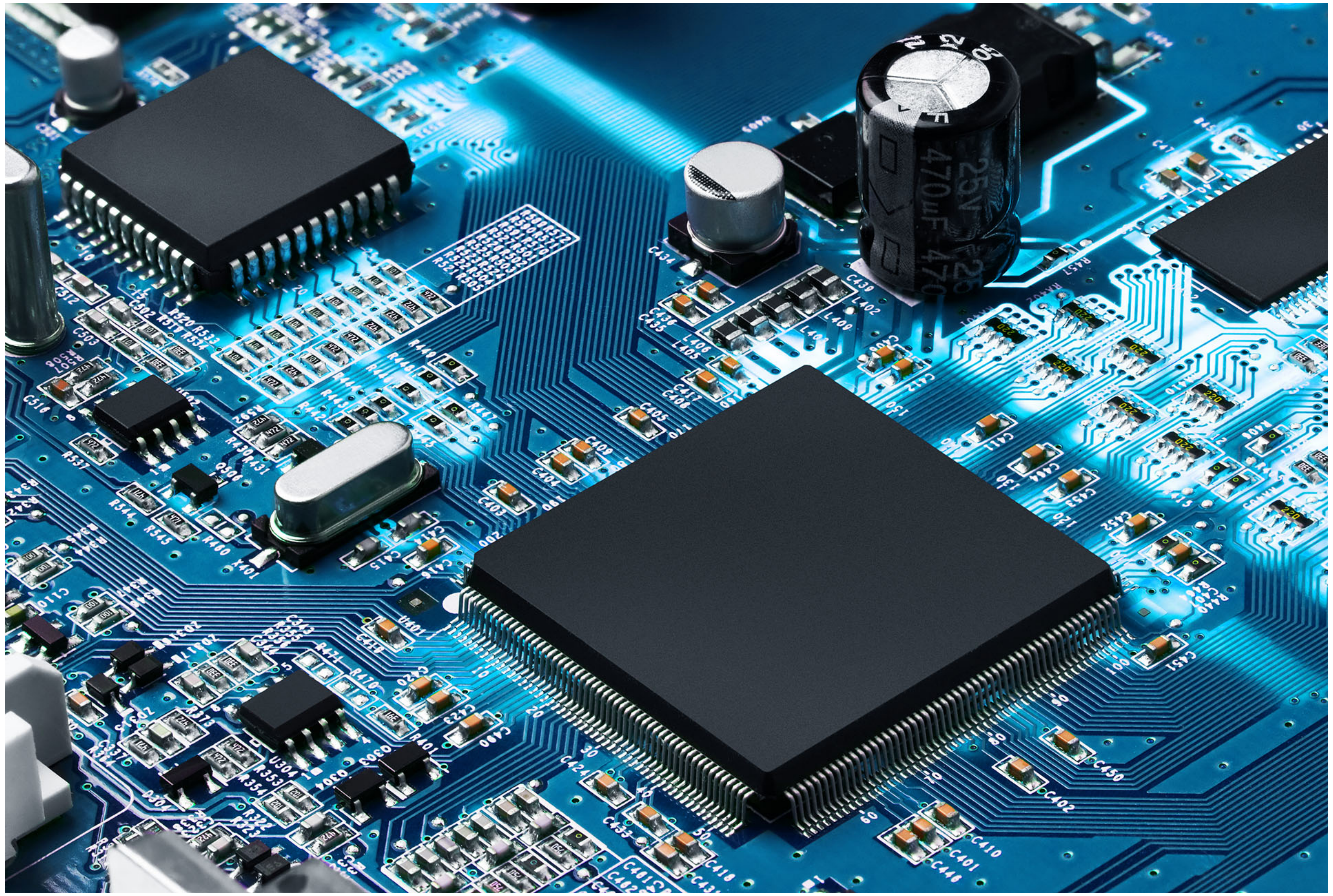


Control of charge
Process and transfer information



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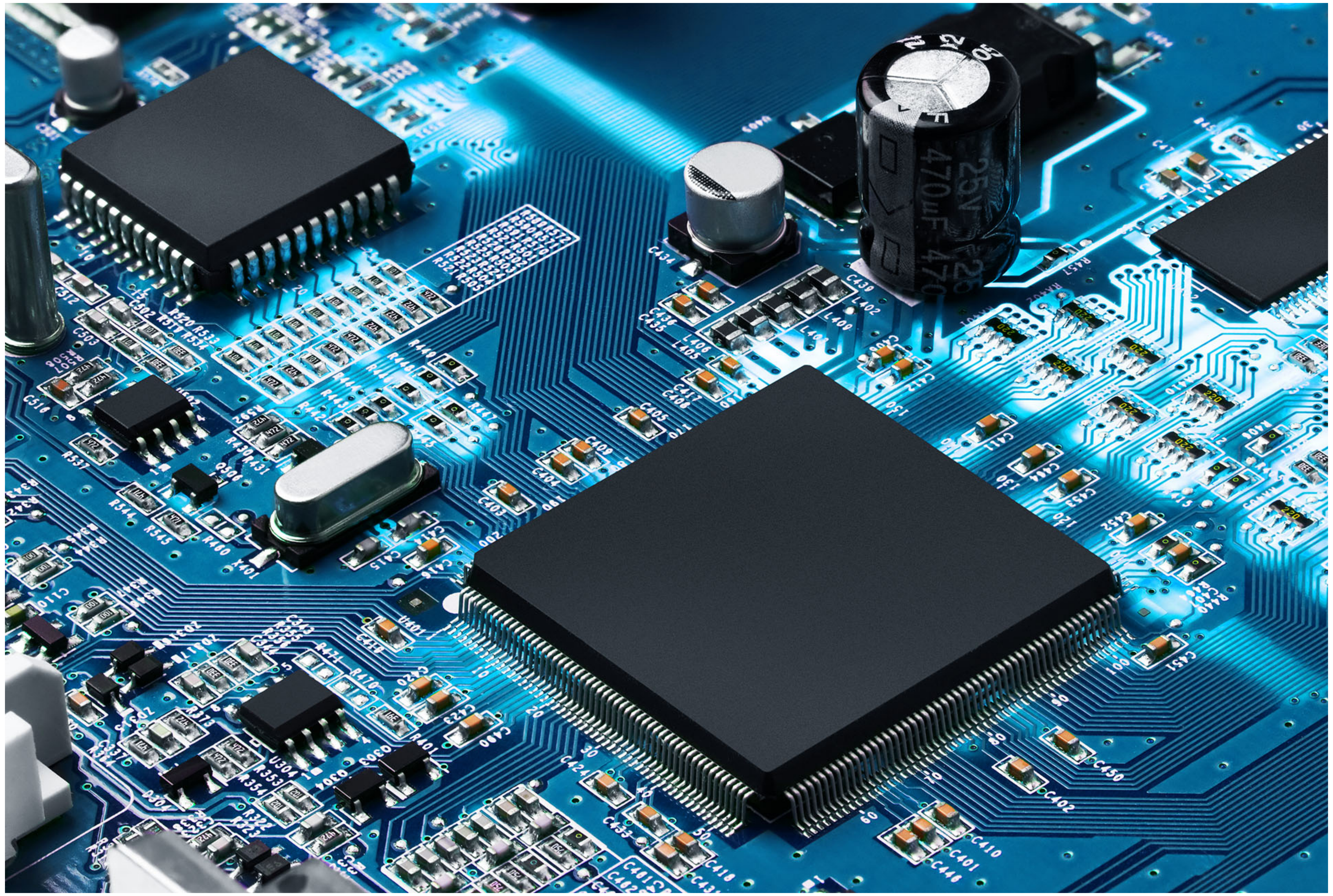

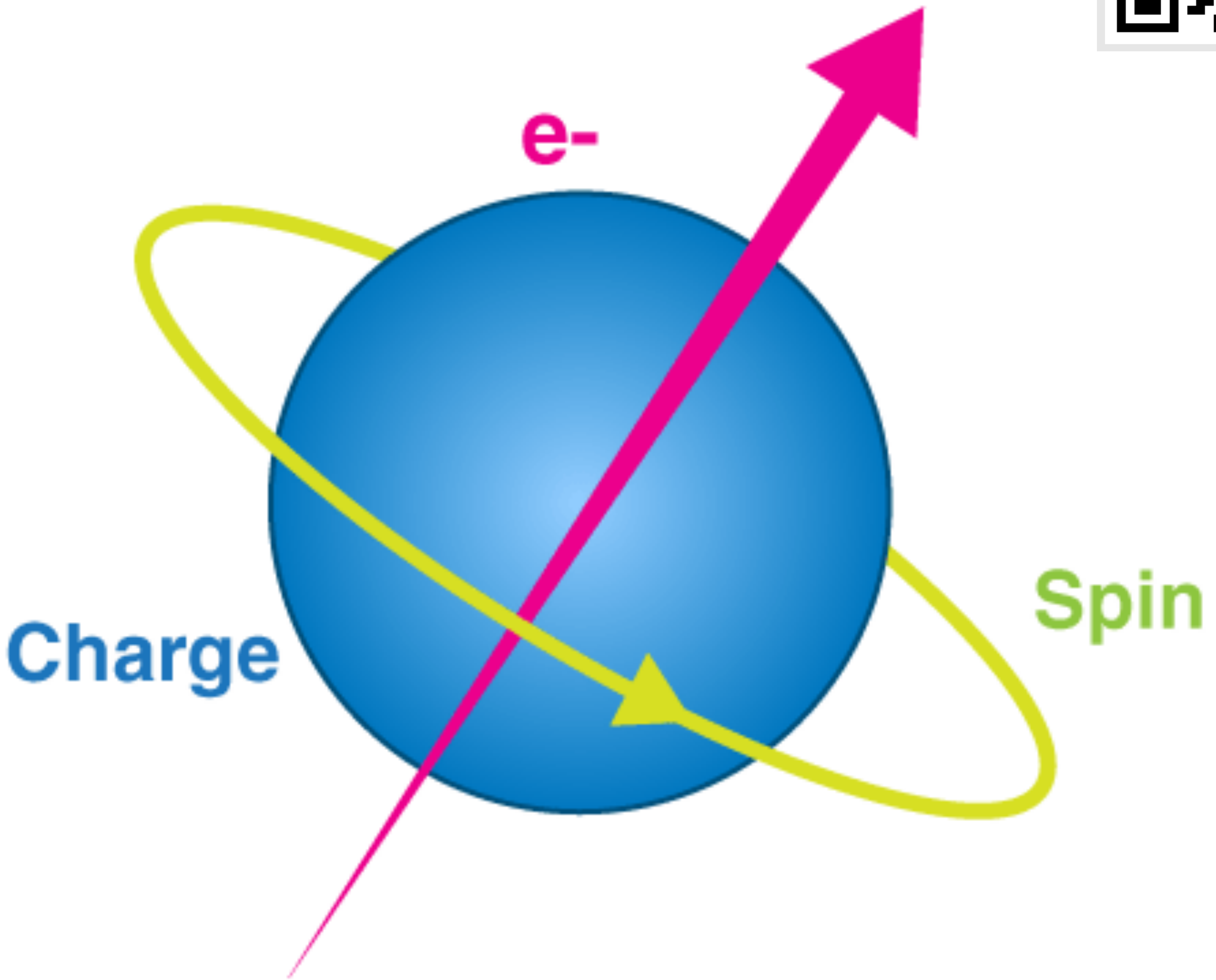

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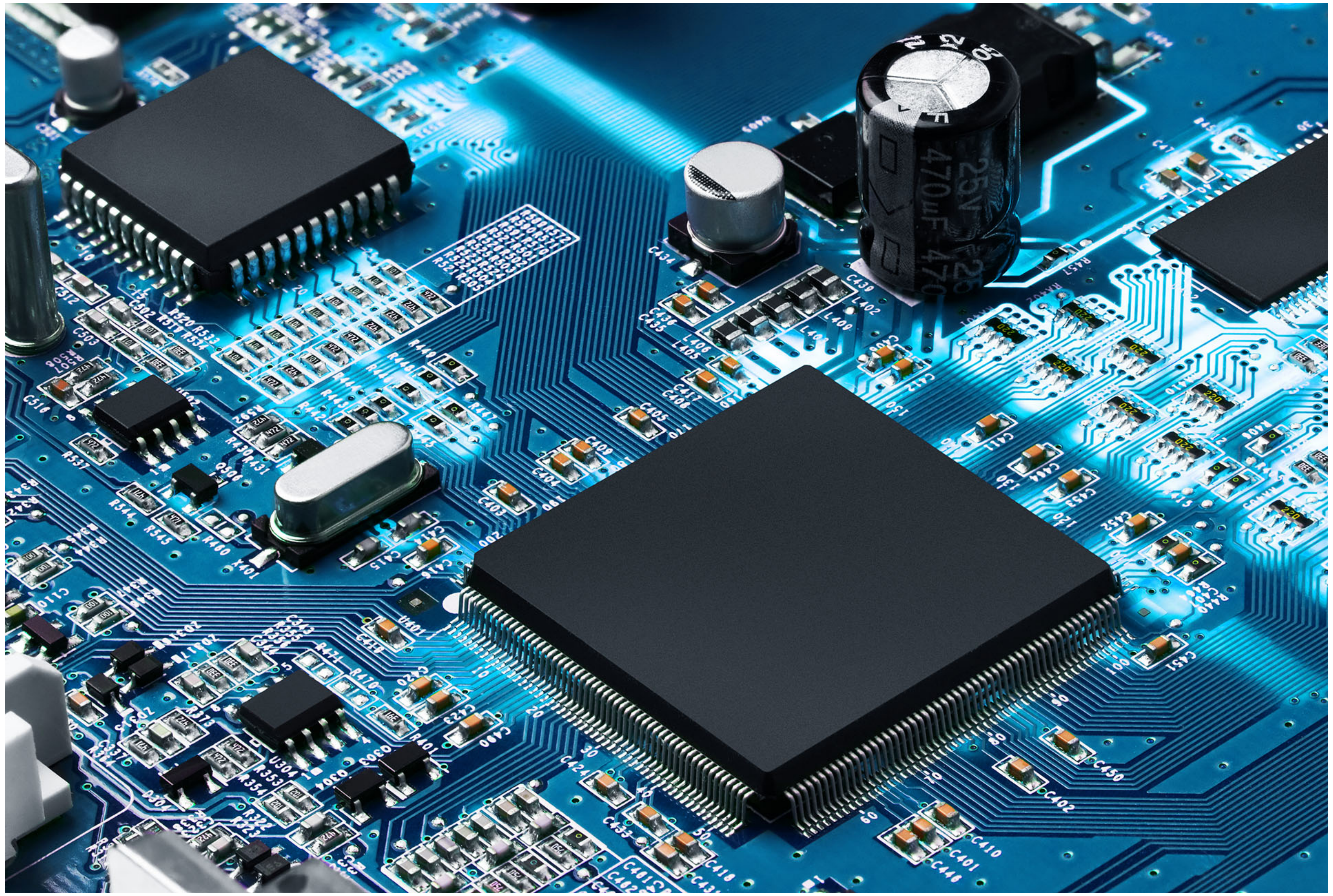

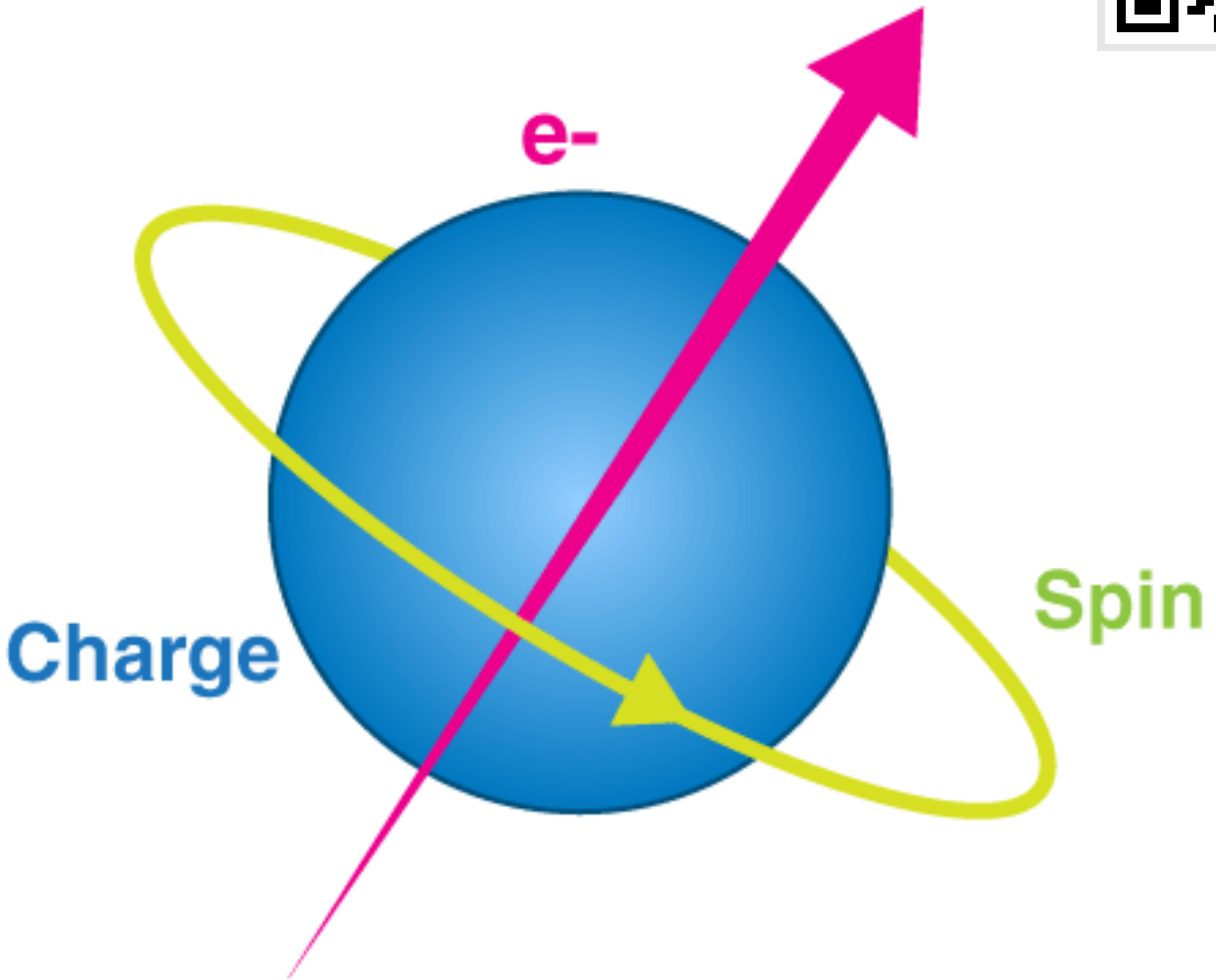

Control of charge and spin

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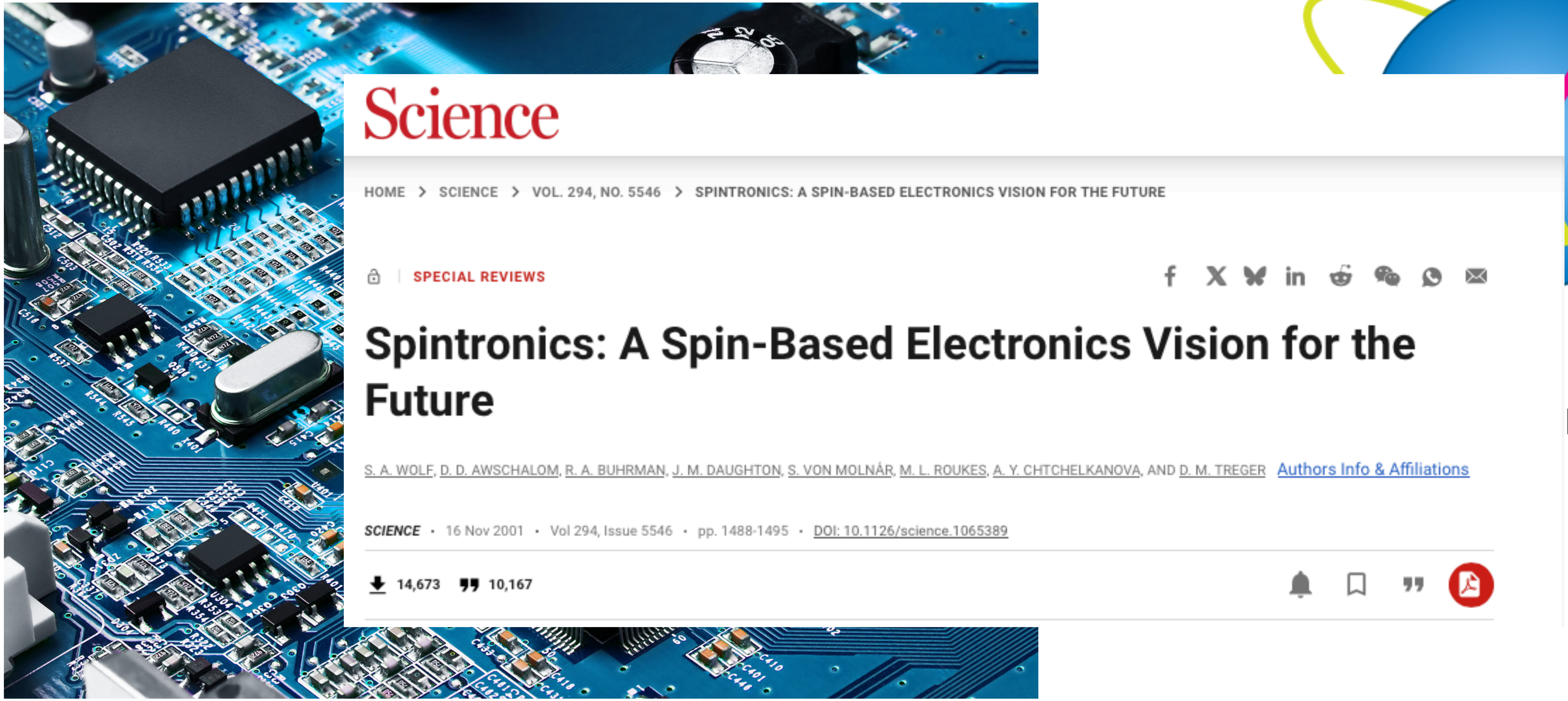
Control of charge
Process and transfer information



Science

HOME > SCIENCE > VOL. 294, NO. 5546 > SPINTRONICS: A SPIN-BASED ELECTRONICS VISION FOR THE FUTURE

SPECIAL REVIEWS

Spintronics: A Spin-Based Electronics Vision for the Future

S. A. WOLF, D. D. AWSCHALOM, R. A. BUHRMAN, J. M. DAUGHTON, S. VON MOLNÁR, M. L. ROUKES, A. Y. CHTCHELKANOVA, AND D. M. TREGER Authors Info & Affiliations

SCIENCE • 16 Nov 2001 • Vol 294, Issue 5546 • pp. 1488-1495 • DOI: 10.1126/science.1065389

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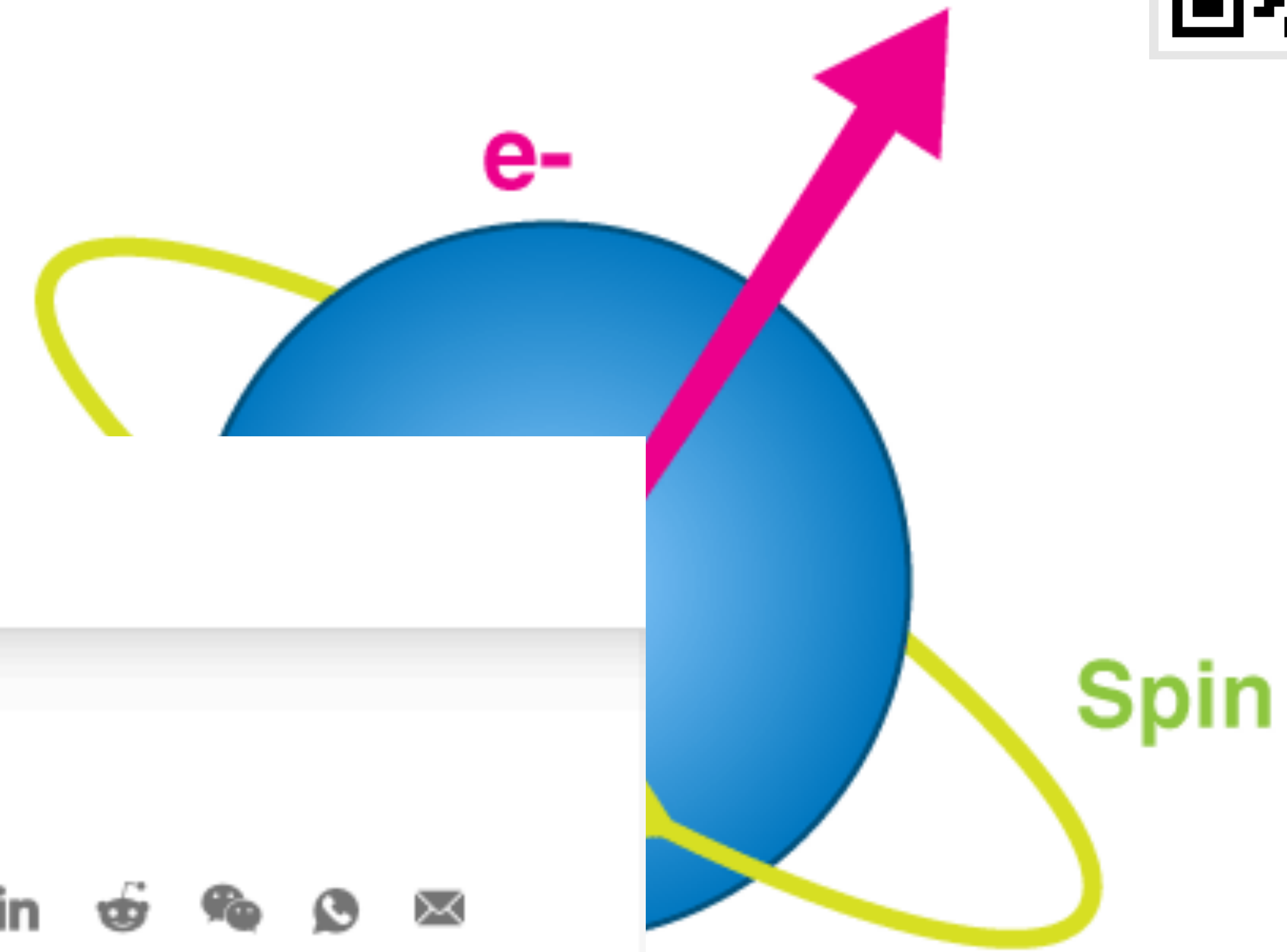
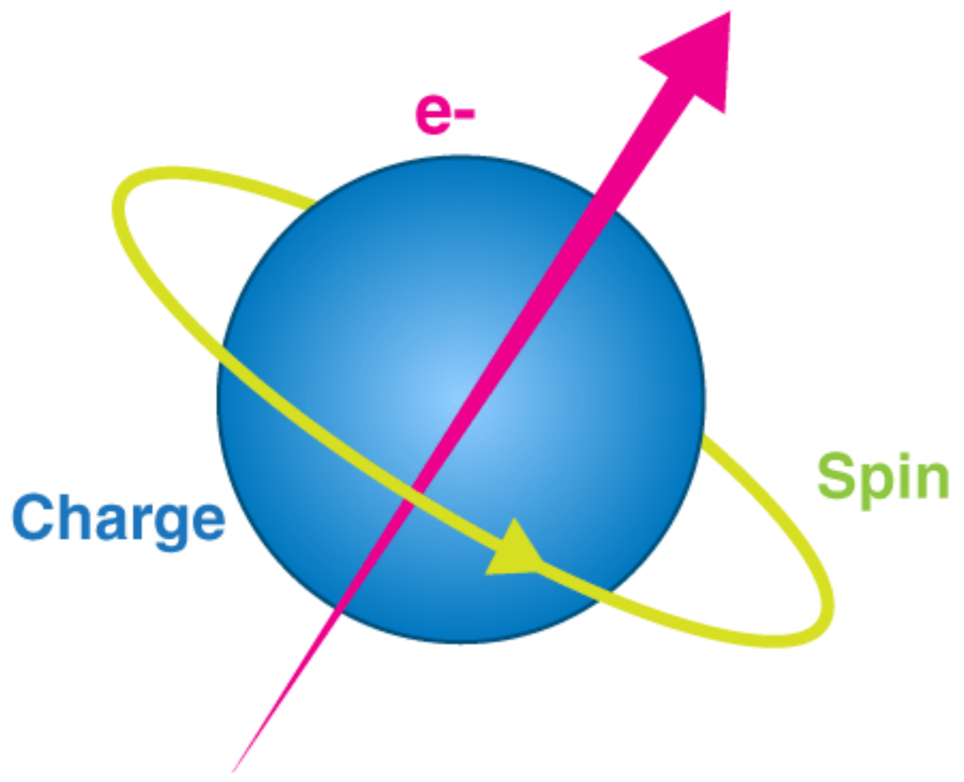


rge and spin



Spintronics

C. Chappert et al., Nature Mater **6**, 813 (2007).
A. D. Kent et al., Nature Nanotech **10**, 187 (2015).
E. Liu et al., Nature Phys **14**, 1125 (2018).
A. K. Nayak et al., Science Advances 2, (2016).
S. V. Faleev et al., Phys. Rev. Mater. 1, 024402 (2017).
T. Jungwirth et al., Nature Phys 14, 200 (2018).

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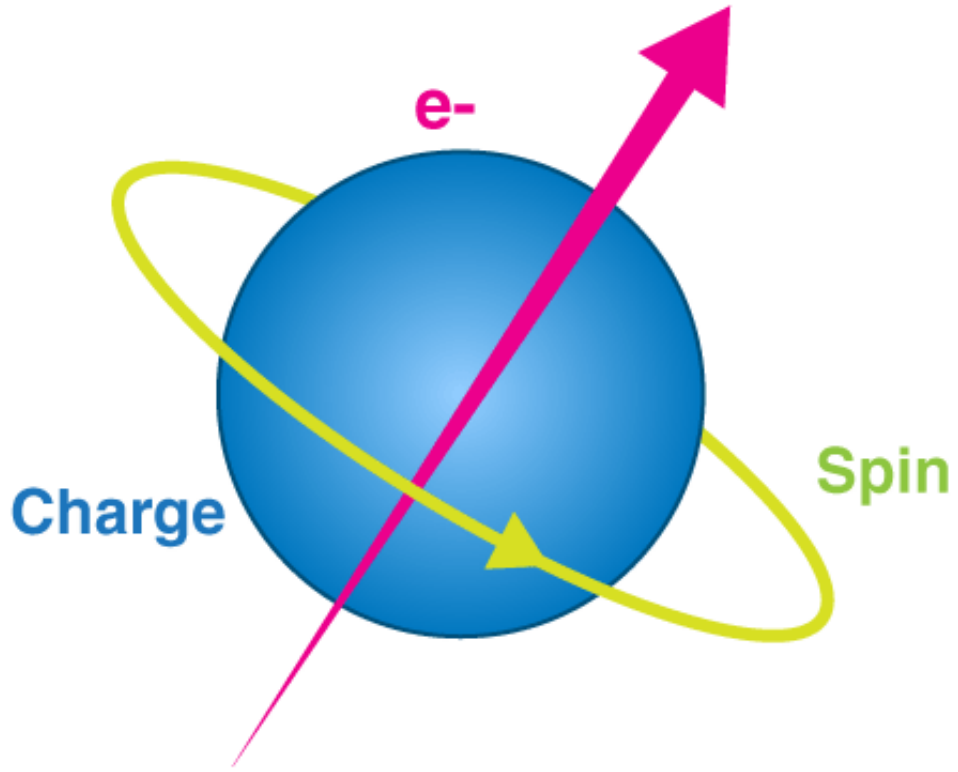

Spintronics

Based on
Ferromagnets

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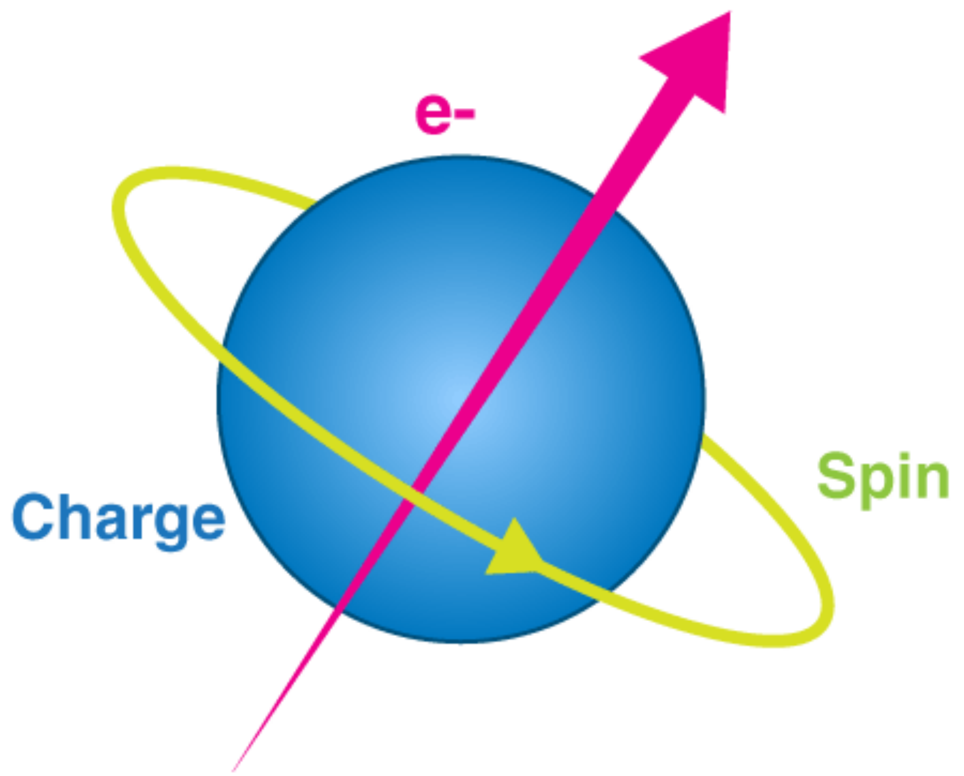

Spintronics

Based on
Ferromagnets

Slower dynamics (GHz)
Stray Fields

C. Chappert et al., Nature Mater ***6****, 813 (2007).*
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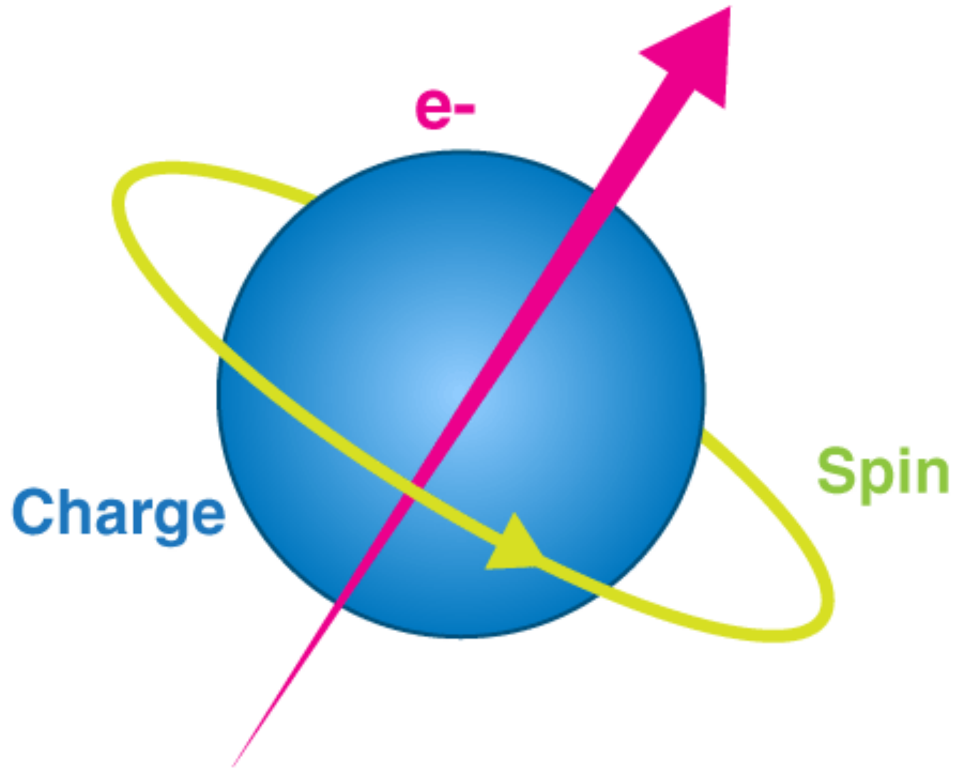

Spintronics

Based on
Ferromagnets

Slower dynamics (GHz)
Stray Fields

Antiferromagnets

*C. Chappert et al., Nature Mater **6**, 813 (2007).*
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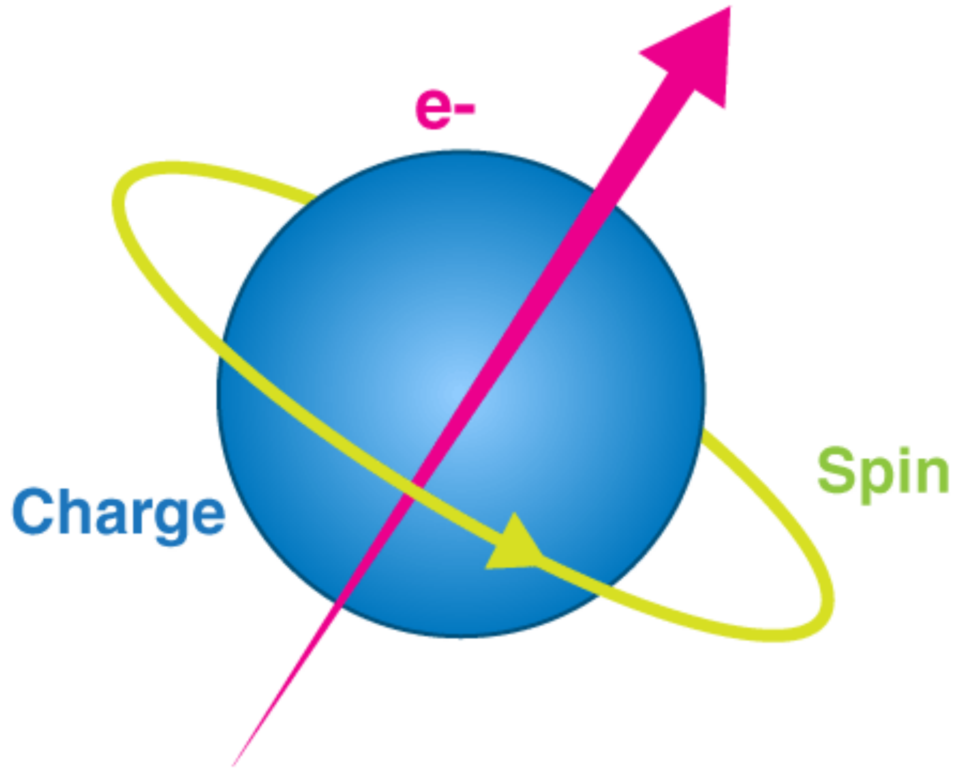

Spintronics

Based on Ferromagnets

Slower dynamics (GHz)
Stray Fields

Antiferromagnets

Faster dynamics (THz)
No Stray Fields

C. Chappert et al., Nature Mater ***6****, 813 (2007).*
A. D. Kent et al., Nature Nanotech ***10****, 187 (2015).*
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Charge

S

Forbes

INNOVATION > CONSUMER TECH

AI's Hidden Cost: The Global Memory Shortage Threat To Affordable Tech

By Tim Bajarin, Contributor. ⓘ Tim Bajarin covers the tech industry's impact on PC and CE markets.

Published Jun 23, 2026, 10:00am EDT

Summary

Computer memory (DRAM) is becoming a critical bottleneck, poised to reshape consumer technology. Despite exponential processor advancements, memory speeds have lagged, creating a "memory wall." The DRAM industry, consolidated to just three major players, deliberately keeps supply tight to maintain prices. This issue is now exacerbated by AI's voracious demand for memory, diverting supply from consumer electronics due to higher profitability. Consequently, global smartphone shipments are projected to decline sharply, especially in developing regions, threatening digital inclusion. Even premium devices like iPhones face price increases. This structural shift represents a significant crisis, hitting the most vulnerable first and potentially changing who can afford to connect.

*C. Chappert et al., Nature Mater **6**, 813 (2007).*
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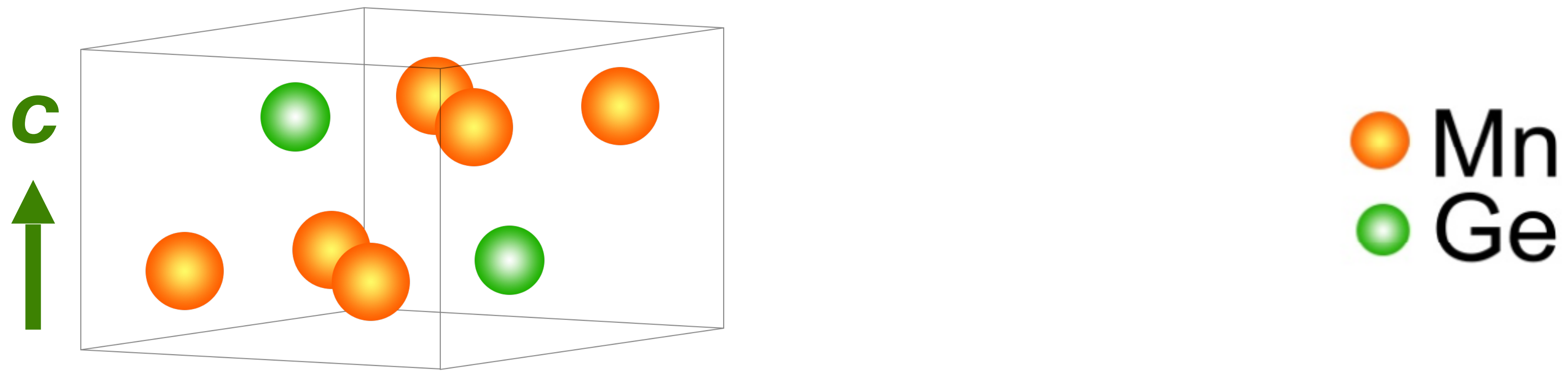
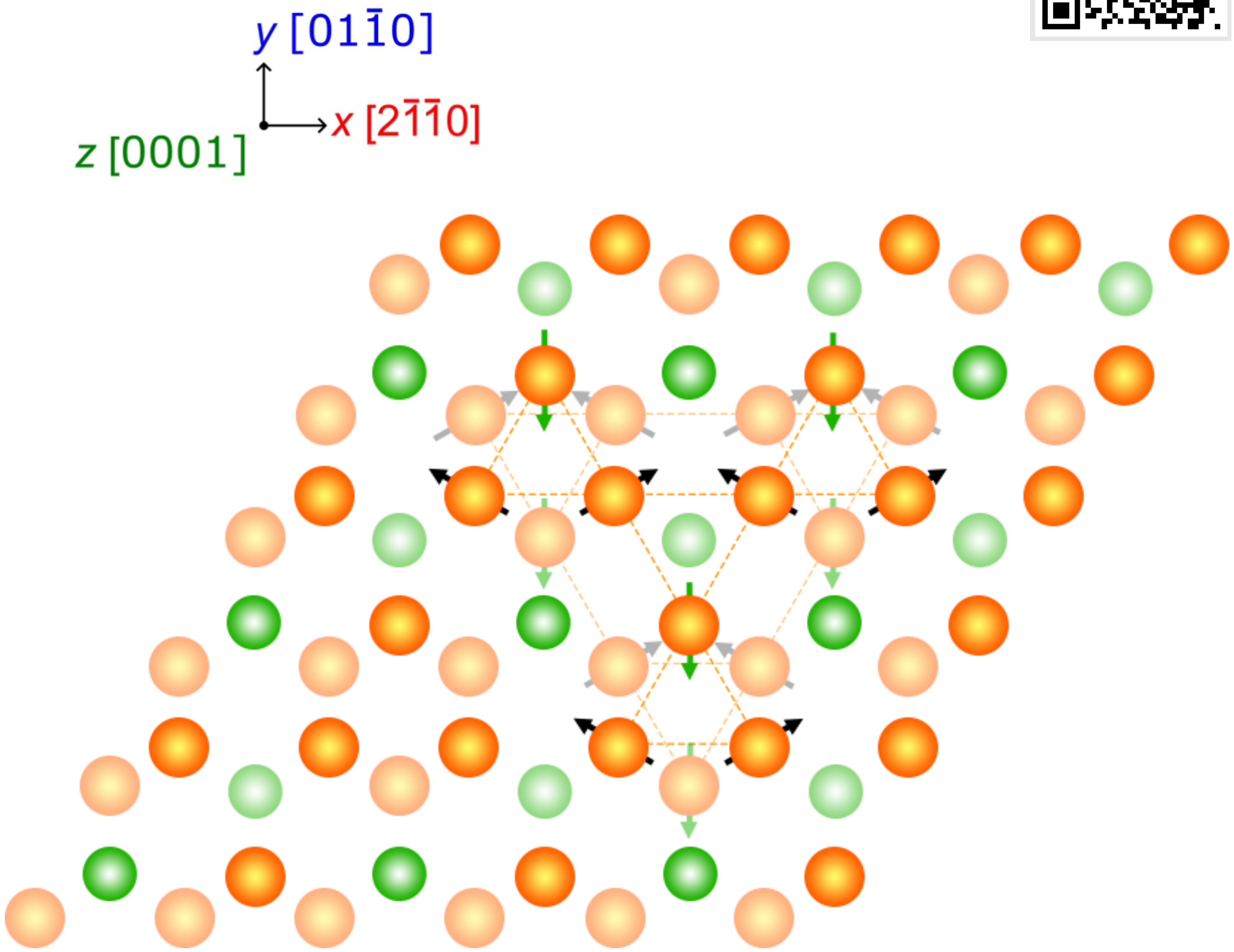
Promising candidate material





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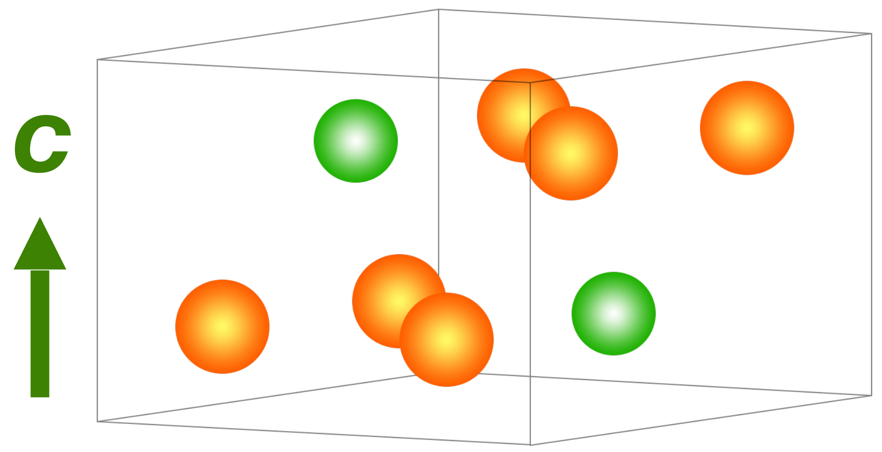

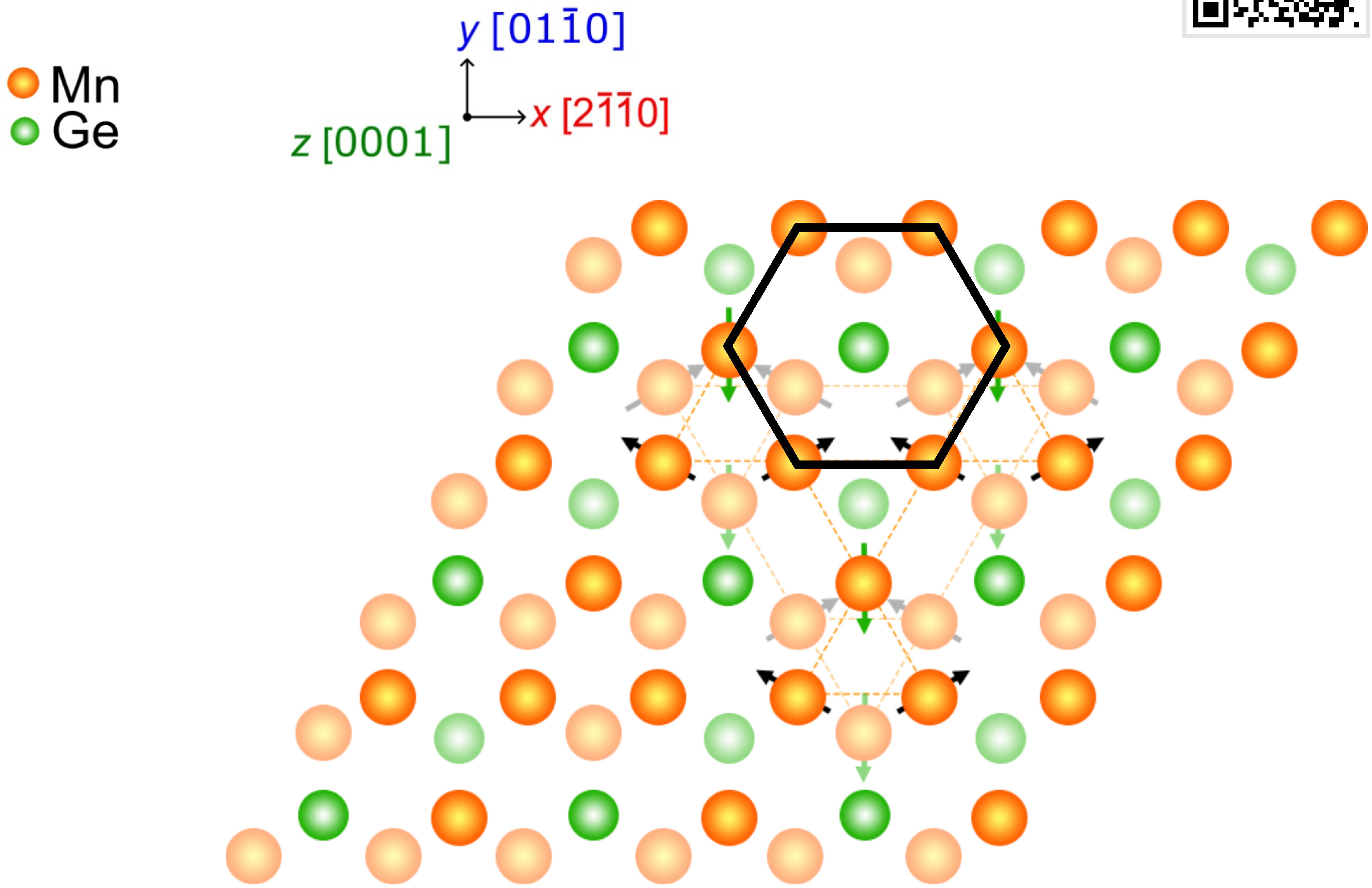

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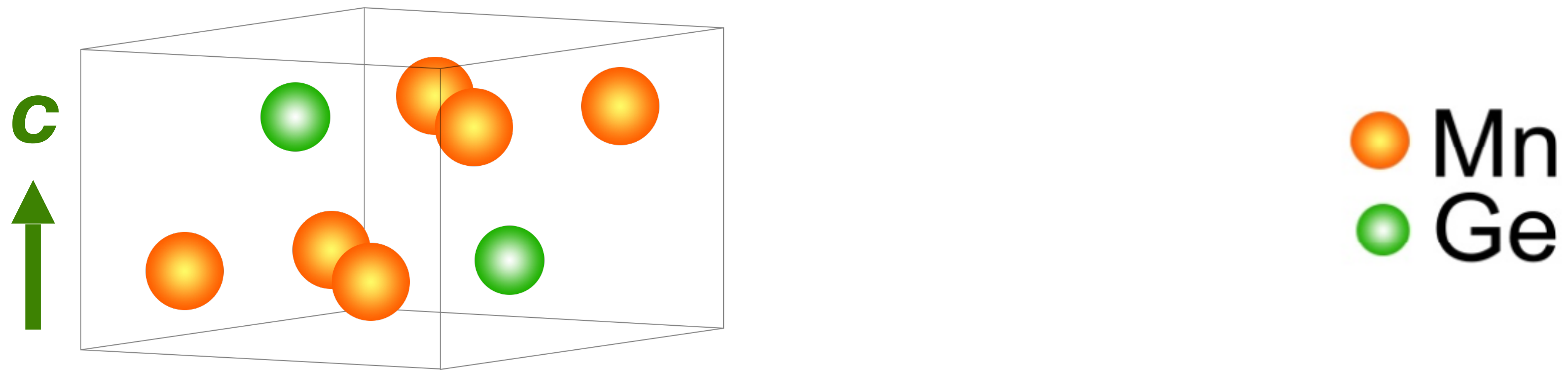

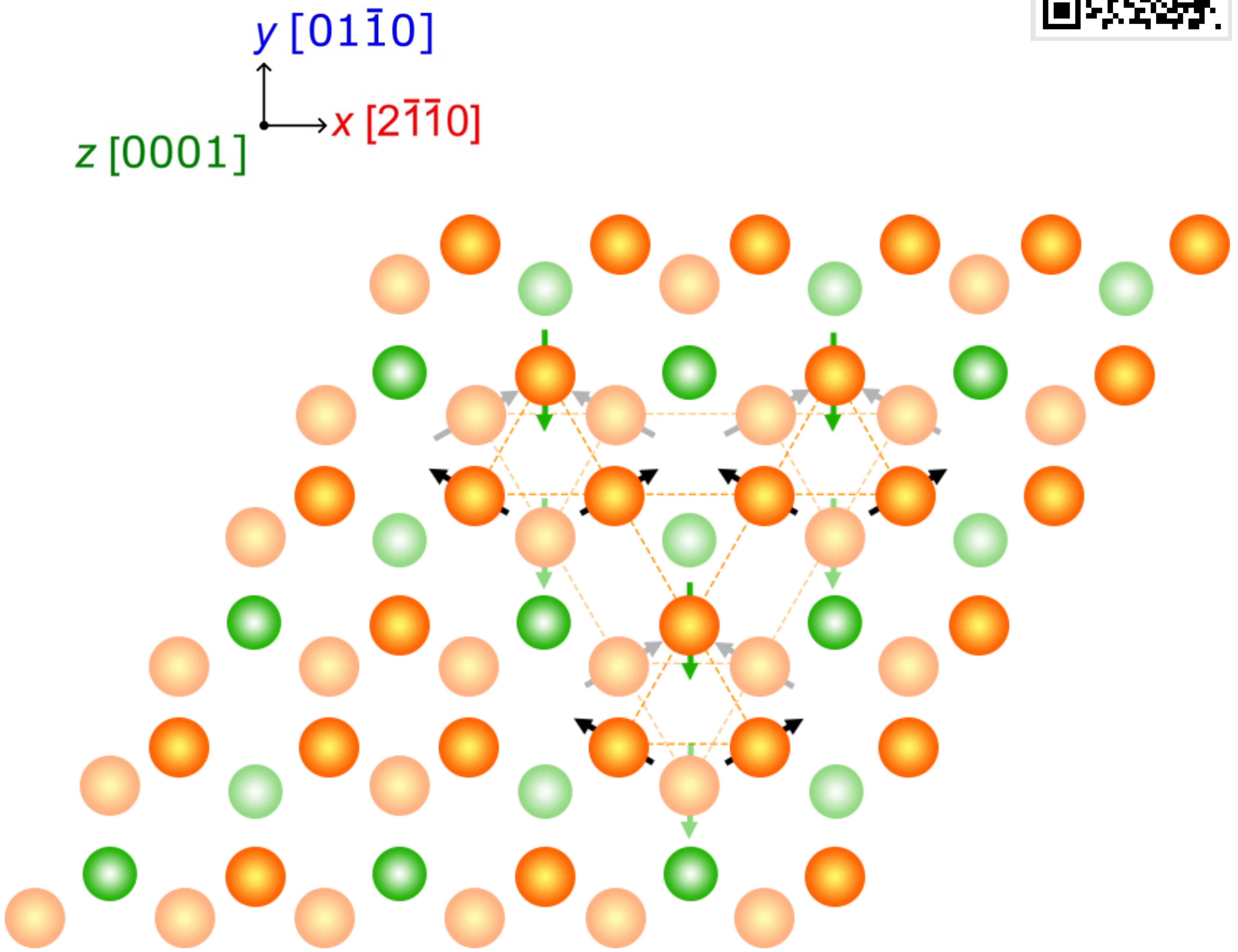

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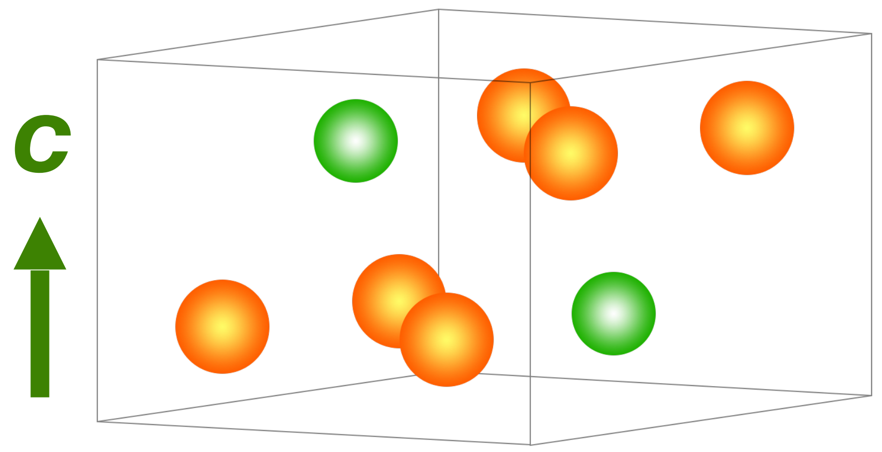
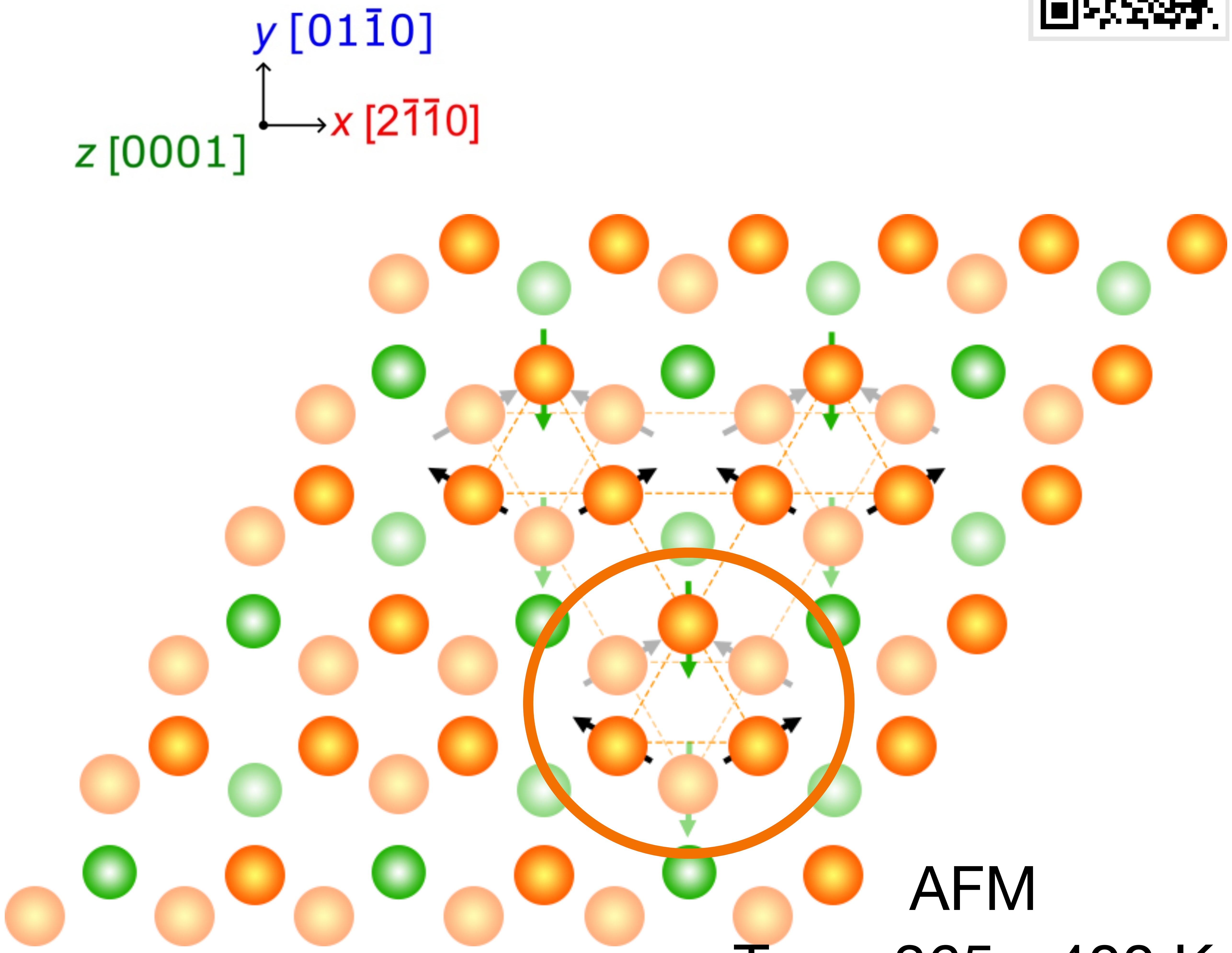


Mn
Ge



AFM

T_N -> 365 - 400 K

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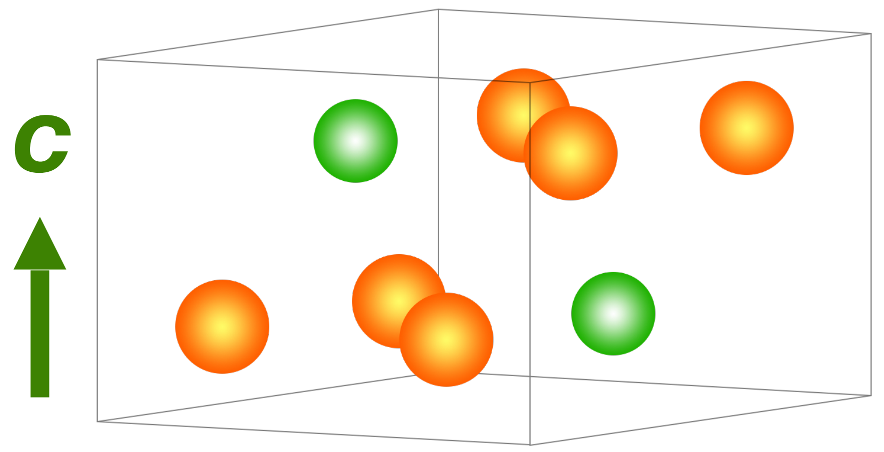
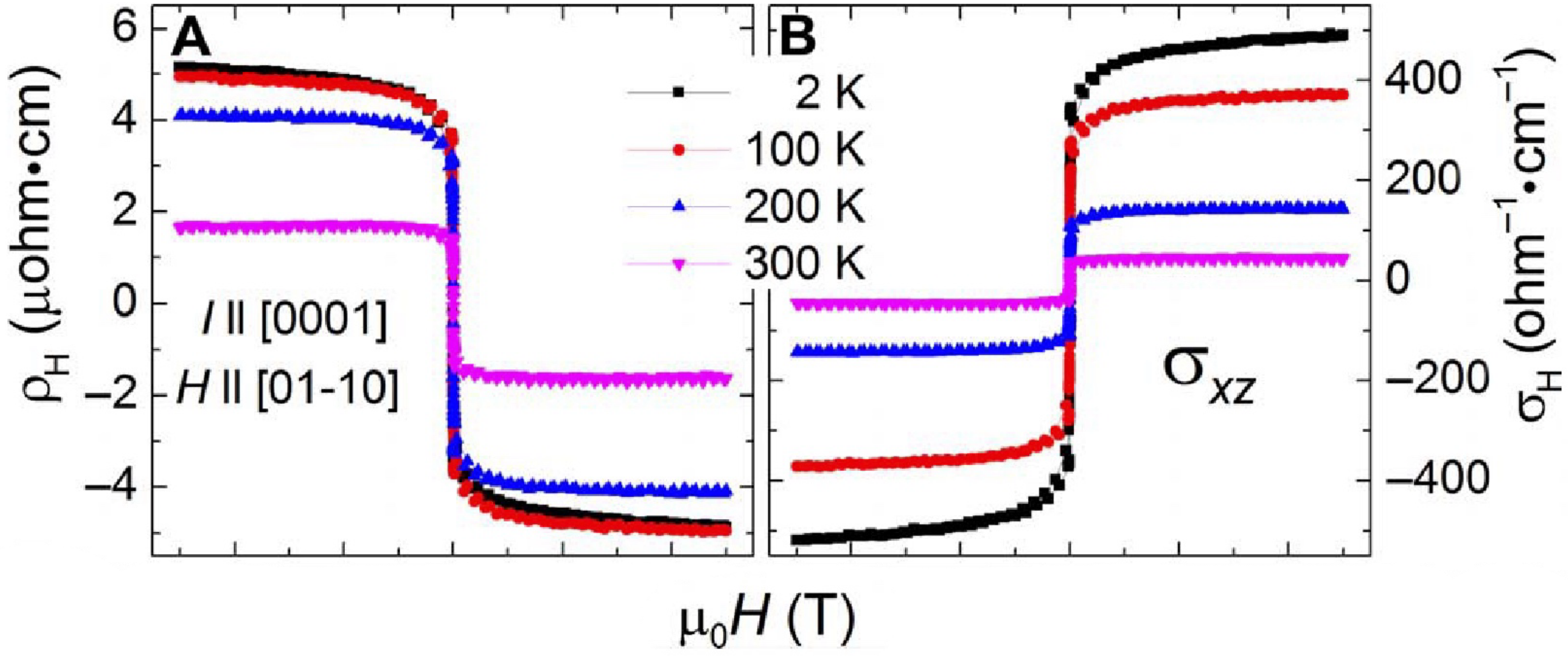
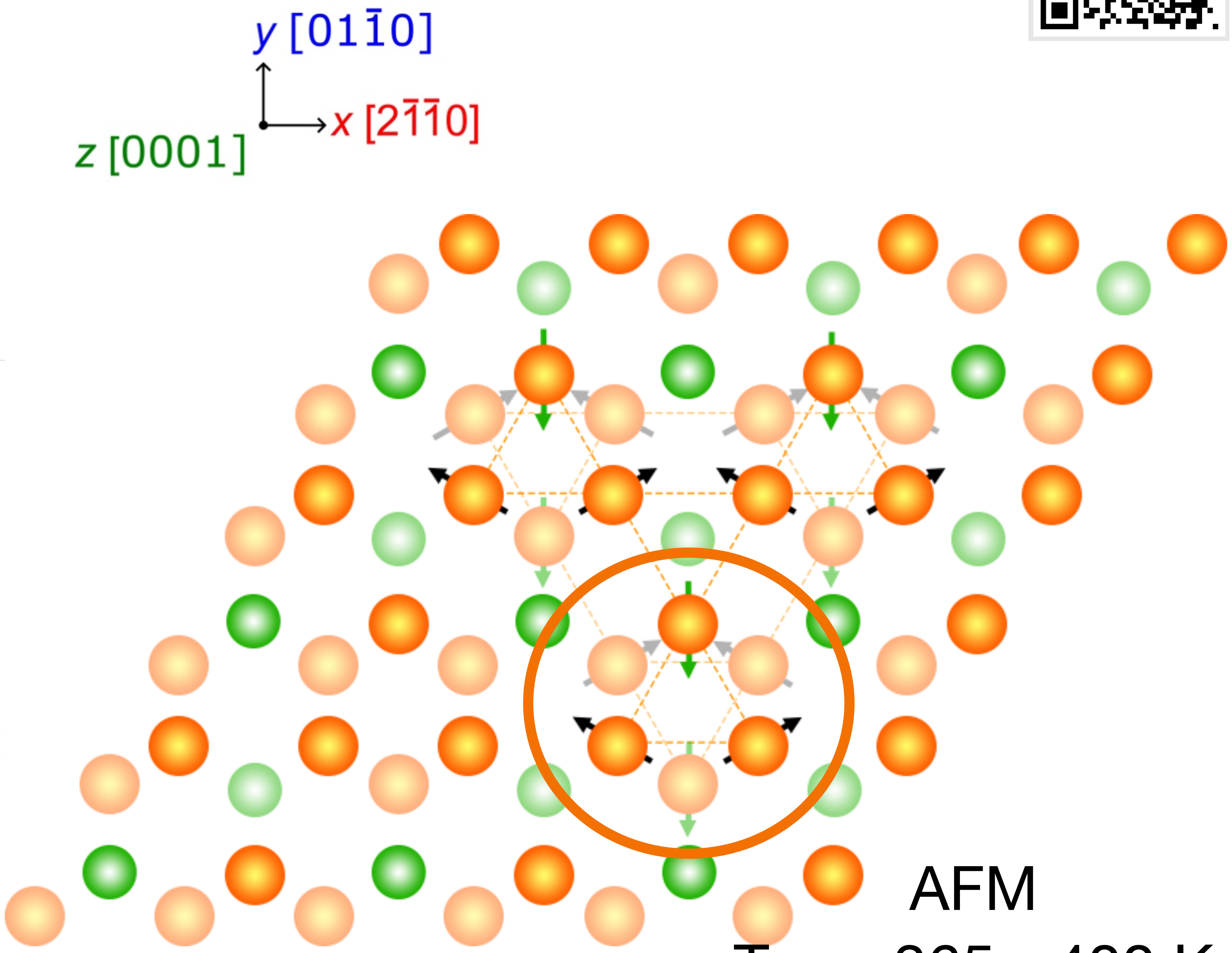


Non trivial electronic properties

A. K. Nayak et al., Science Advances 2, (2016).





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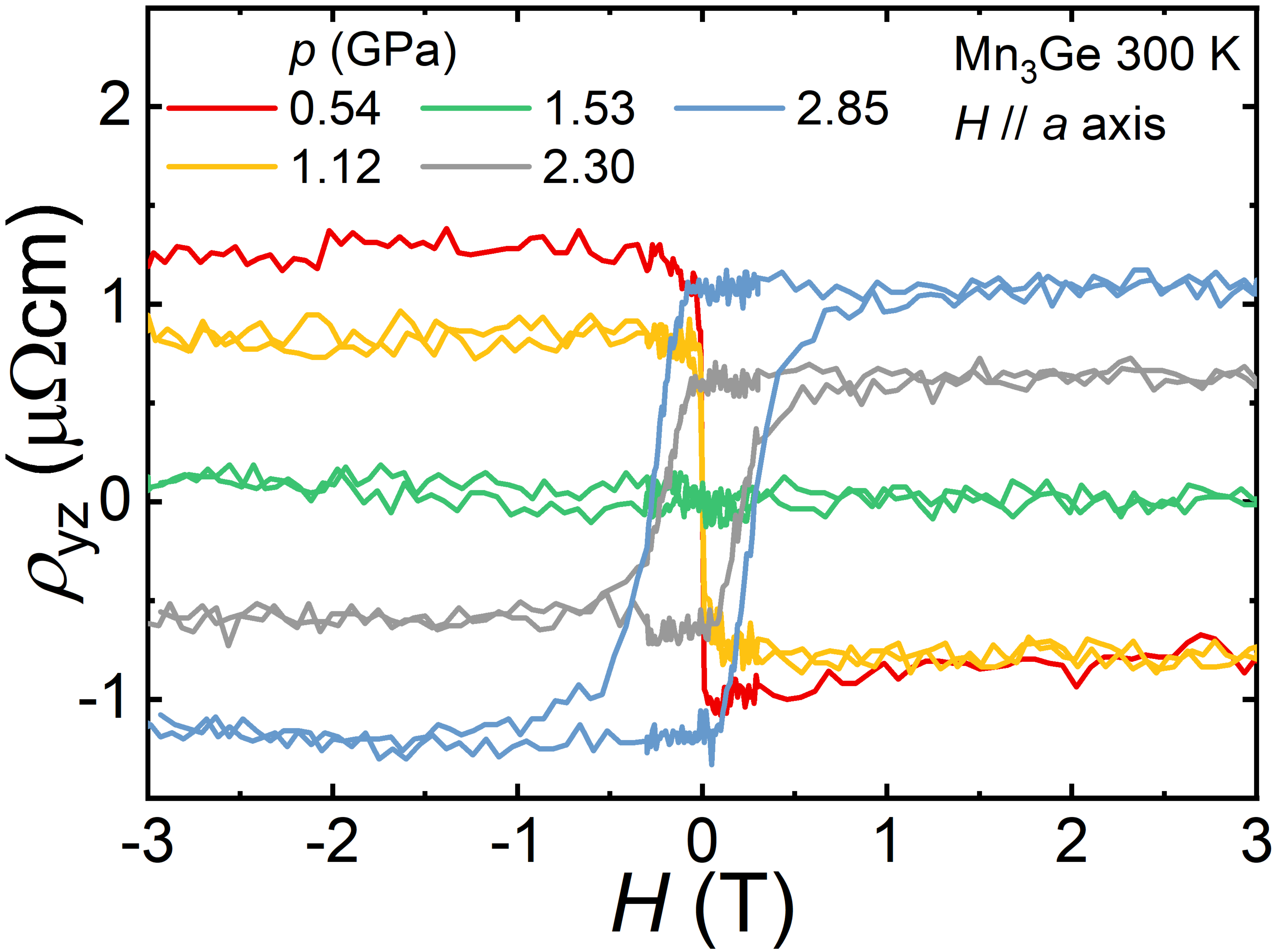
Continuous suppression of the AHE



R. D. Dos Reis et al., Physical Review Materials 4, 51401 (2020).

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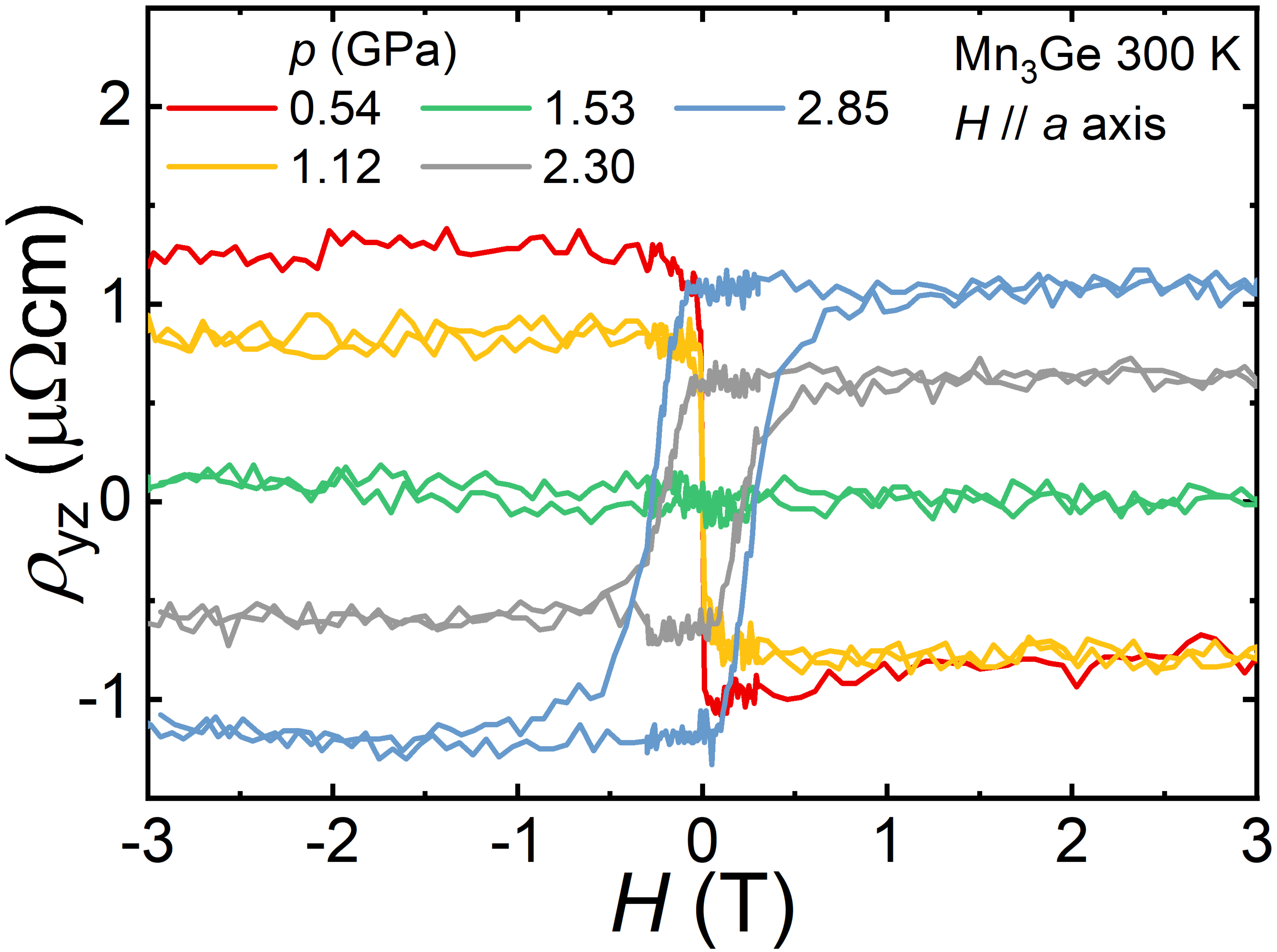
Hydrostatic Pressure

Continuous suppression of the AHE



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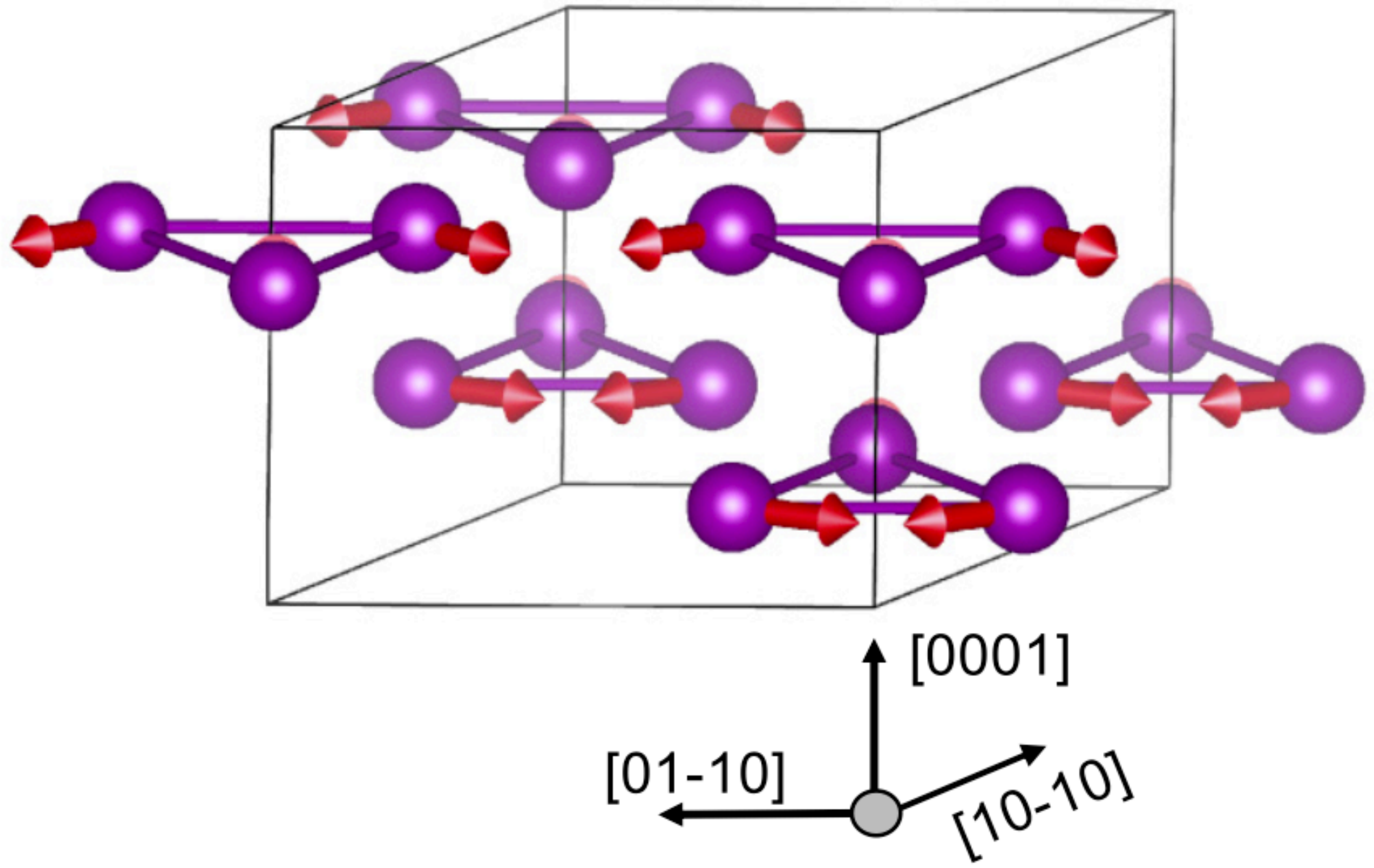

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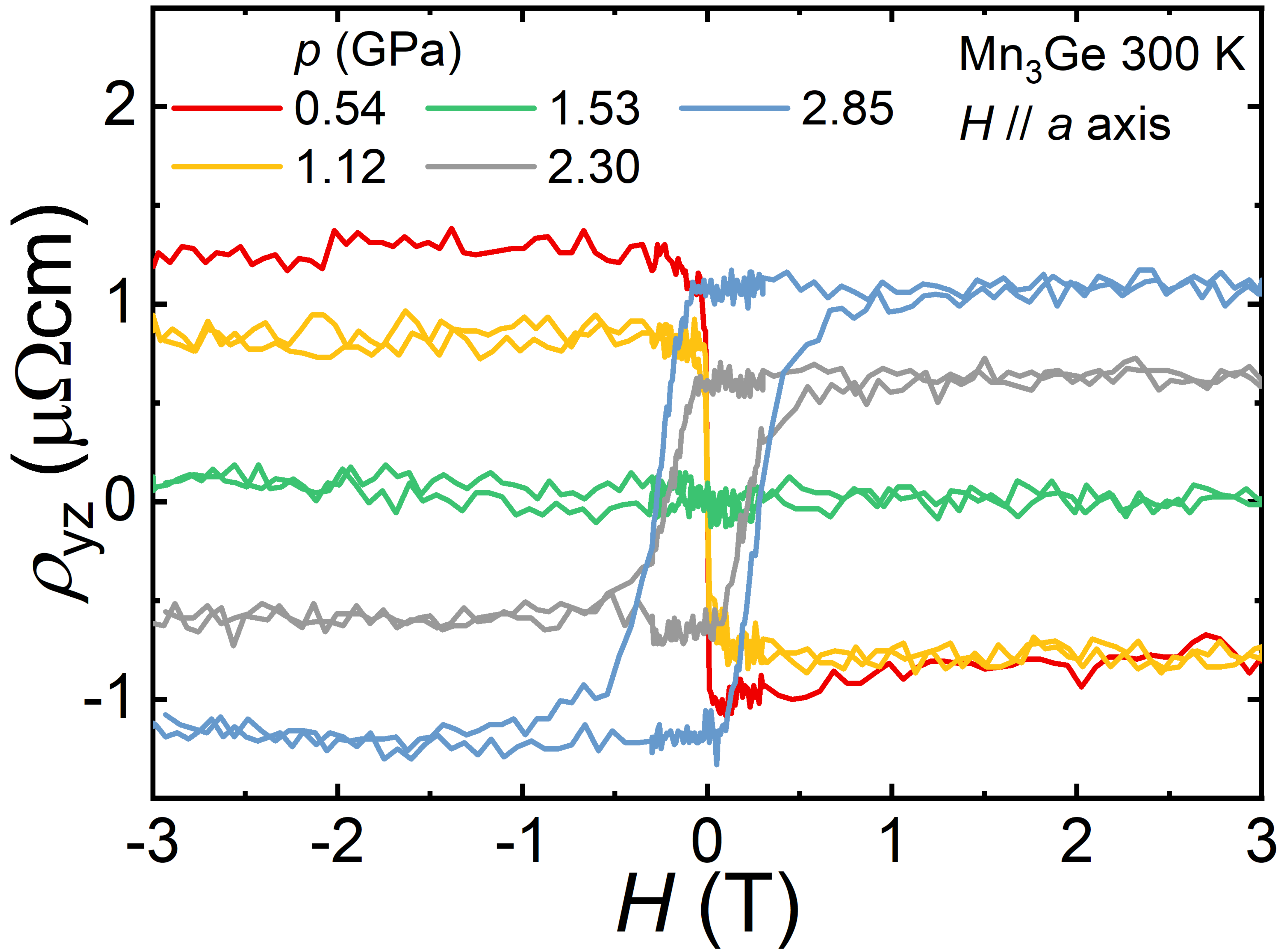

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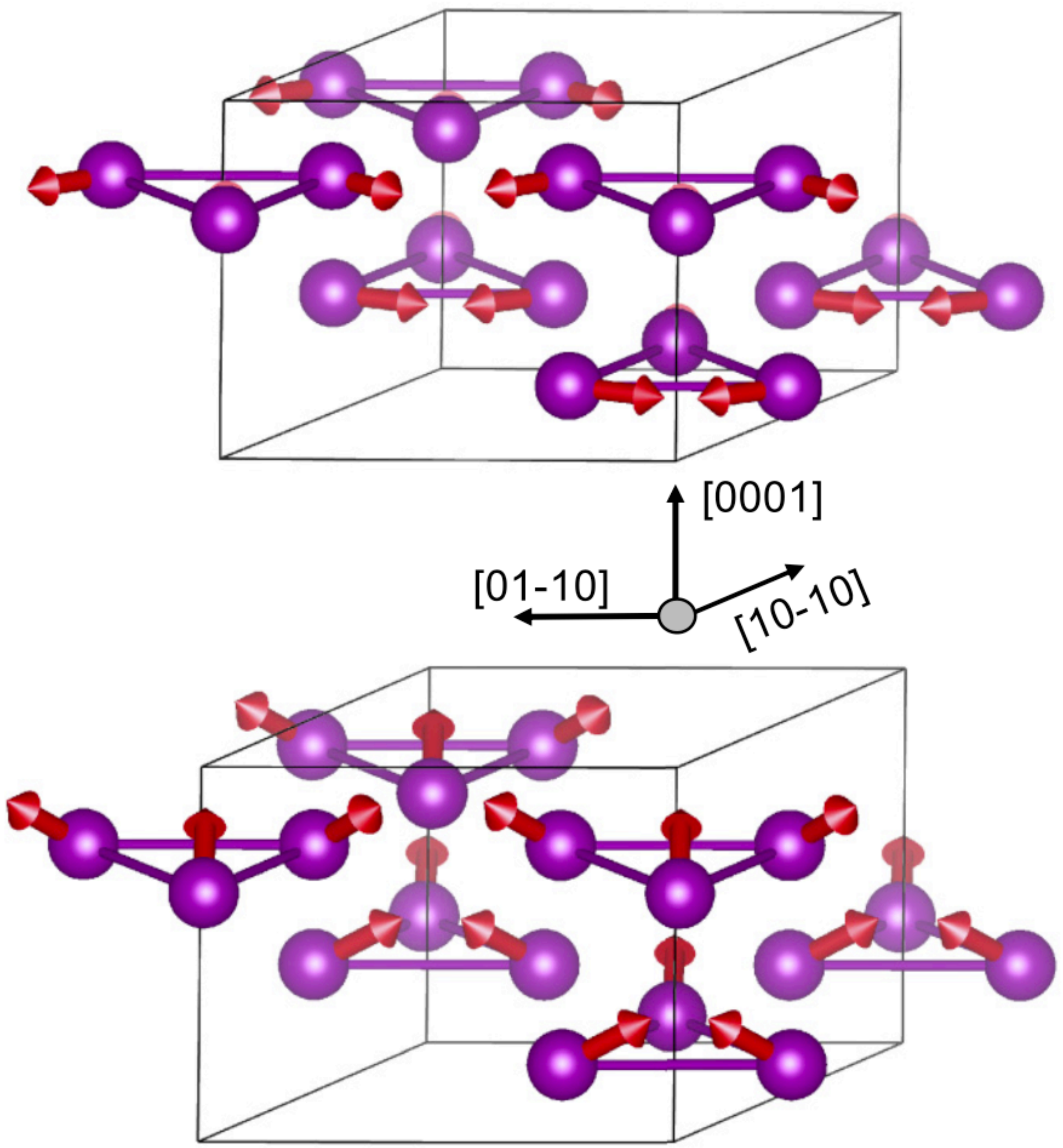

PHYSICAL REVIEW B **106**, 064431 (2022)

Tuning the transport properties of Mn_3Ge through the effect of strain on its magnetism

Sayak Dasgupta
Department of Physics and Astronomy & Stewart Blusson Quantum Matter Institute, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z1
and Institute for Solid State Physics, University of Tokyo, Kashiwa 277-8581, Japan

(Received 12 January 2022; revised 14 March 2022; accepted 26 March 2022; published 25 August 2022)

Strain

- Potential of uniaxial stress
- In-plane
- Out-of-plane

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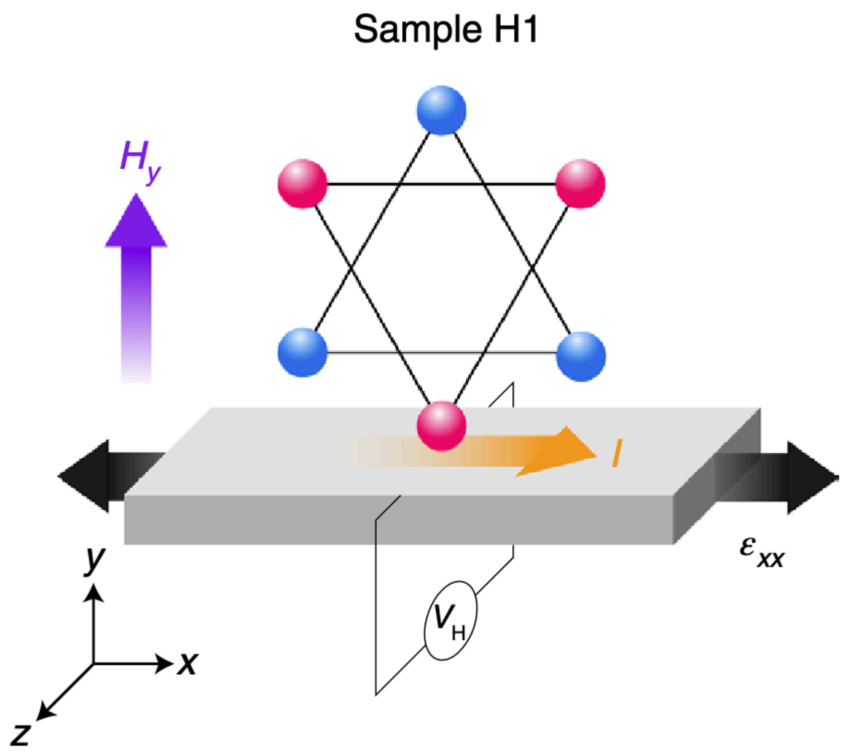

Experimental Evidence

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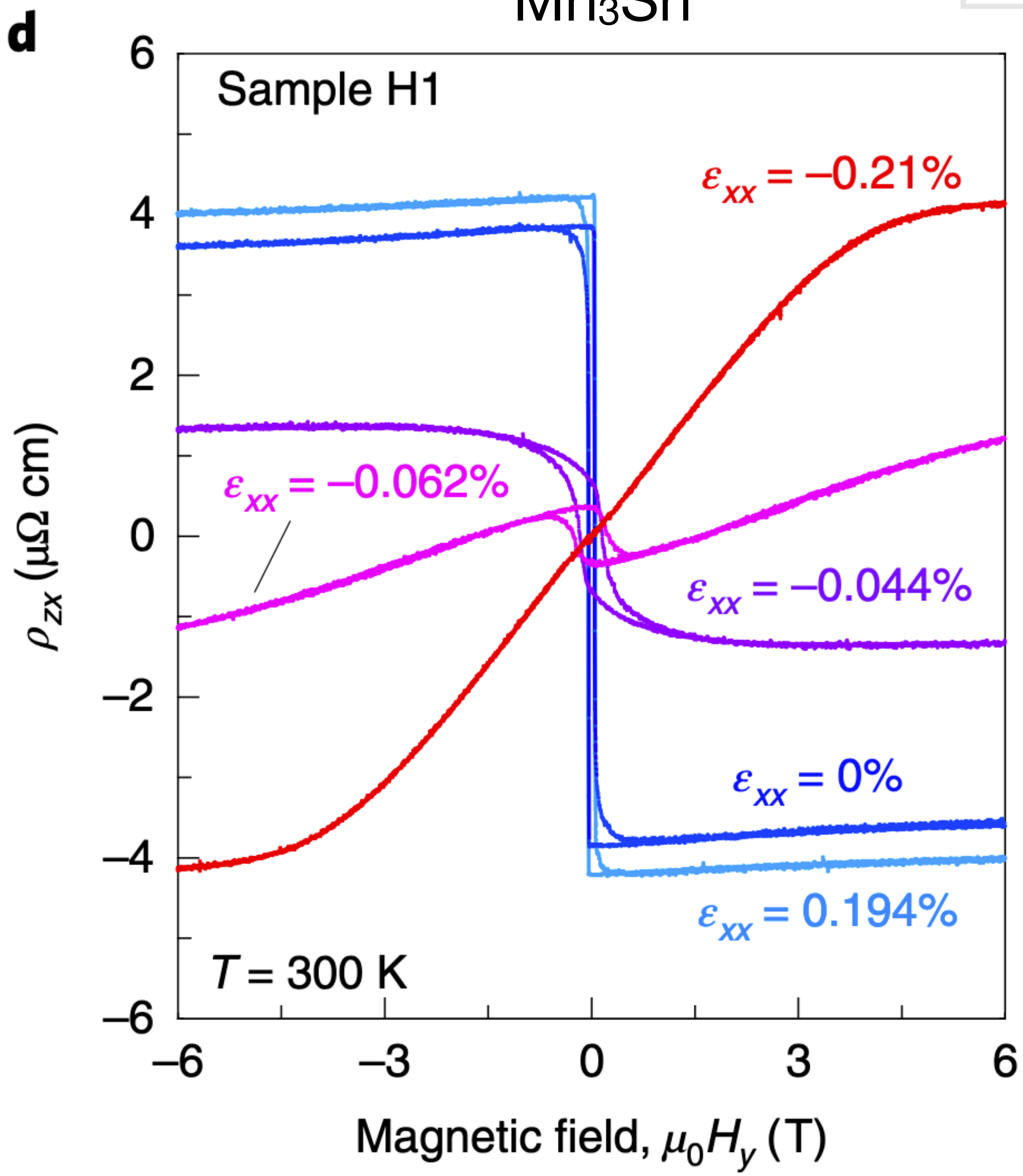
Mn_3Sn



M. Ikhlas et al., Nat. Phys. 18, 1086 (2022).

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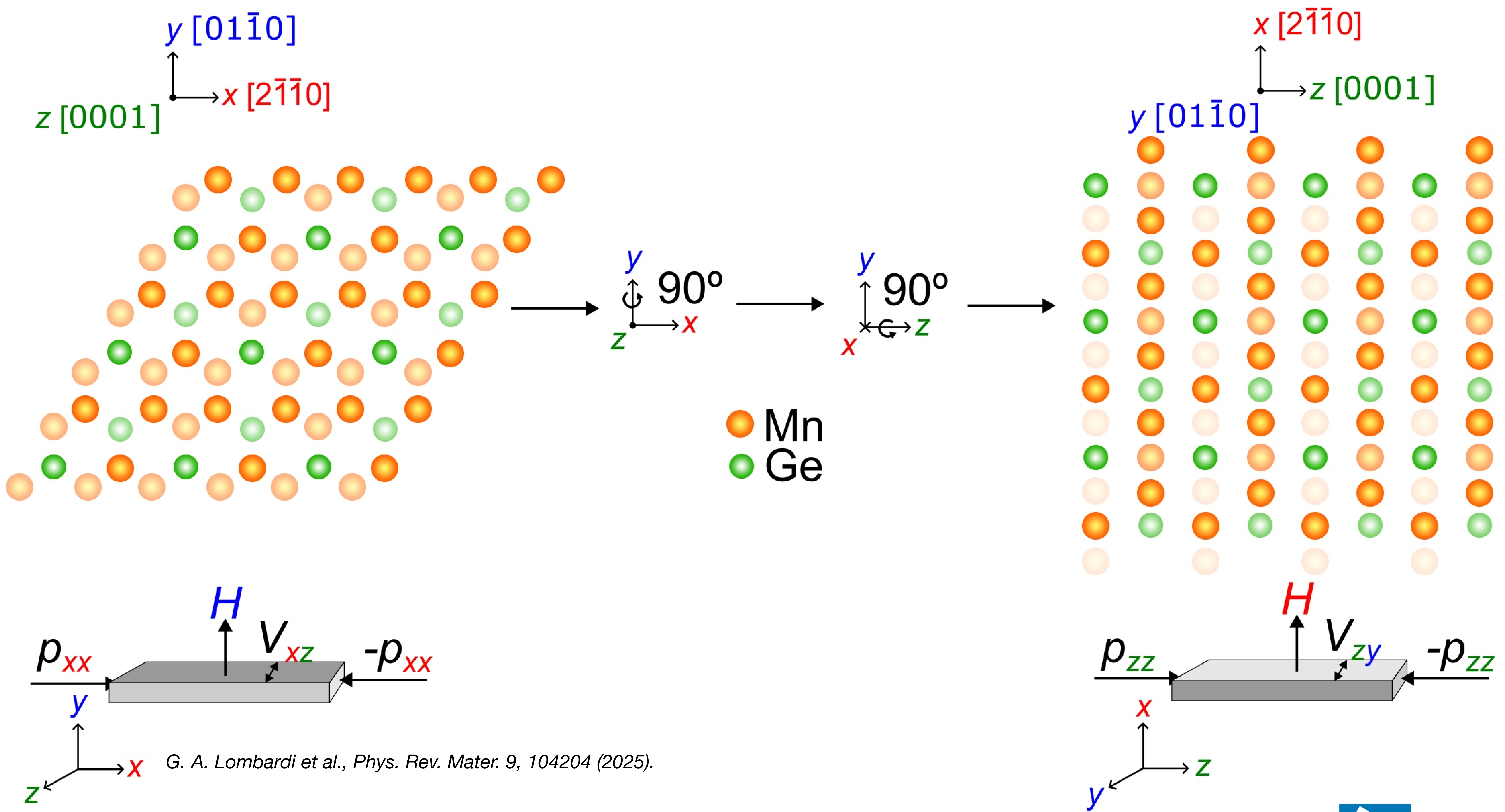
XRD and Electrical Transport



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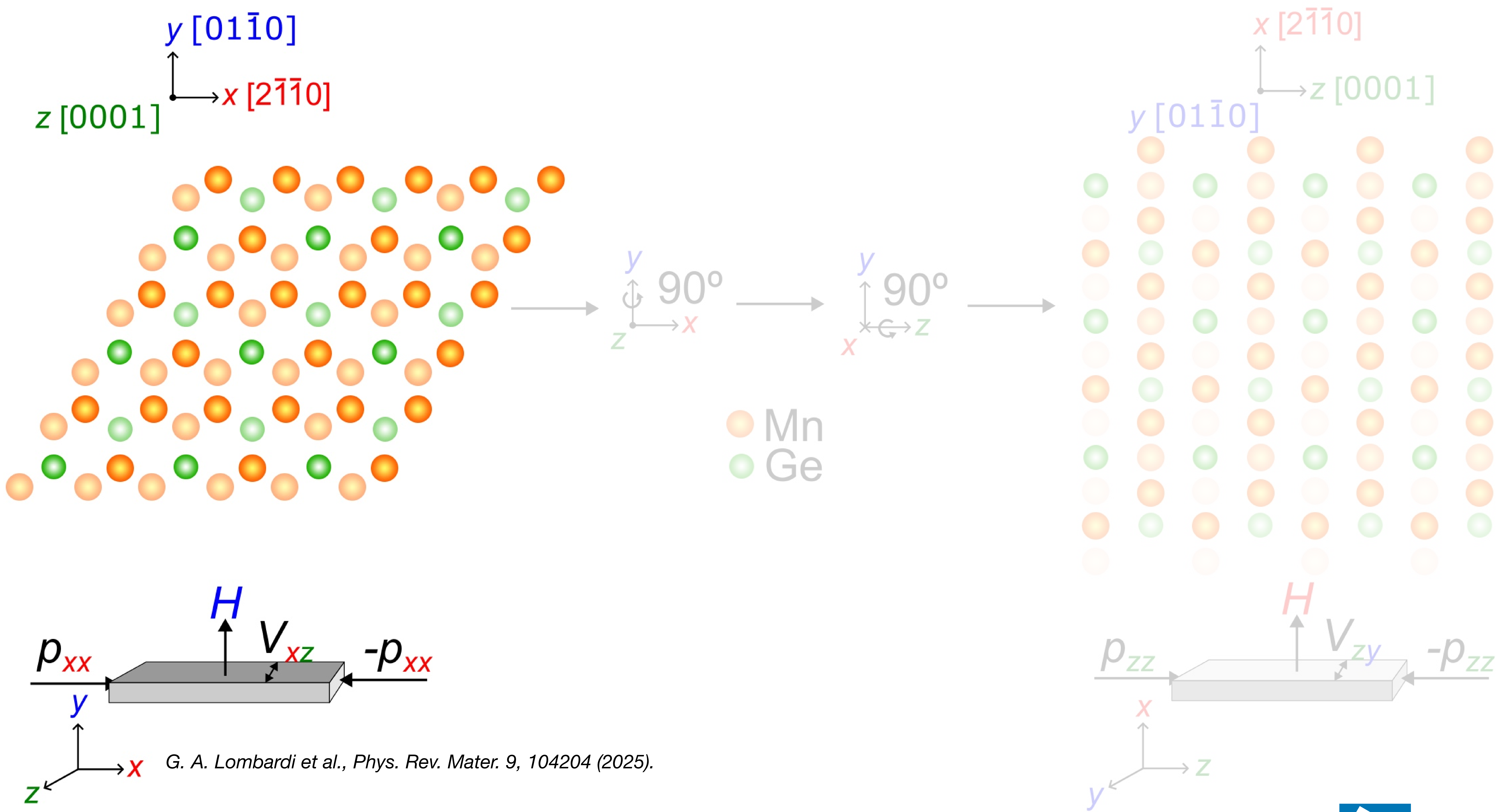

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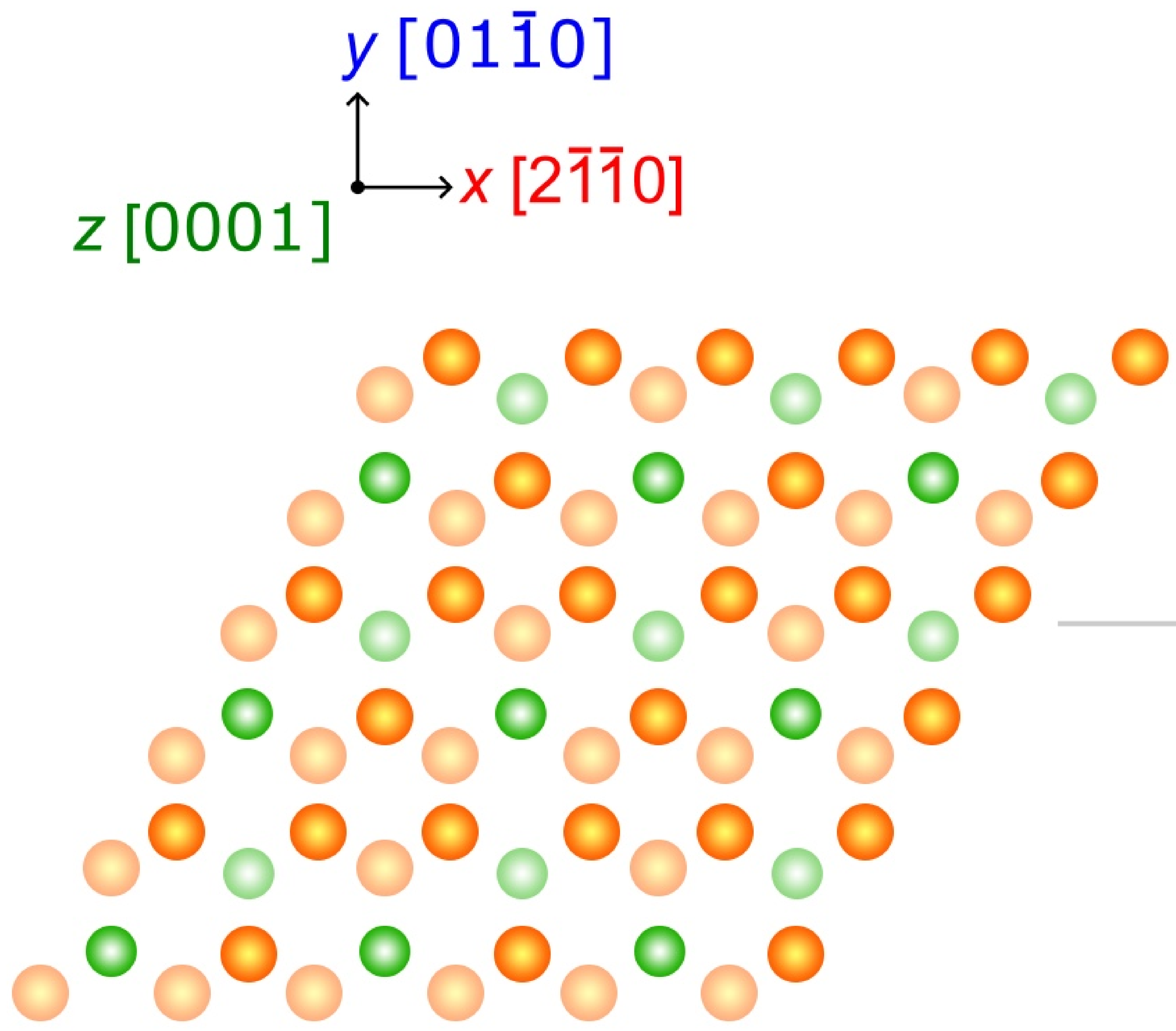

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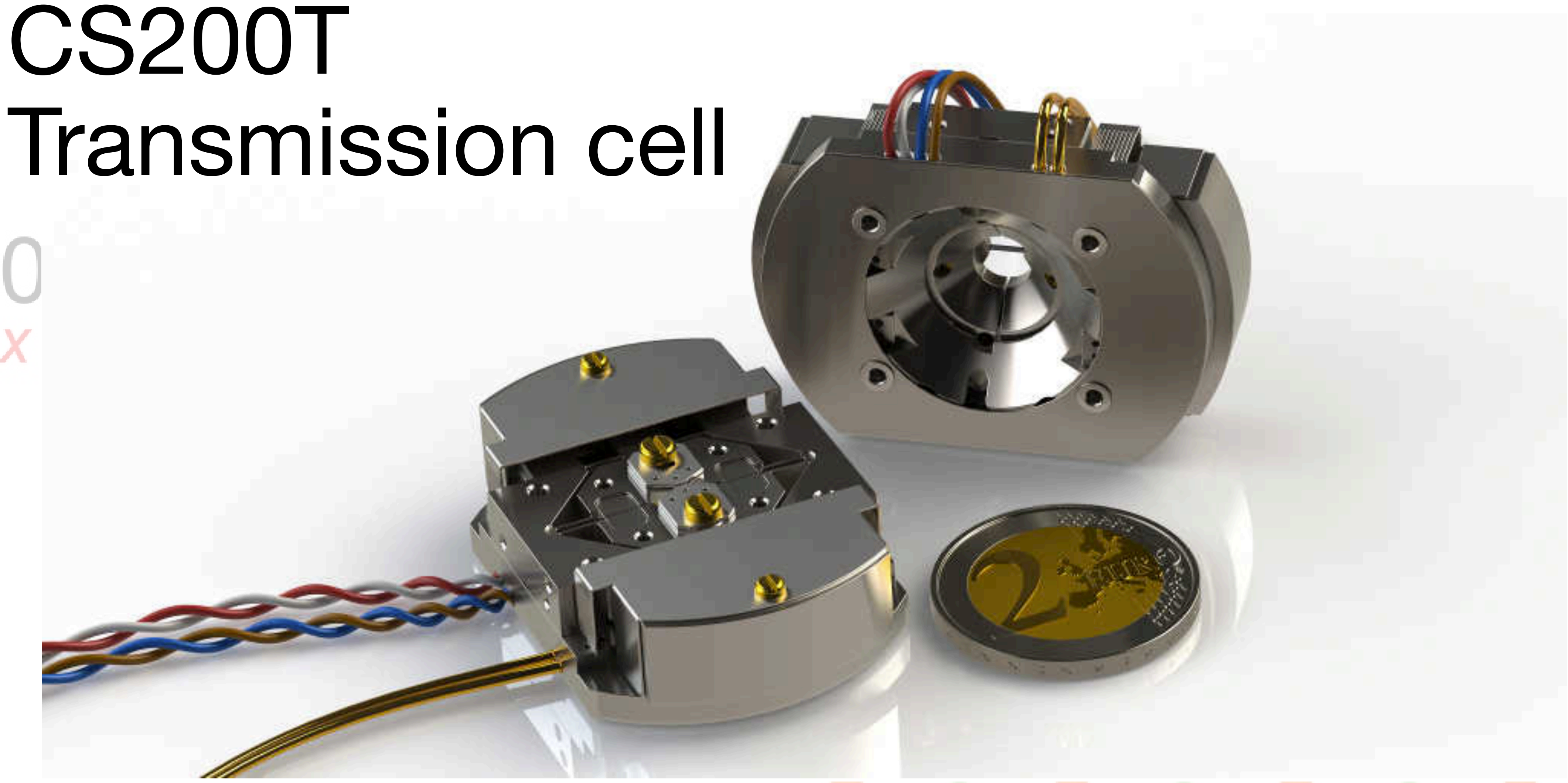

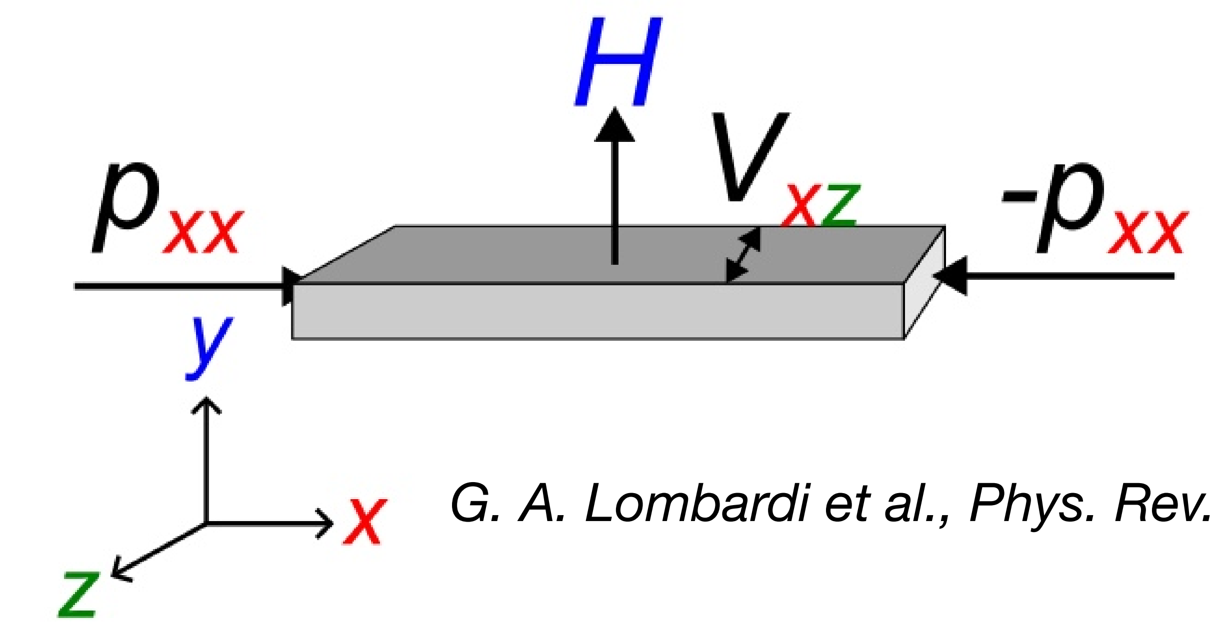

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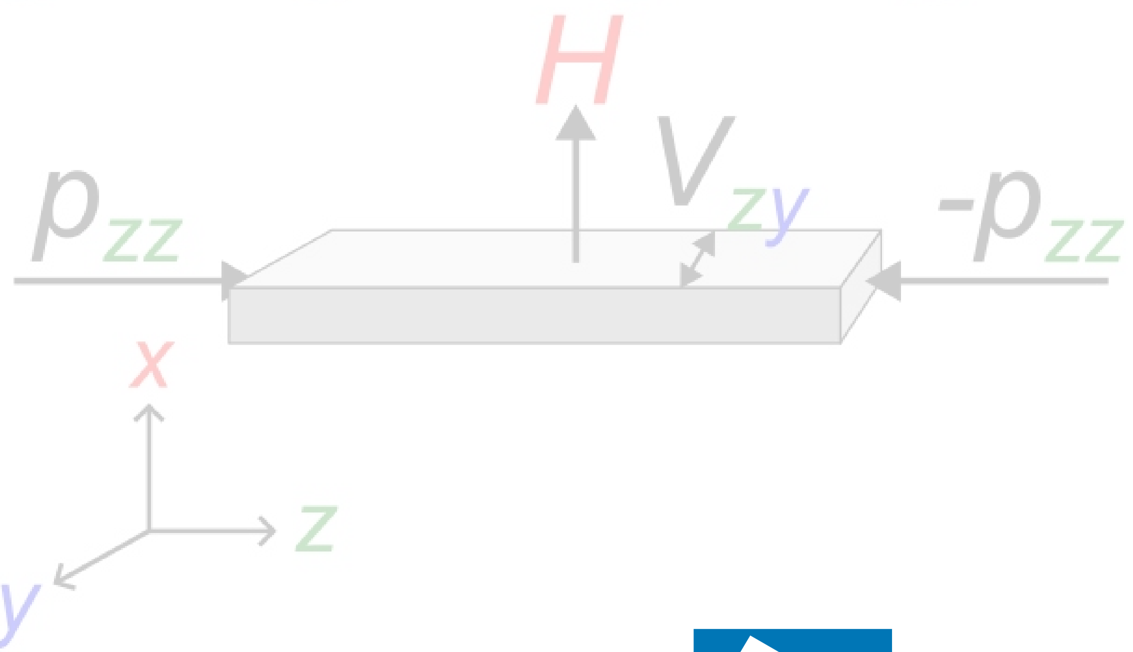

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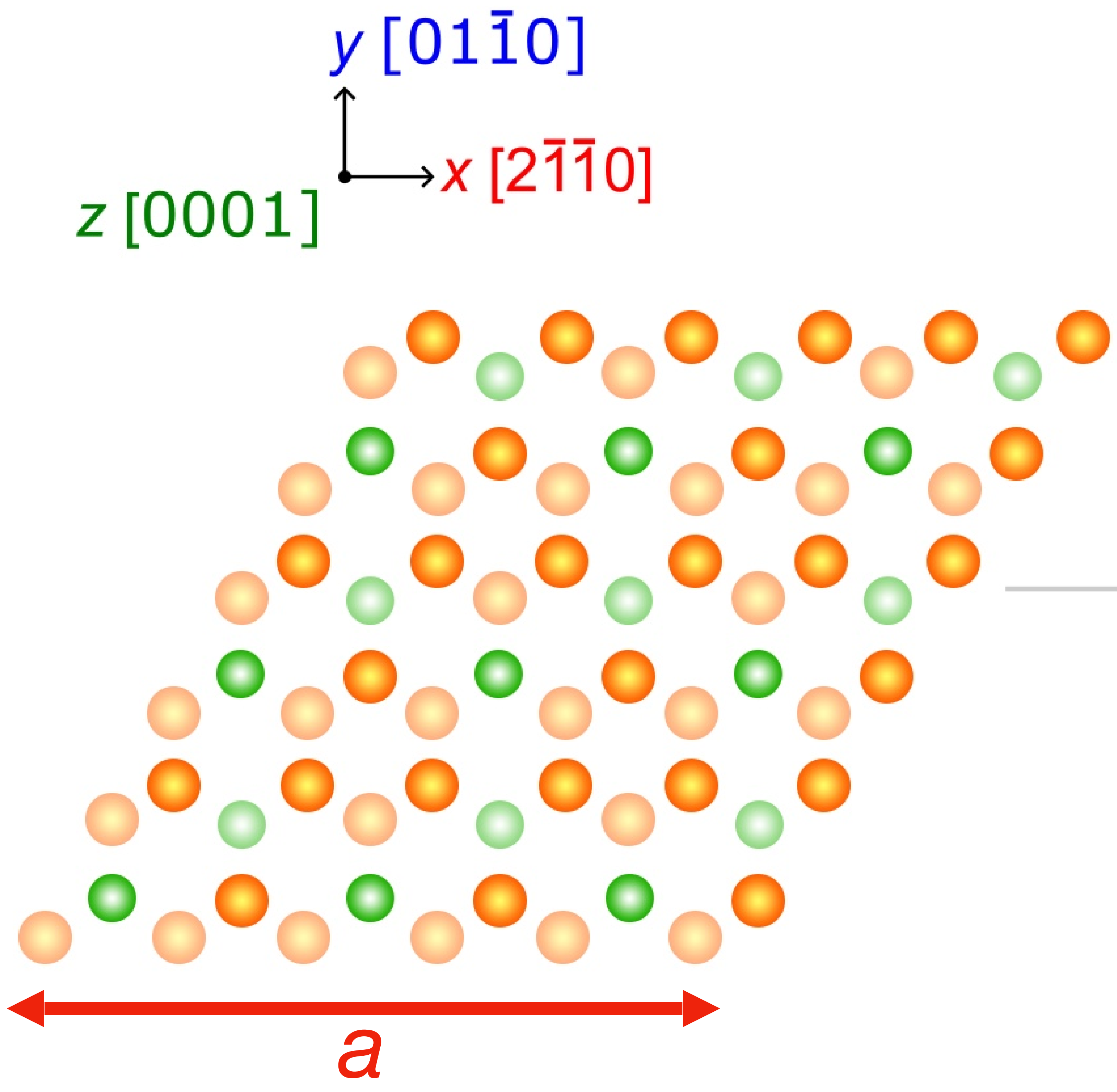

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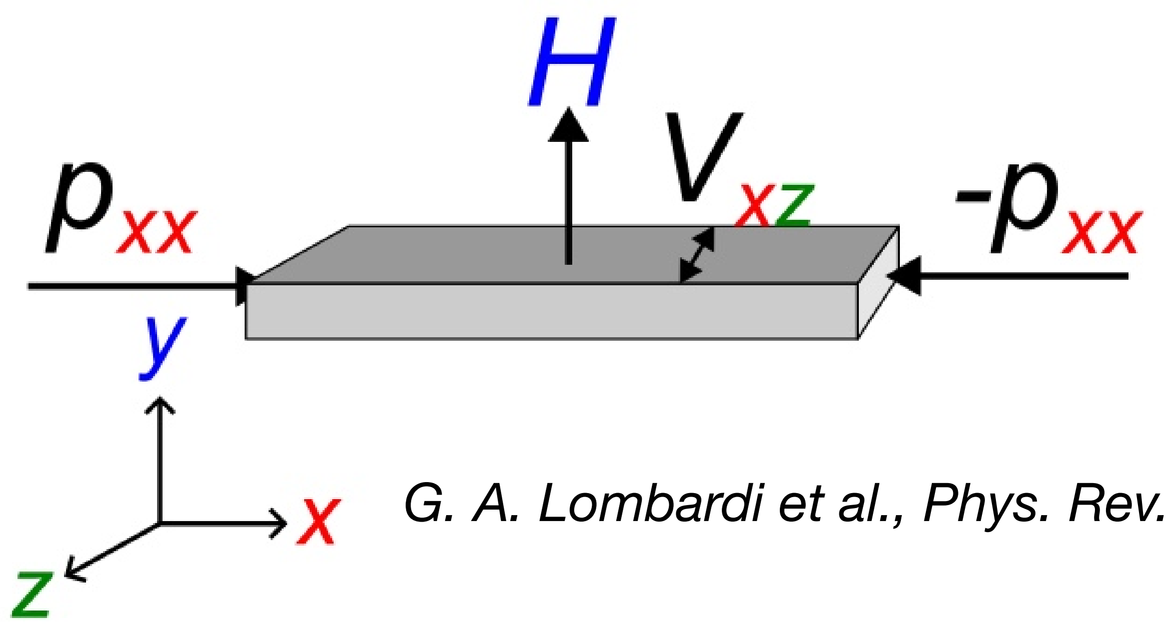

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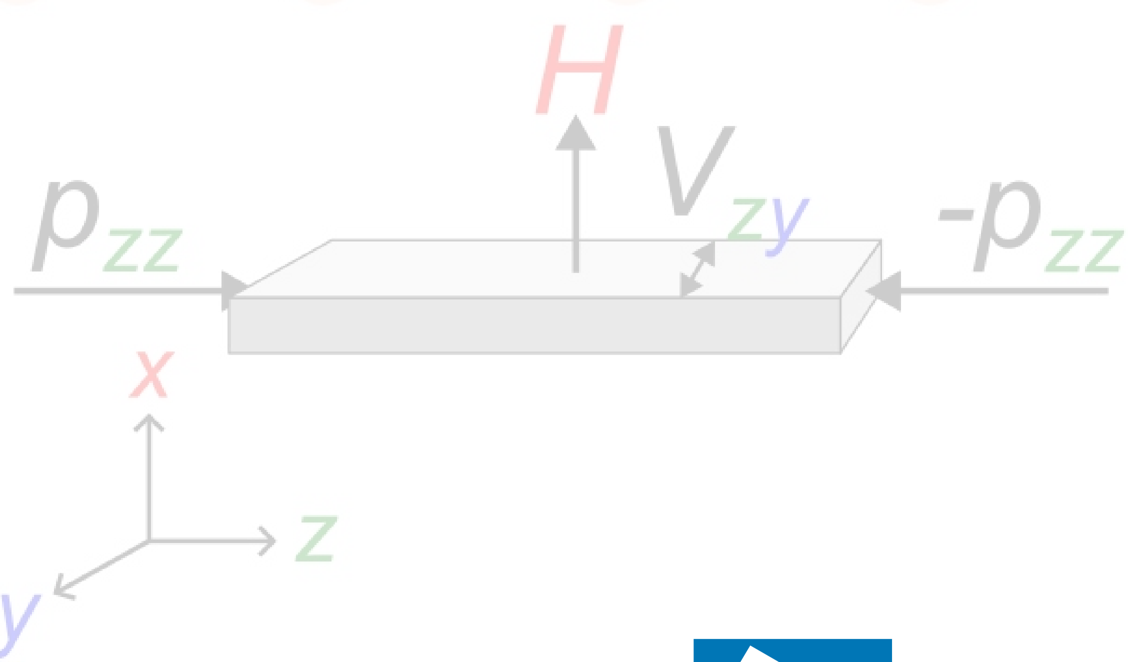

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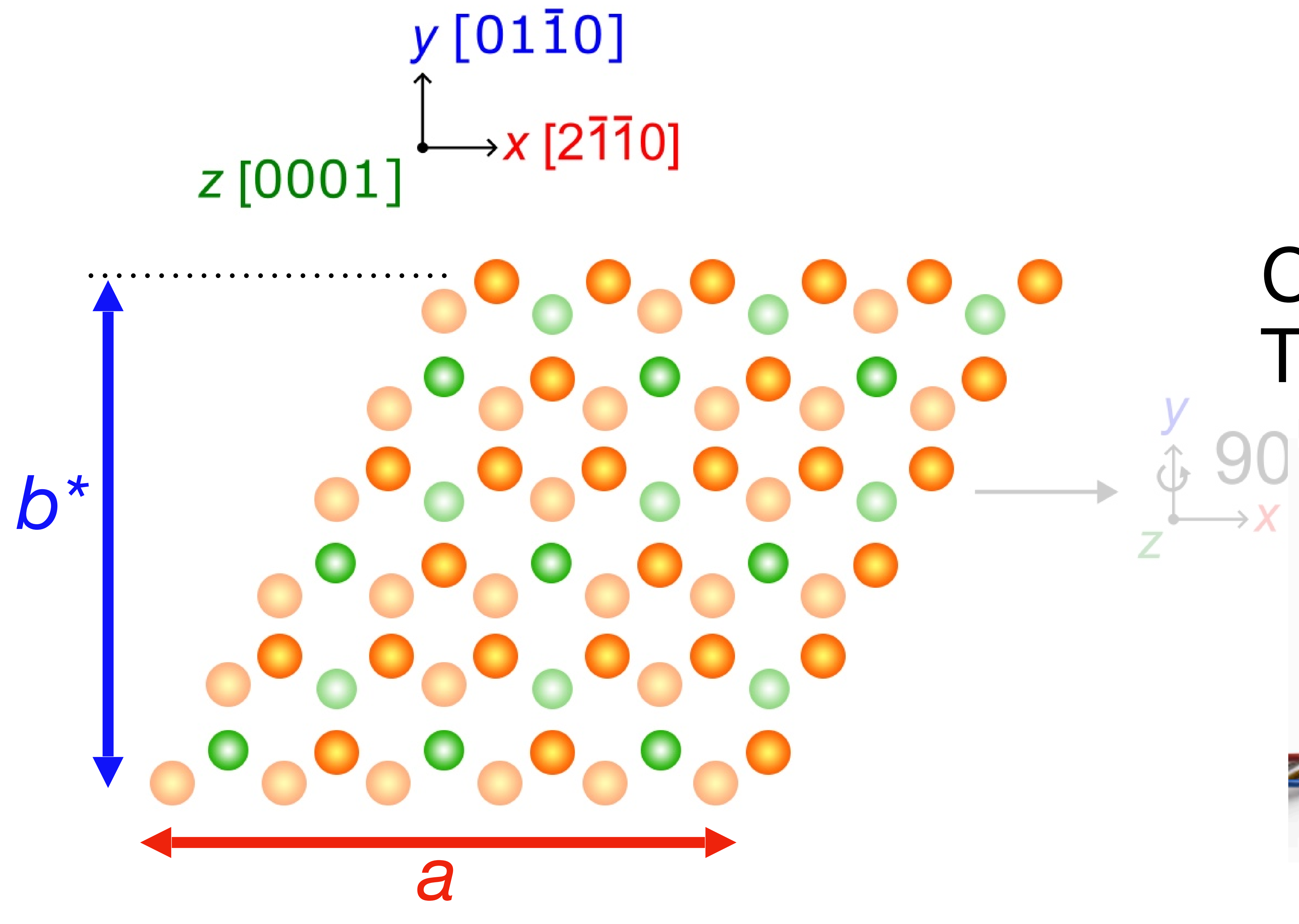

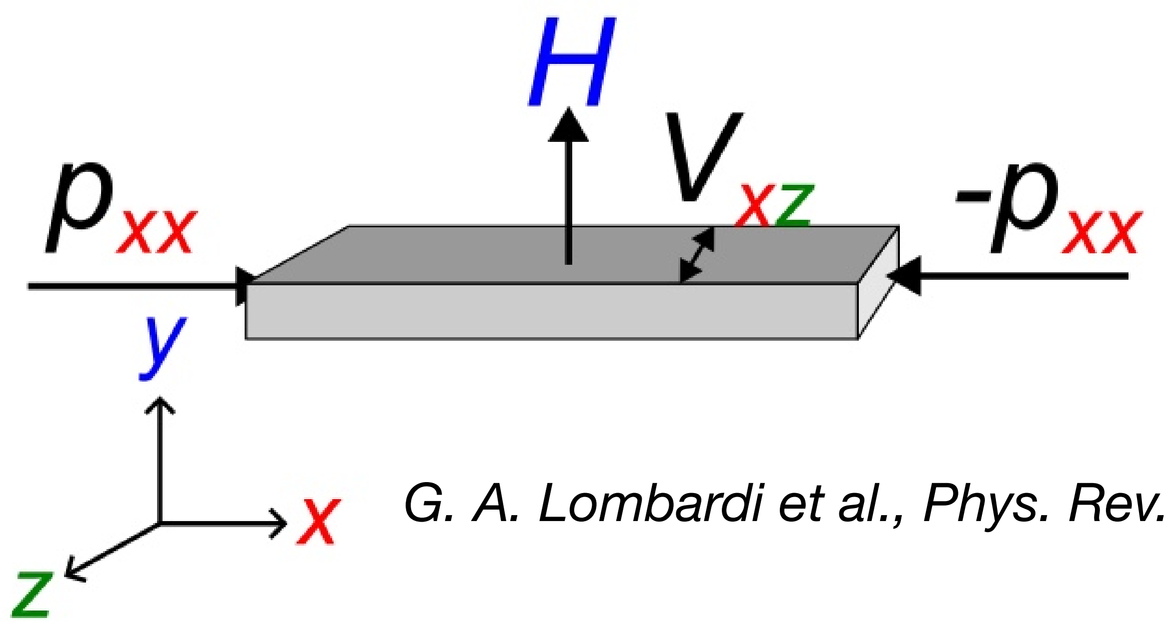

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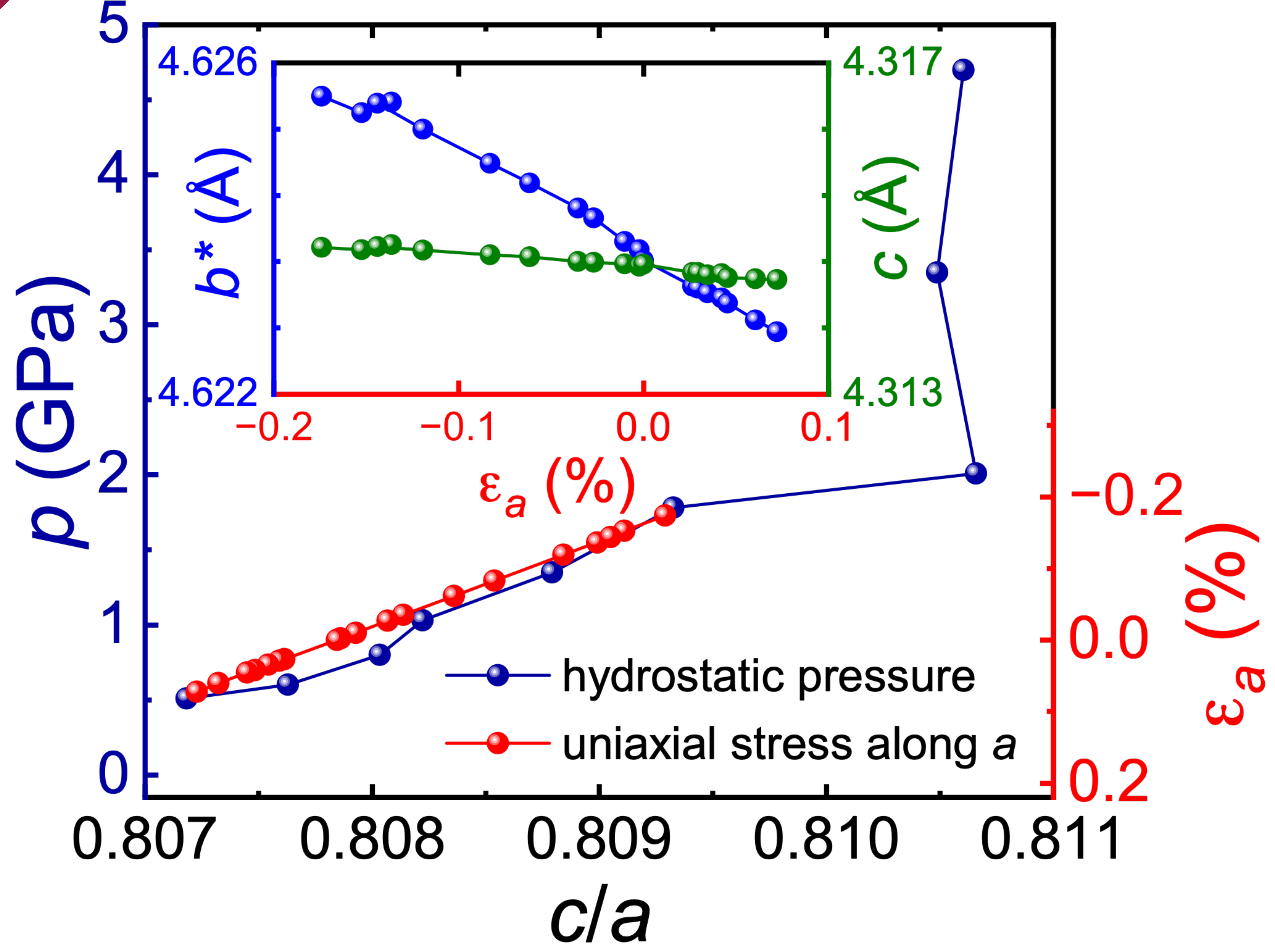

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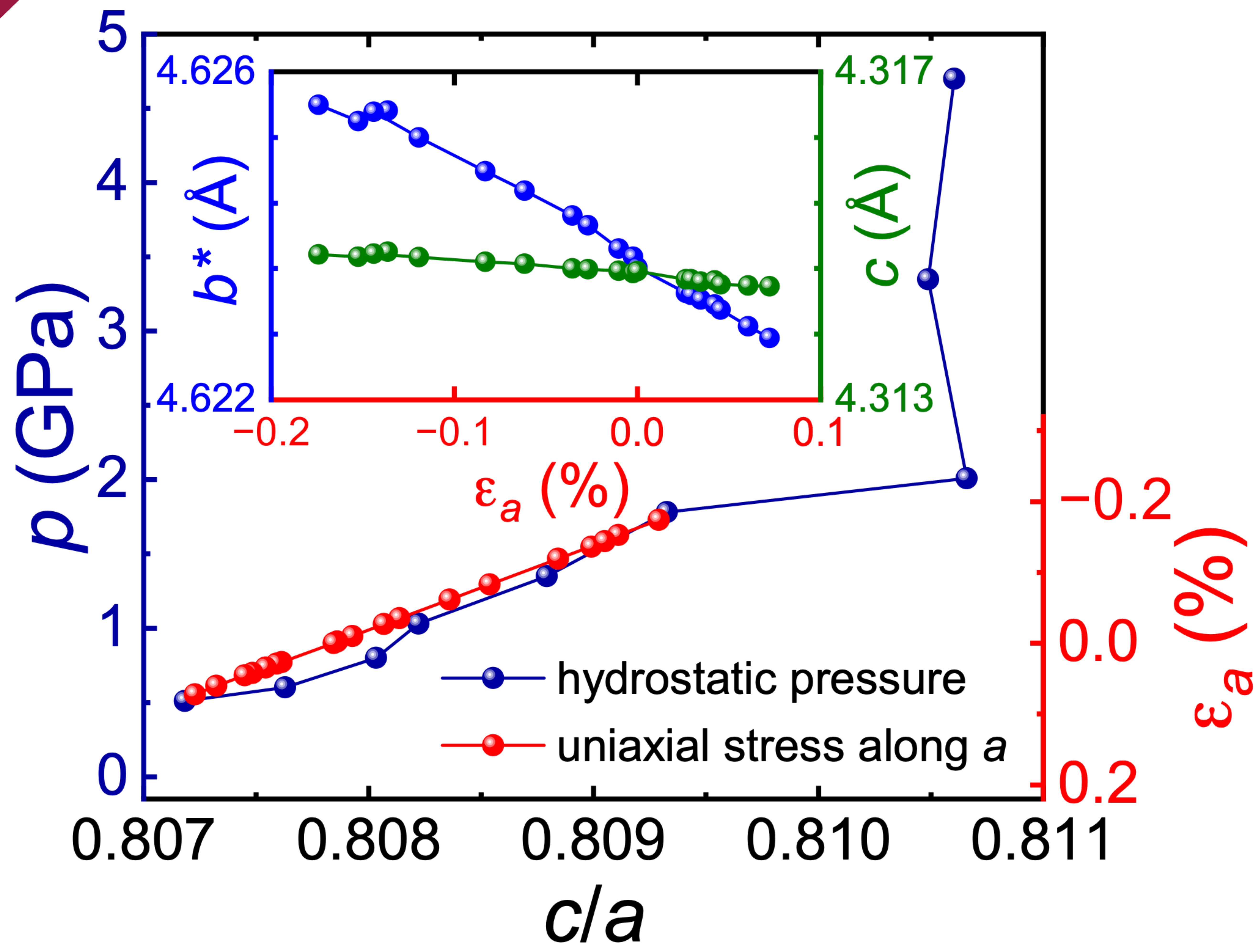
- *c*/*a* ratio



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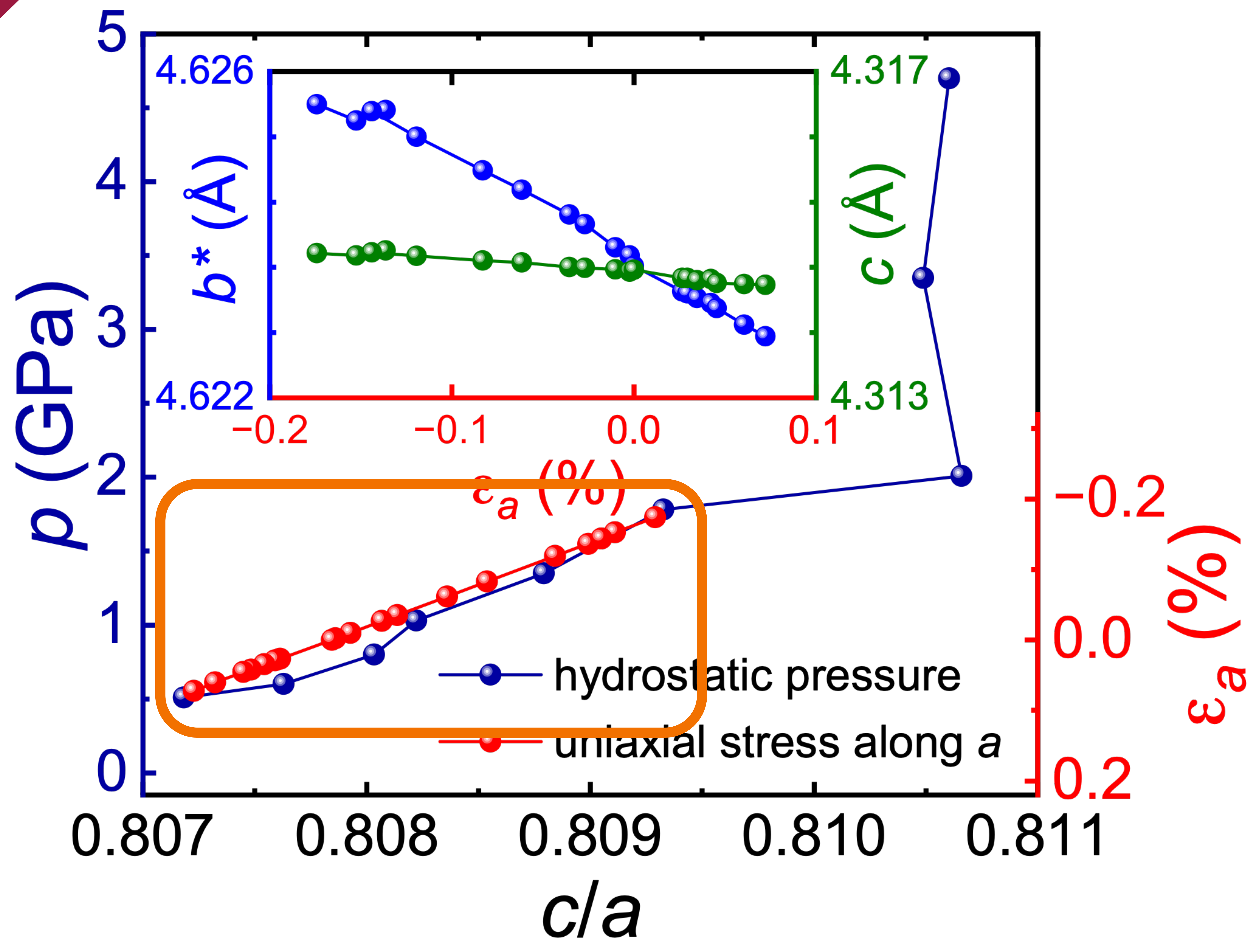
- *c/a* ratio



A. S. Sukhanov et al., Phys. Rev. B 97, 214402 (2018).
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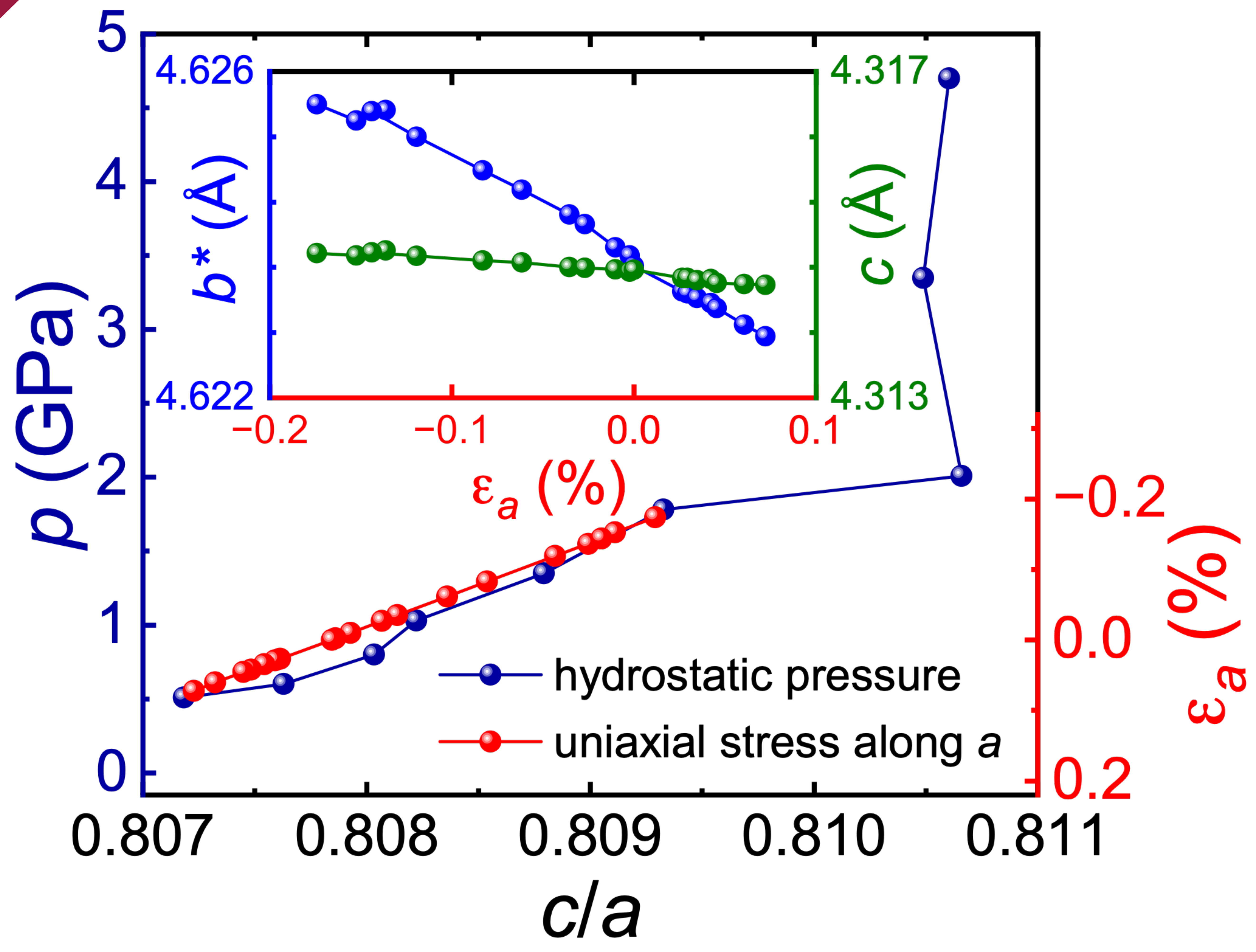
- *c/a* ratio



A. S. Sukhanov et al., Phys. Rev. B 97, 214402 (2018).
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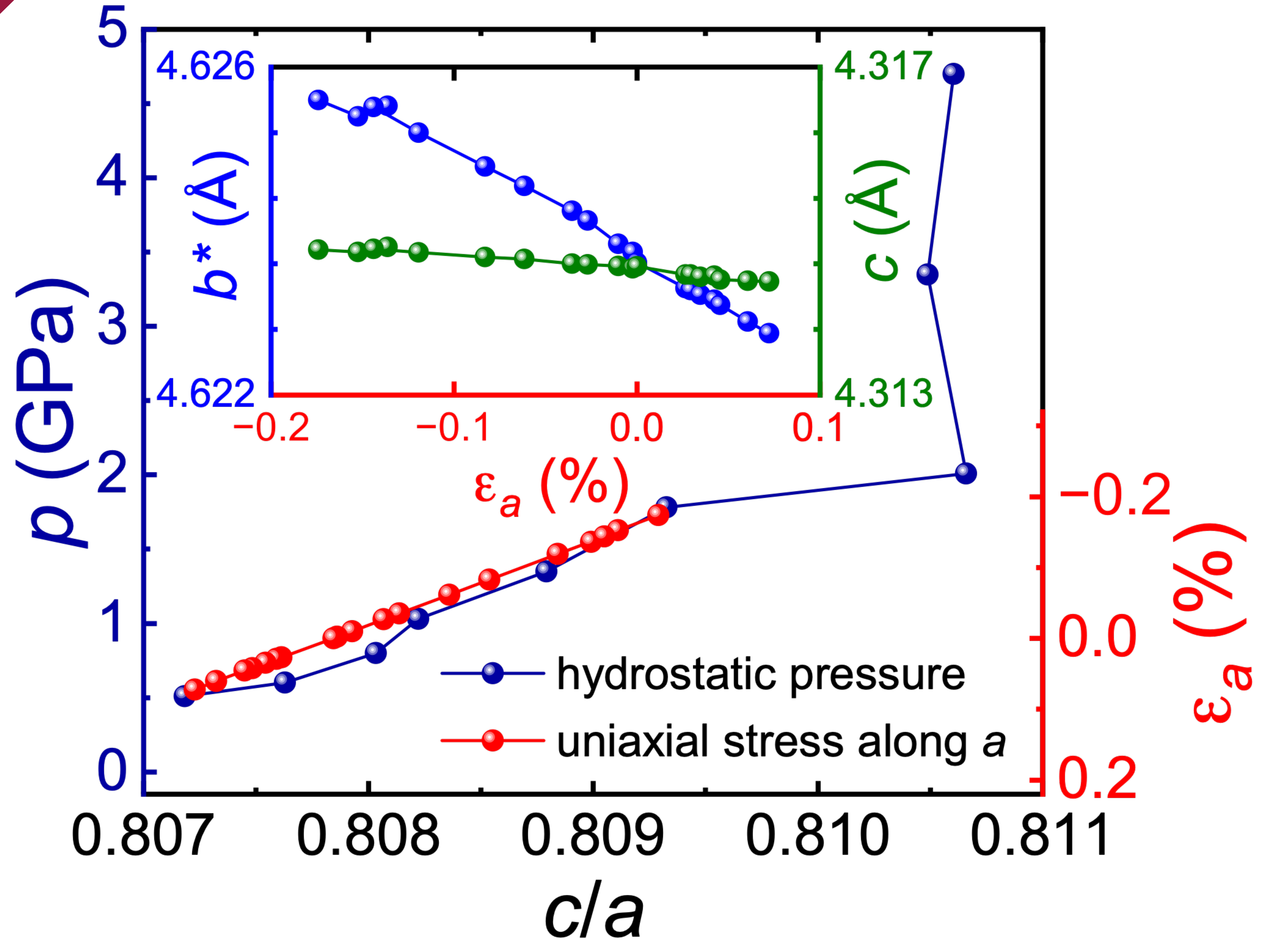
- *c*/*a* ratio
- Larger Young's modulus along *c*



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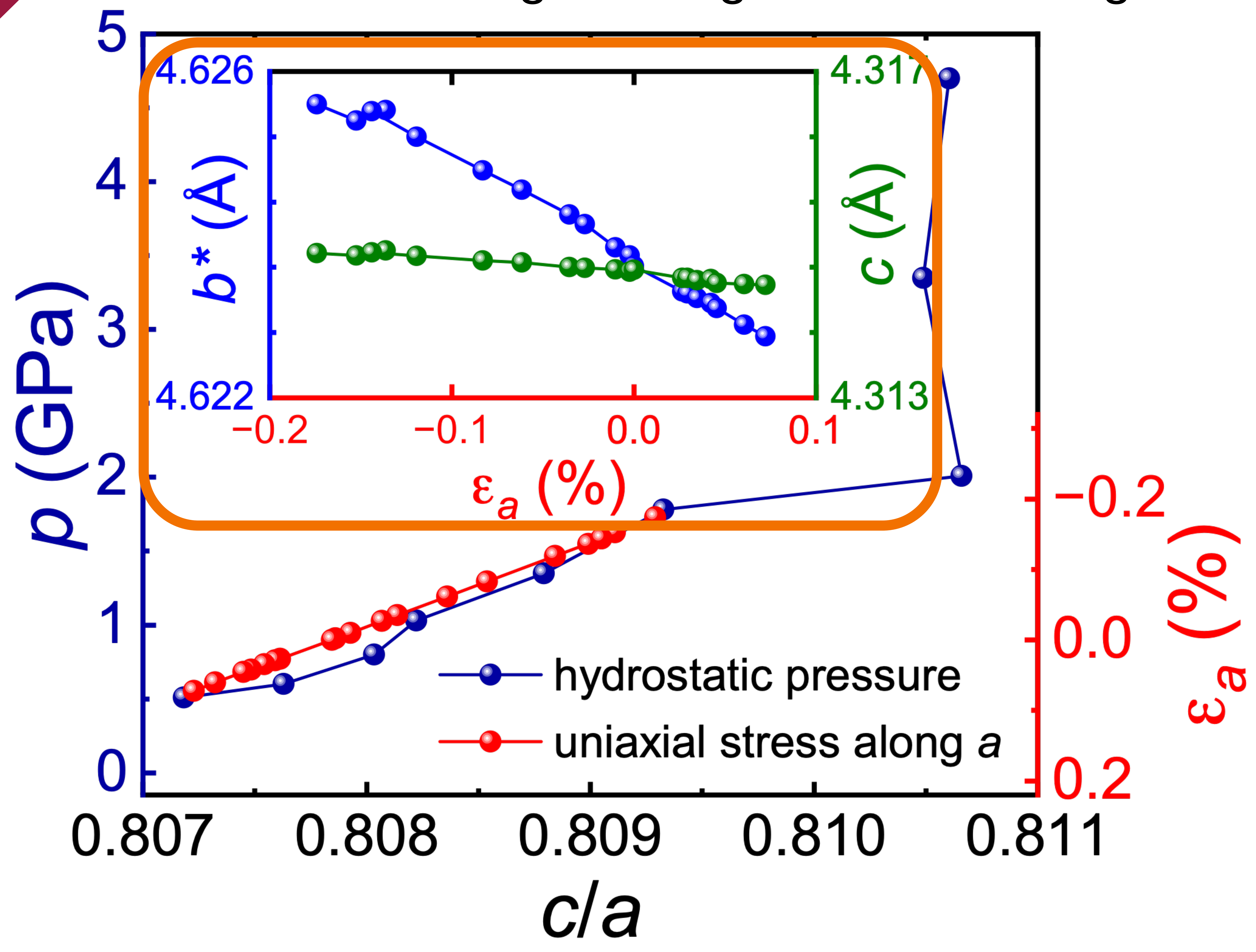

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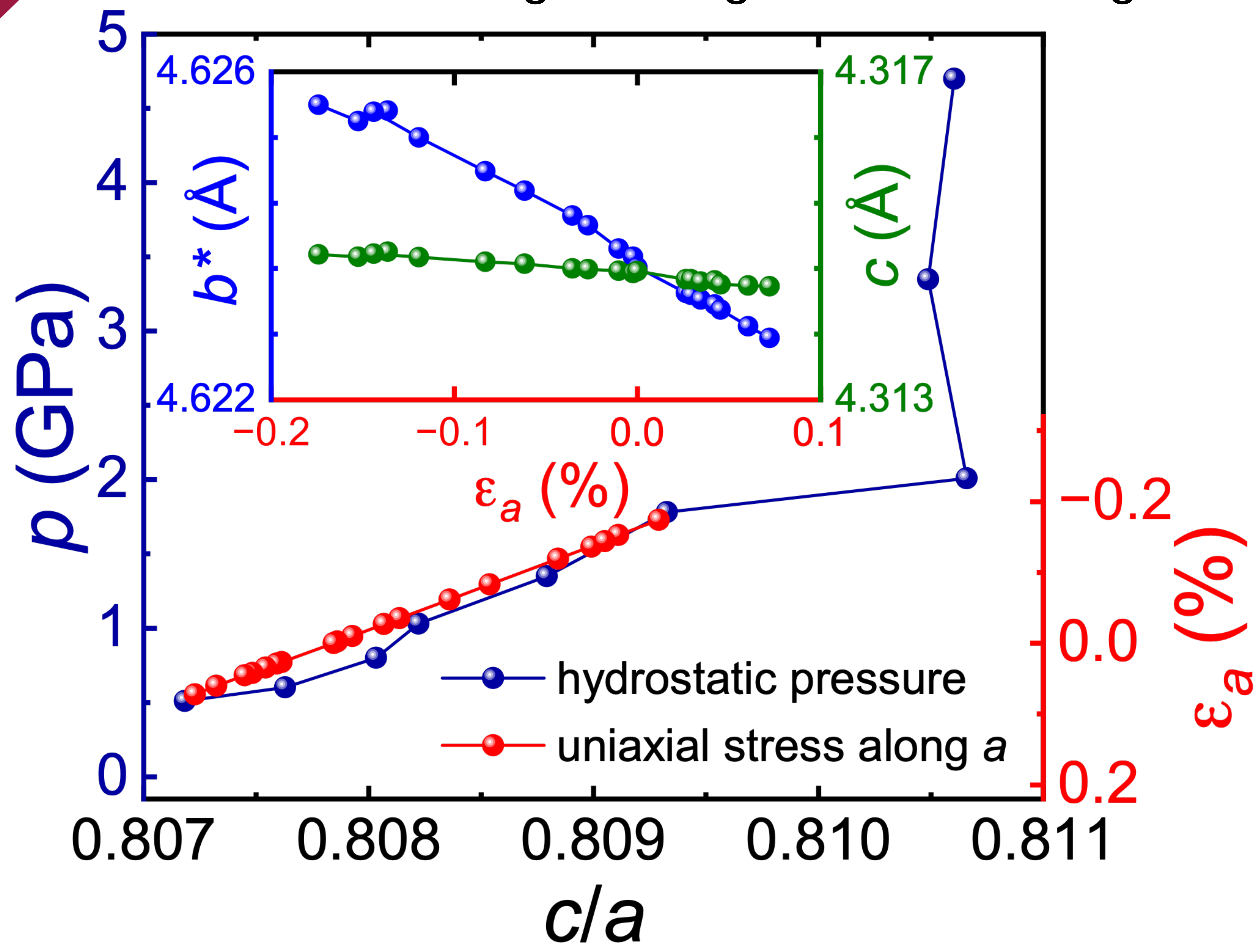
- *c*/*a* ratio
- Larger Young's modulus along *c*



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- *c*/*a* ratio
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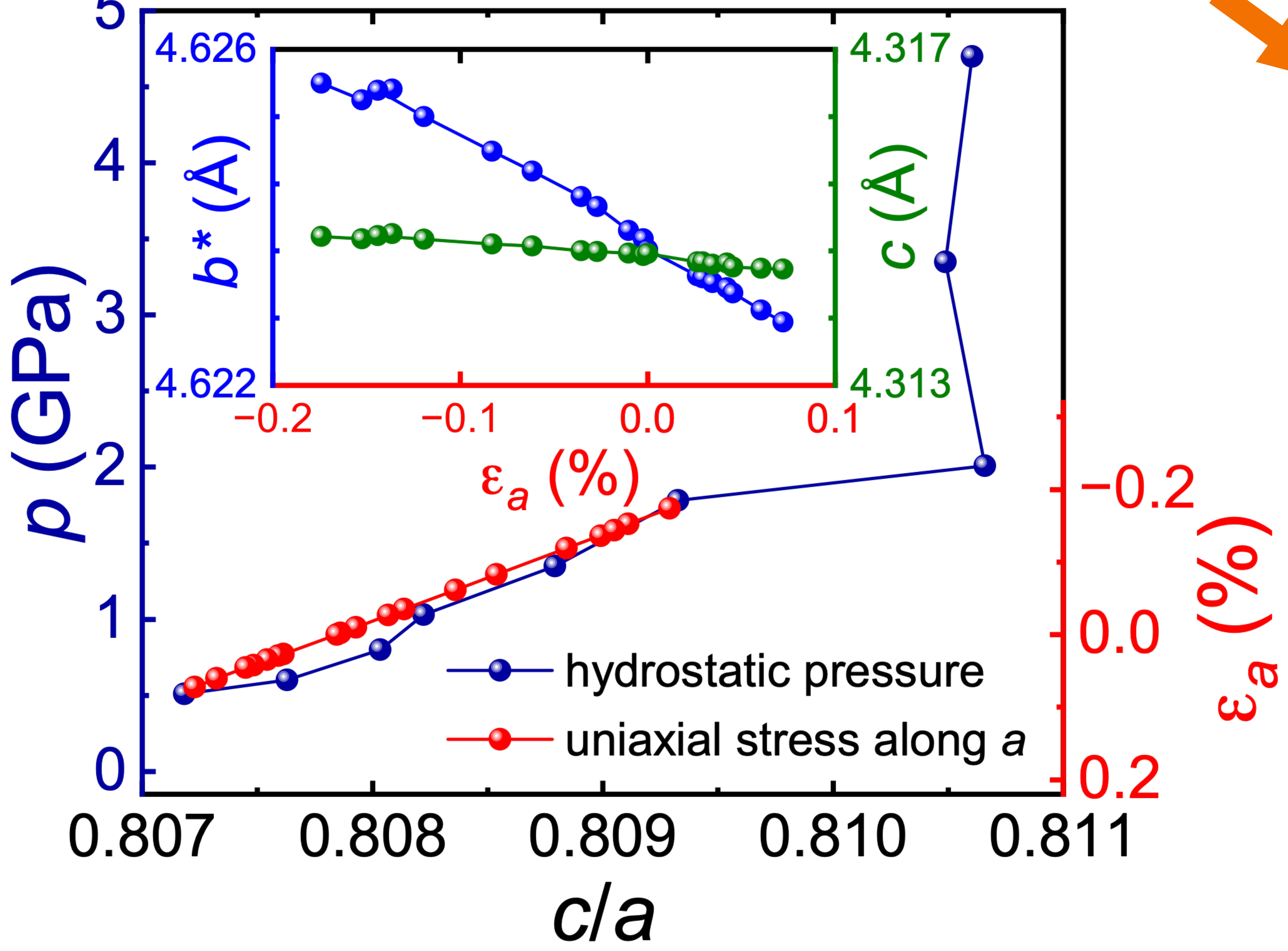

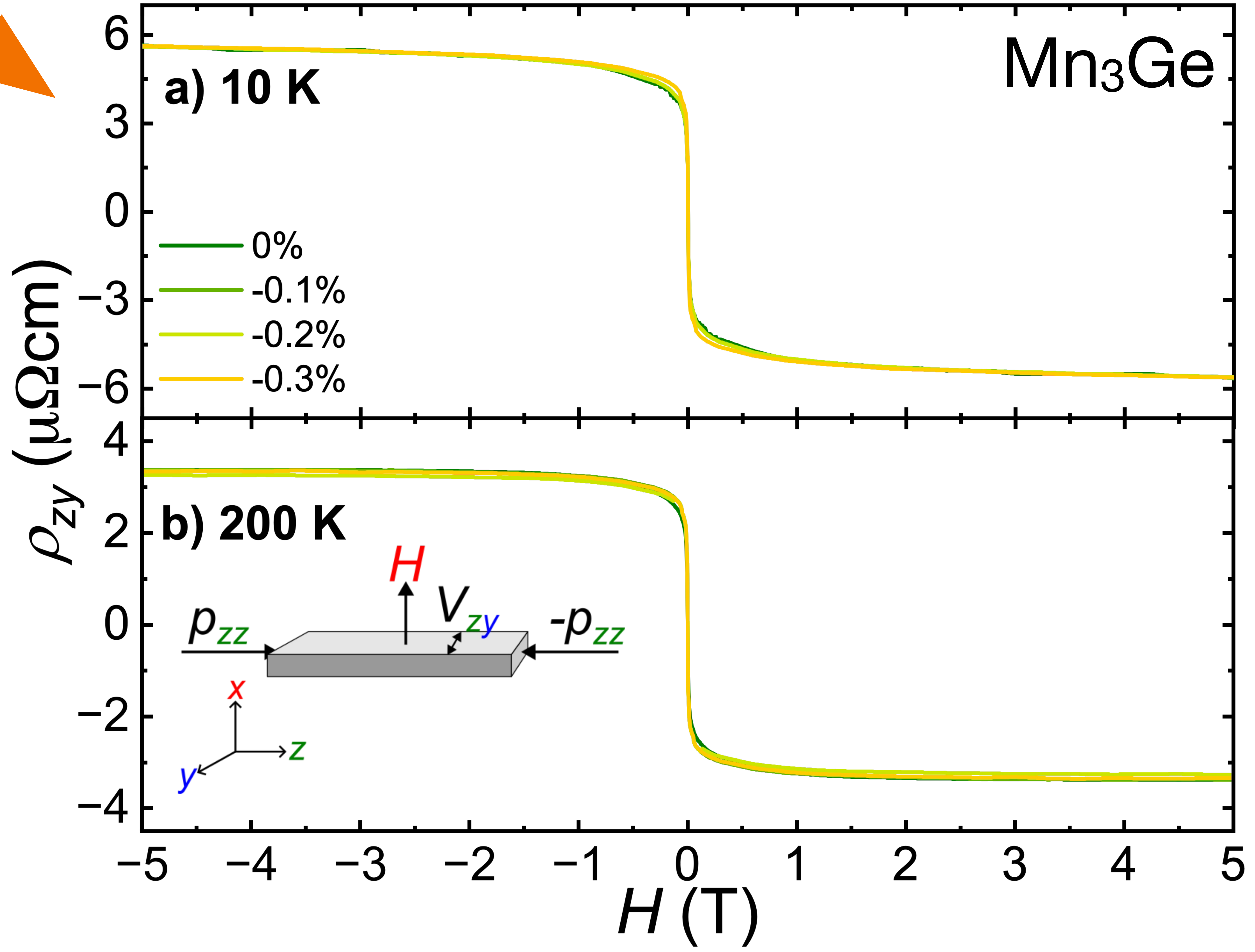

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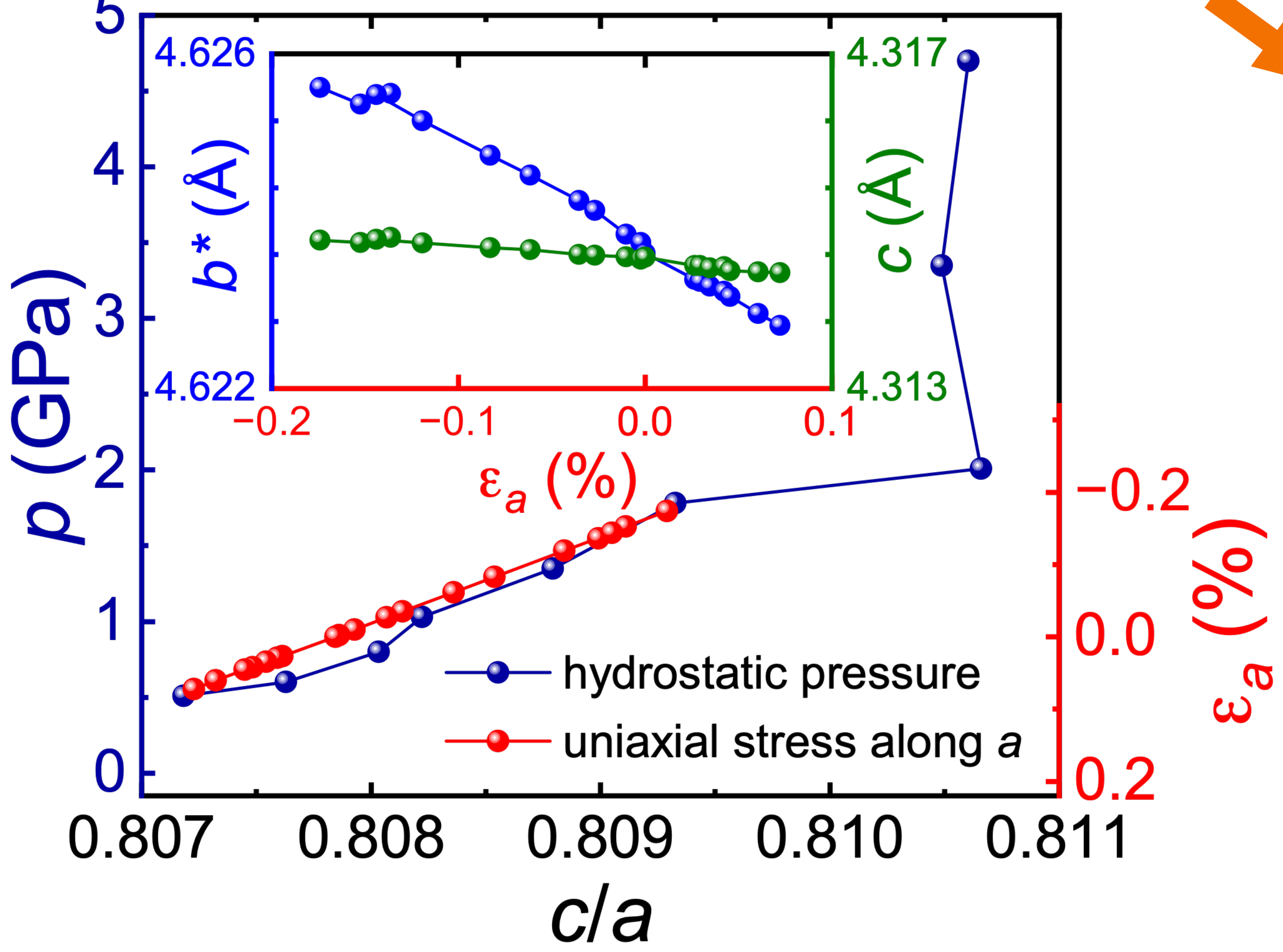
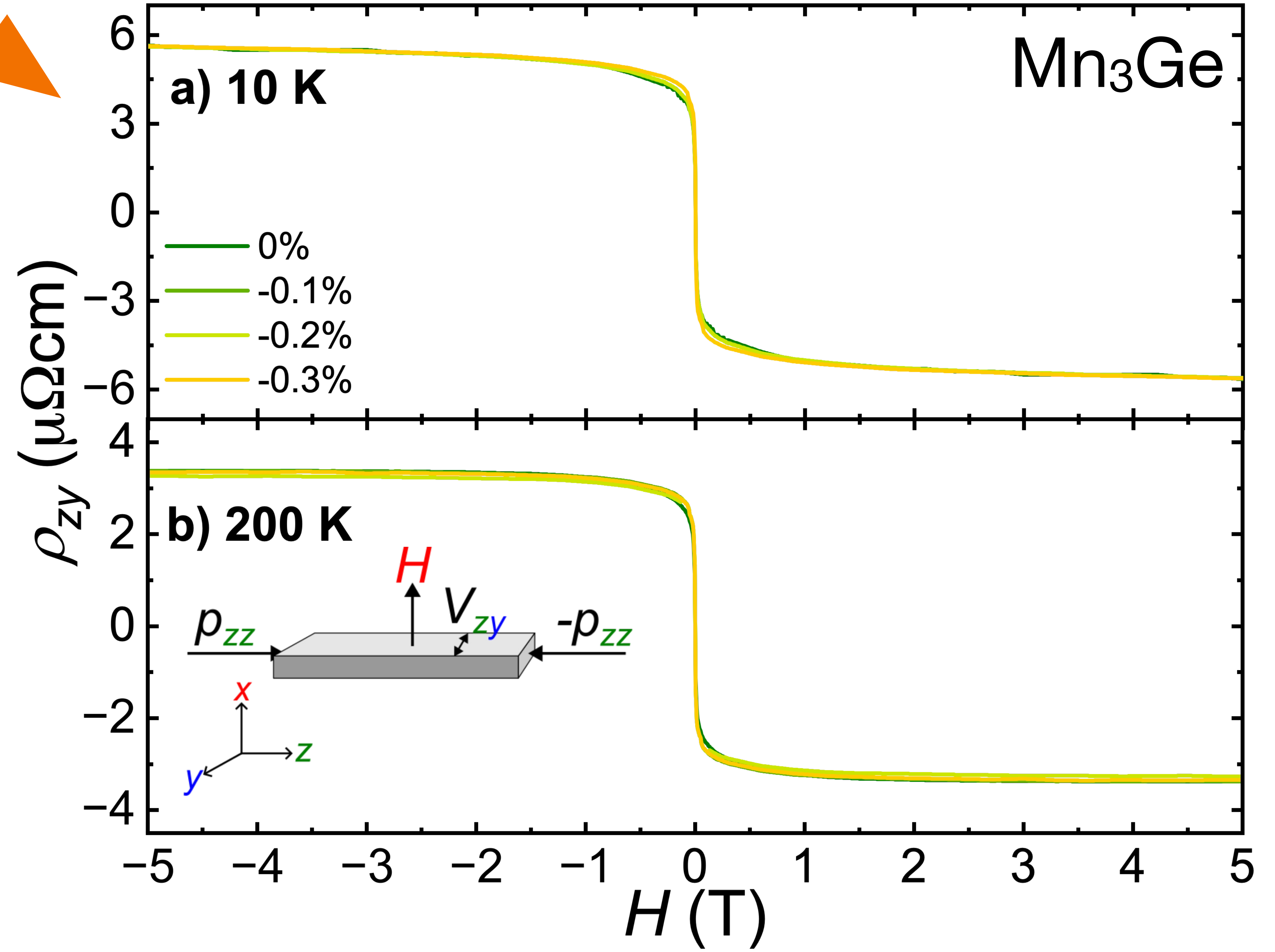
- *c*/*a* ratio
- Larger Young's modulus along *c*



- Contradicts theoretical work



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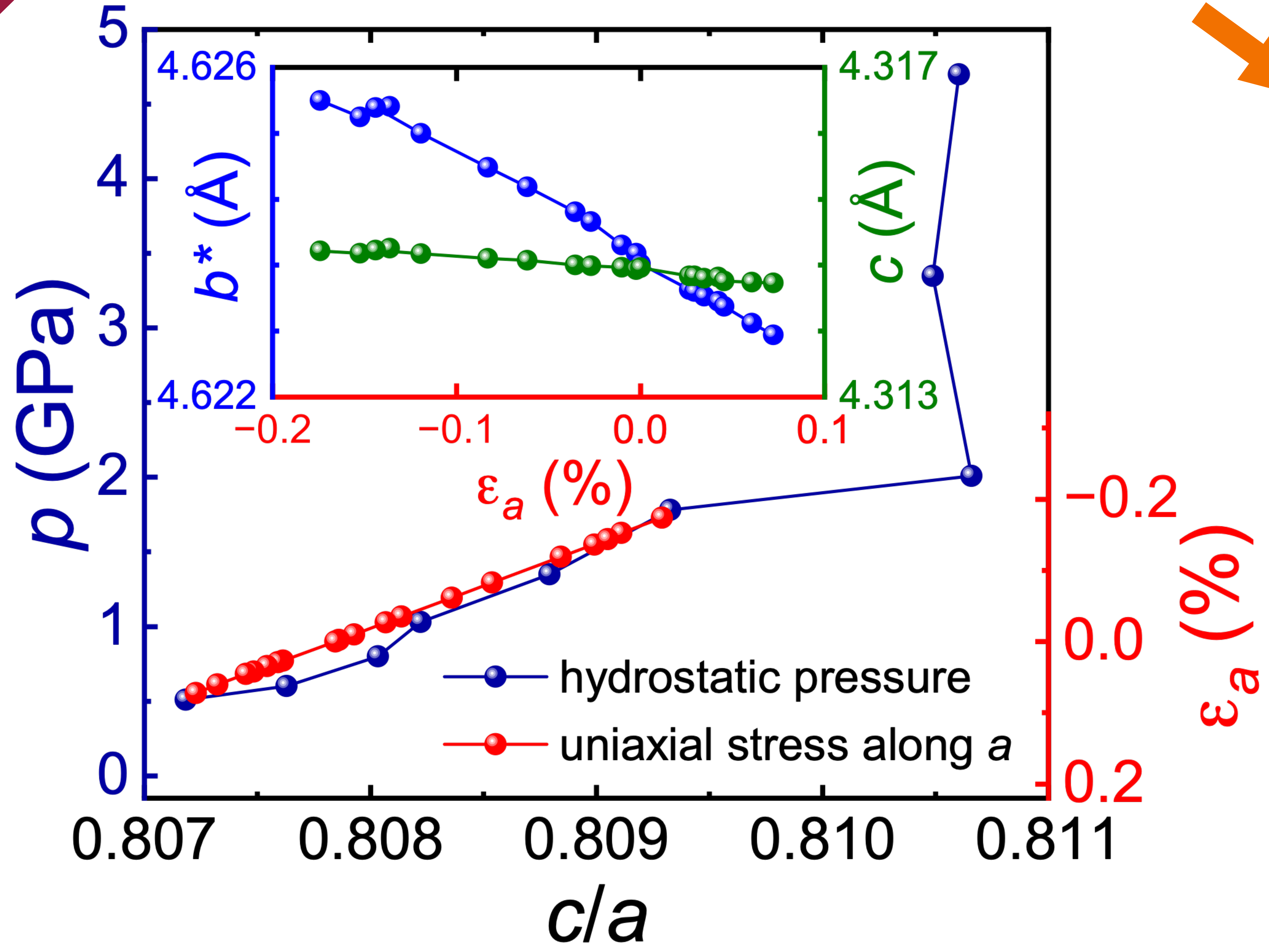
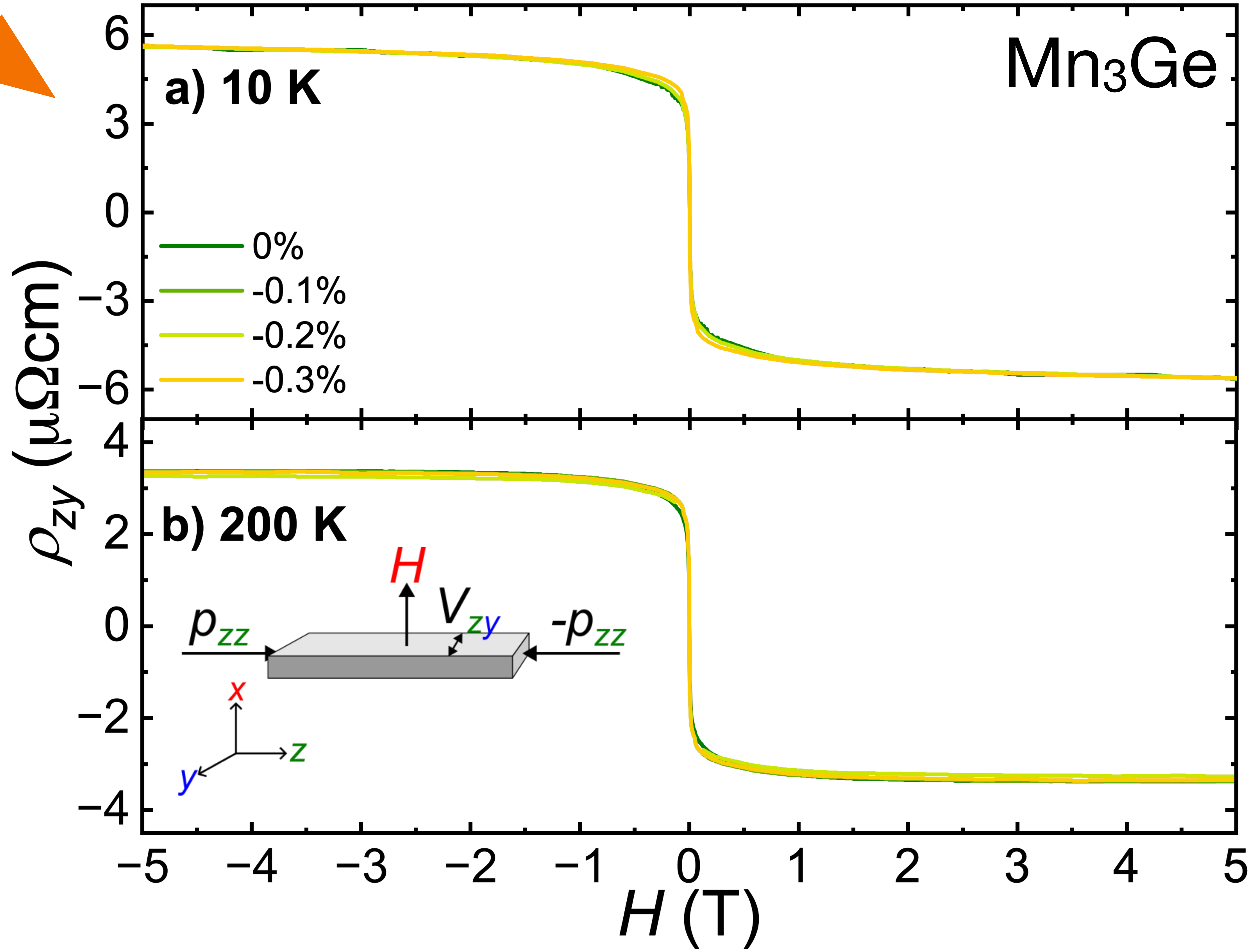
- *c*/*a* ratio
- Larger Young's modulus along *c*

- Contradicts theoretical work
- Higher force needed





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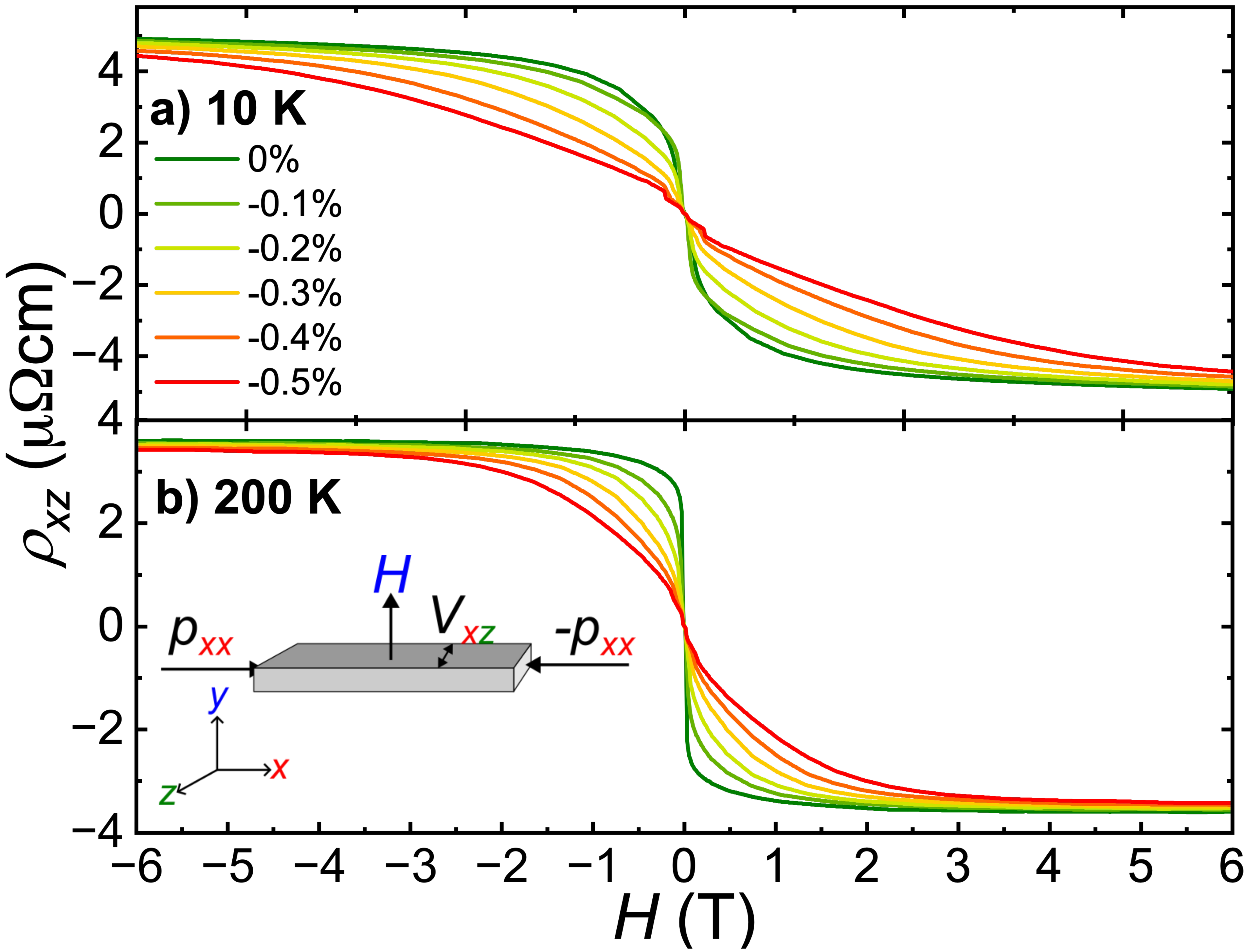
Mn₃Ge uniaxial stress



R. D. Dos Reis et al., Physical Review Materials 4, 51401 (2020).
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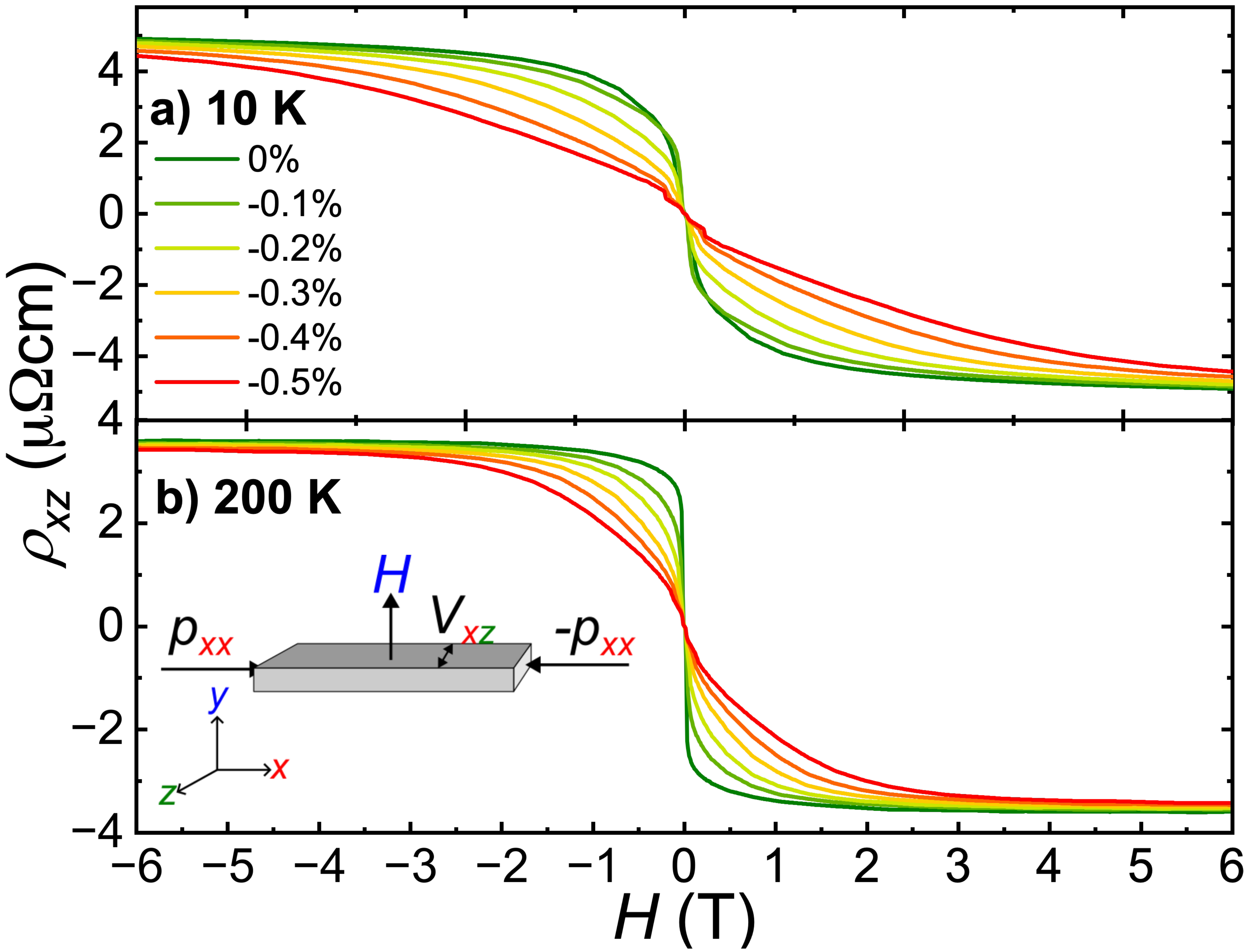
- Strong strain dependent AHE

Mn3Ge uniaxial stress



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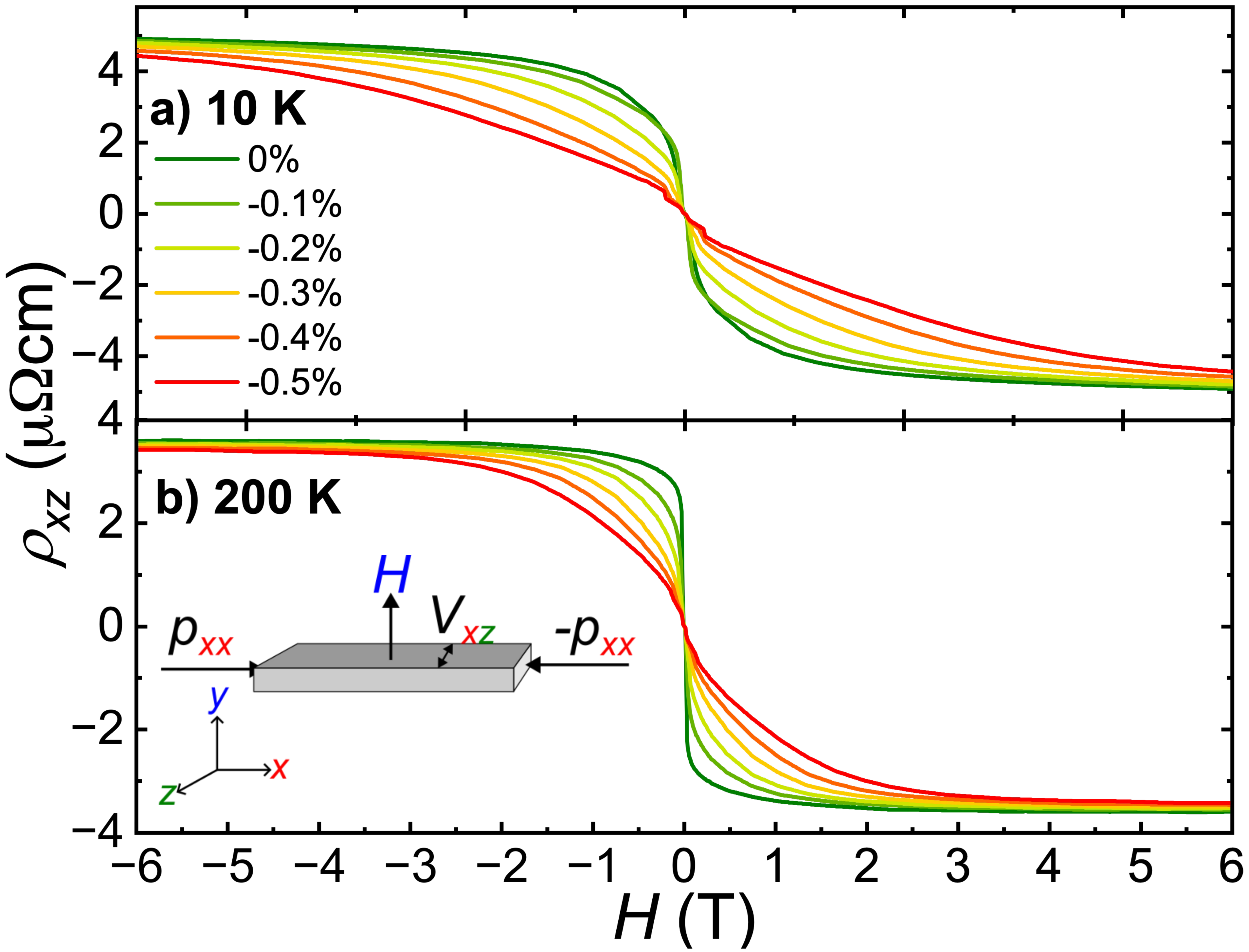
- Strong strain dependent AHE

Mn₃Ge uniaxial stress



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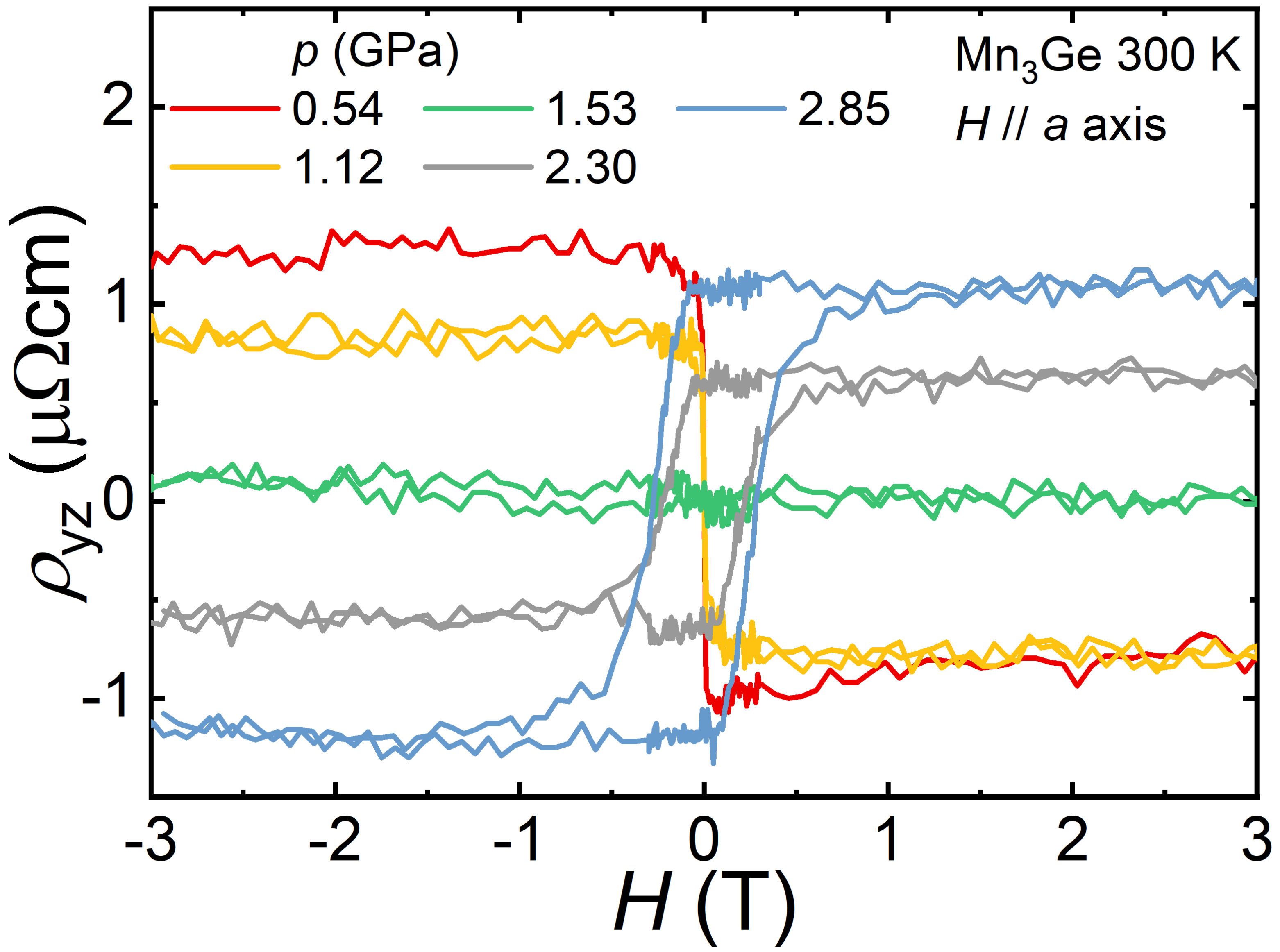
Mn₃Ge hydrostatic pressure



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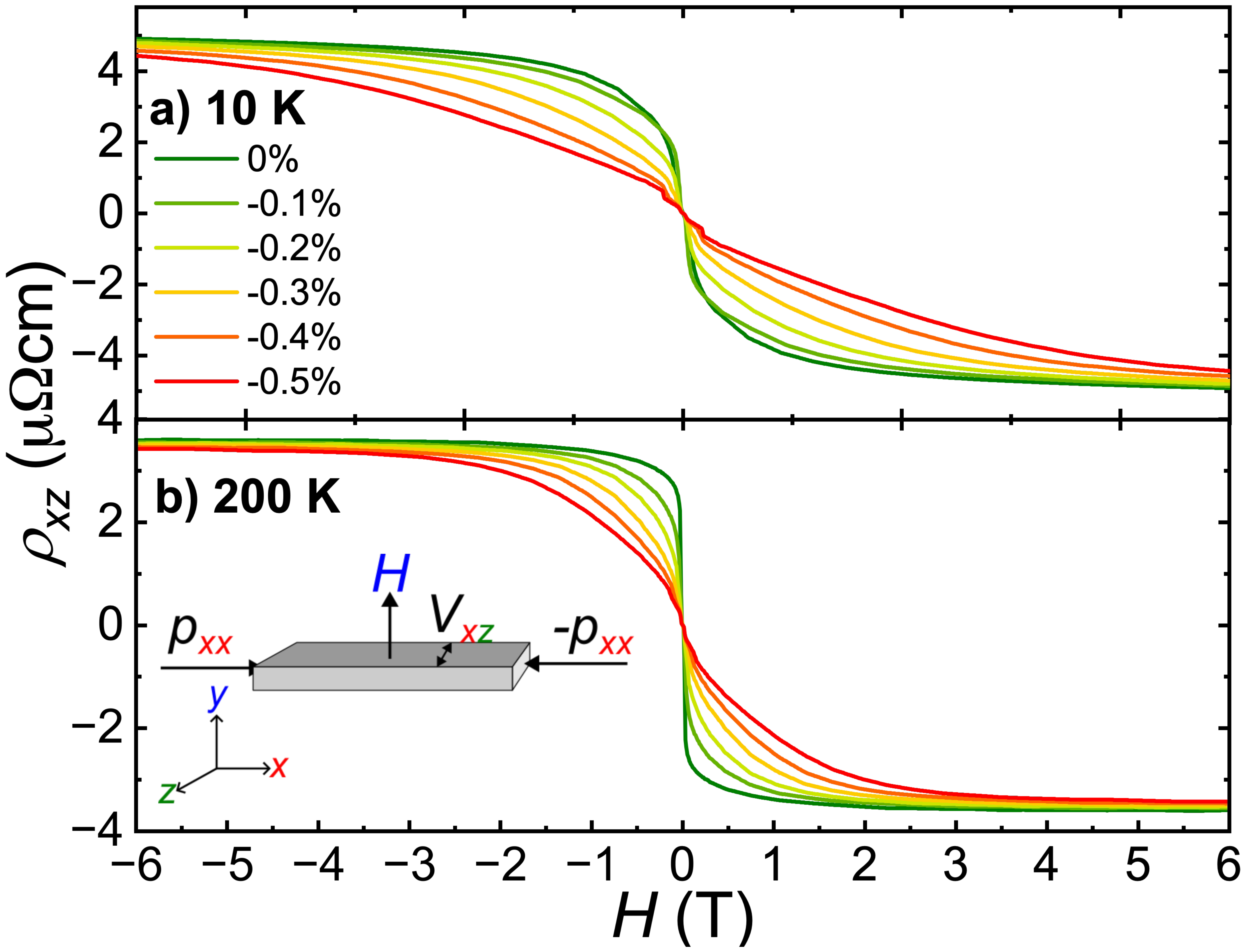
- Strong strain dependent AHE

Mn_3Ge uniaxial stress



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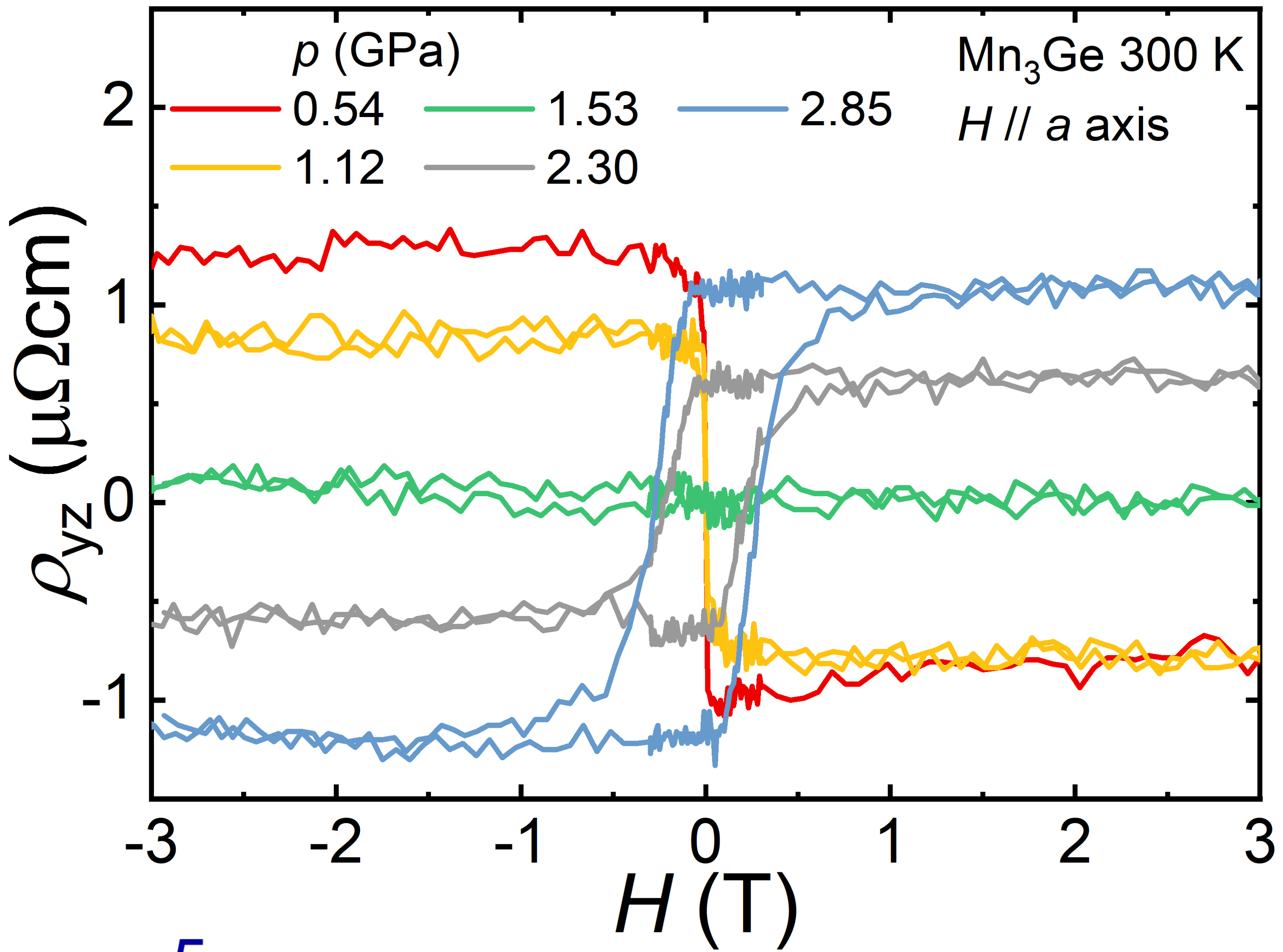
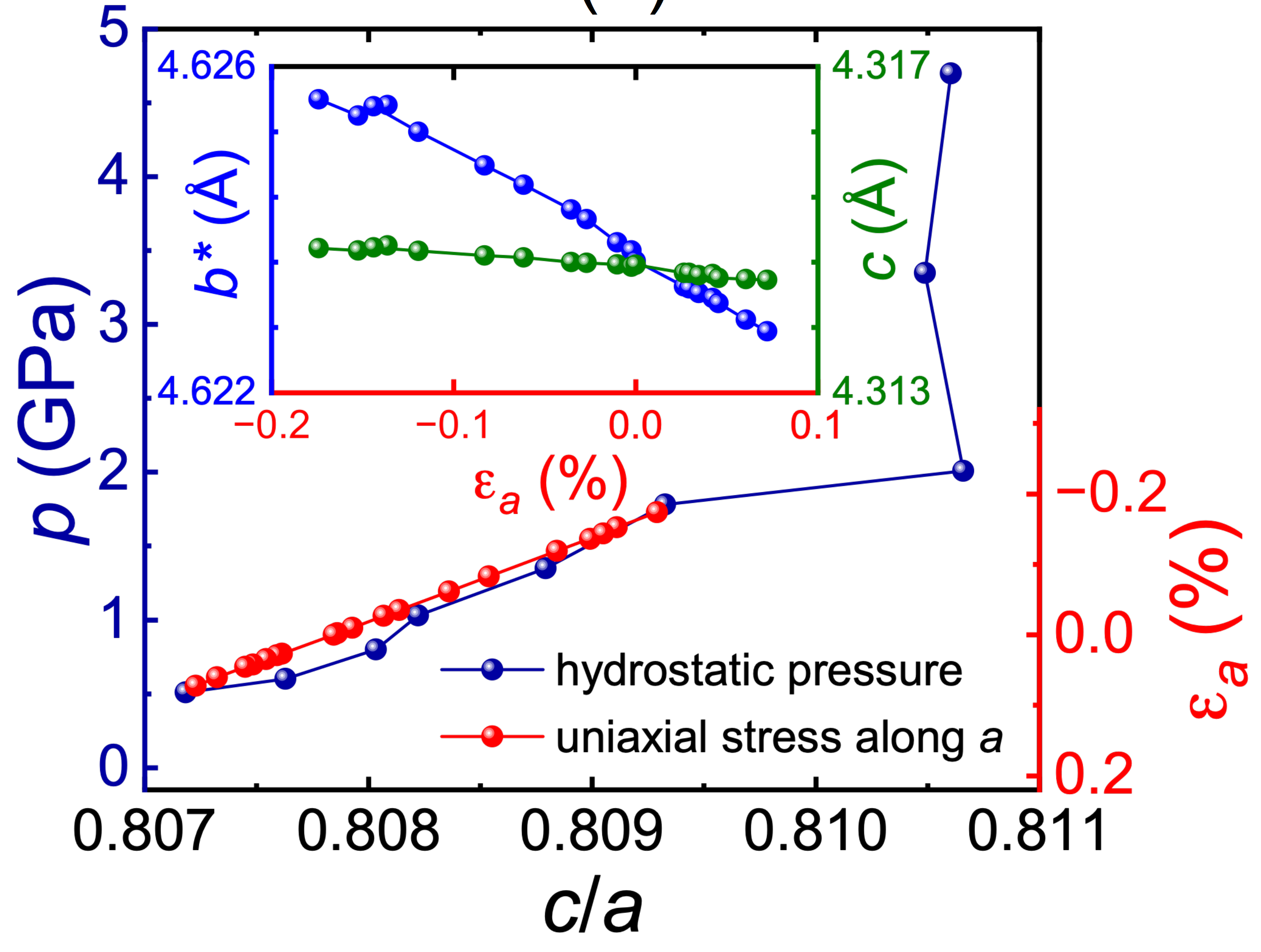
Mn_3Ge hydrostatic pressure





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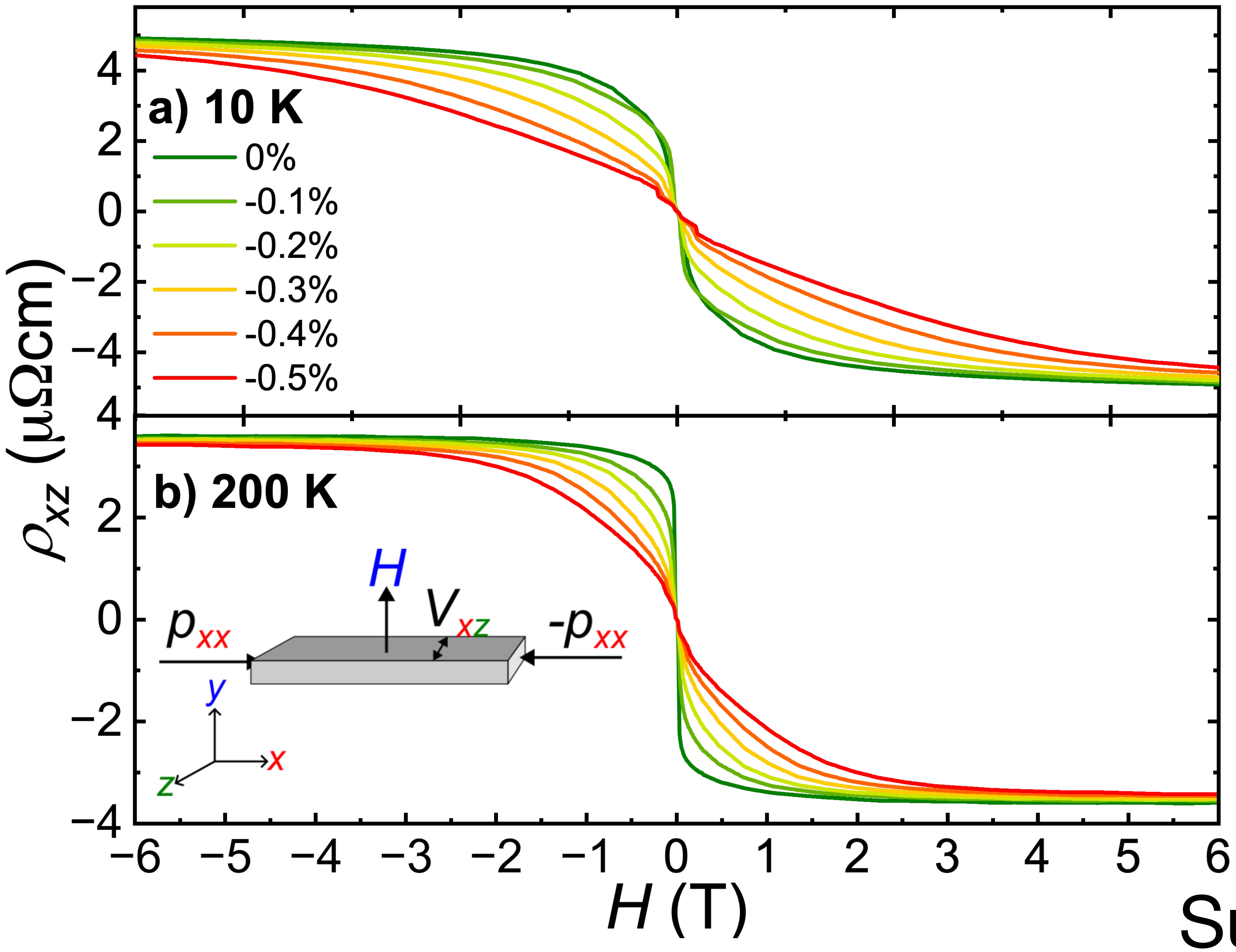
Results

- Strong strain dependent AHE

Mn3Ge uniaxial stress



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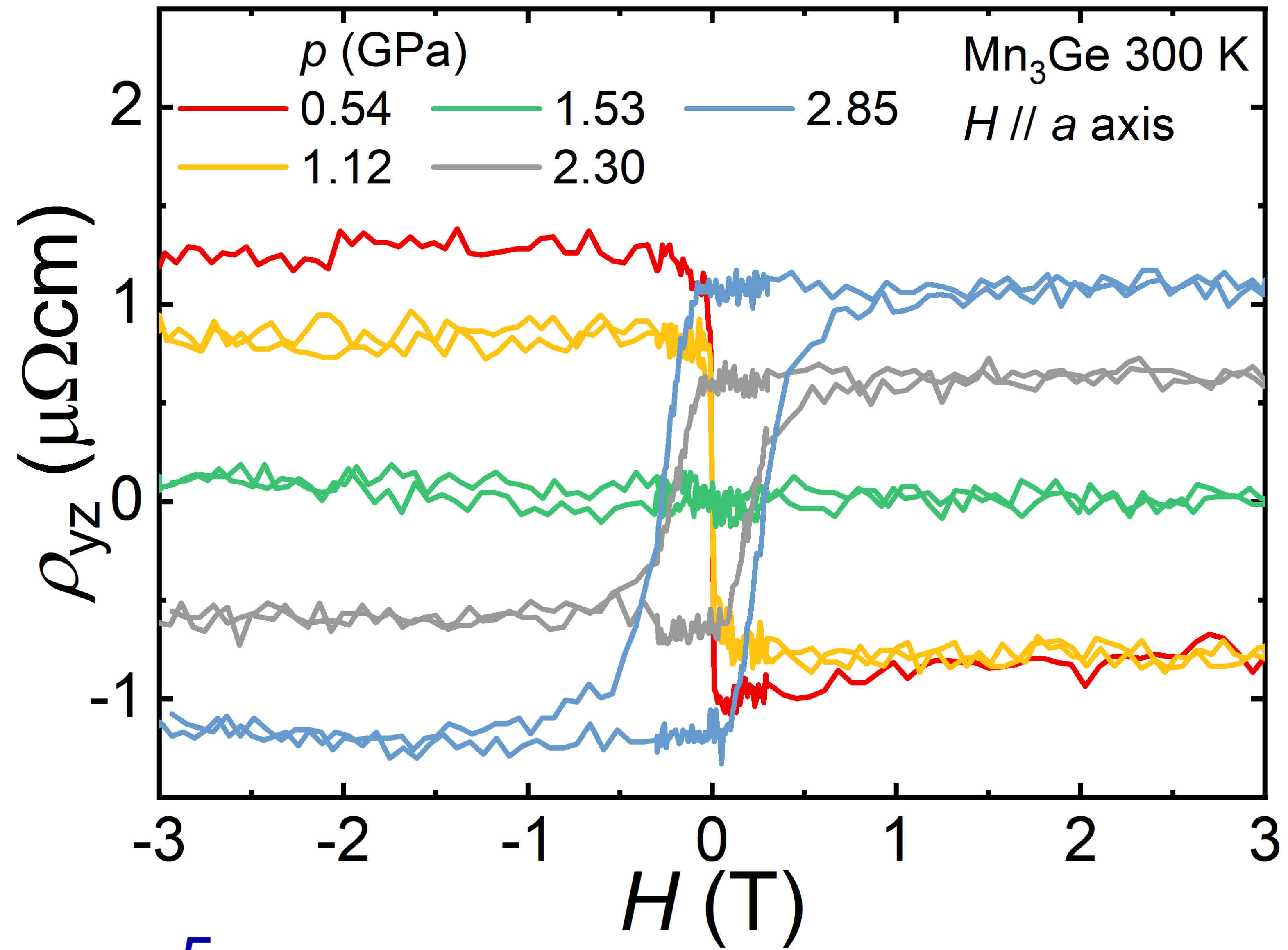
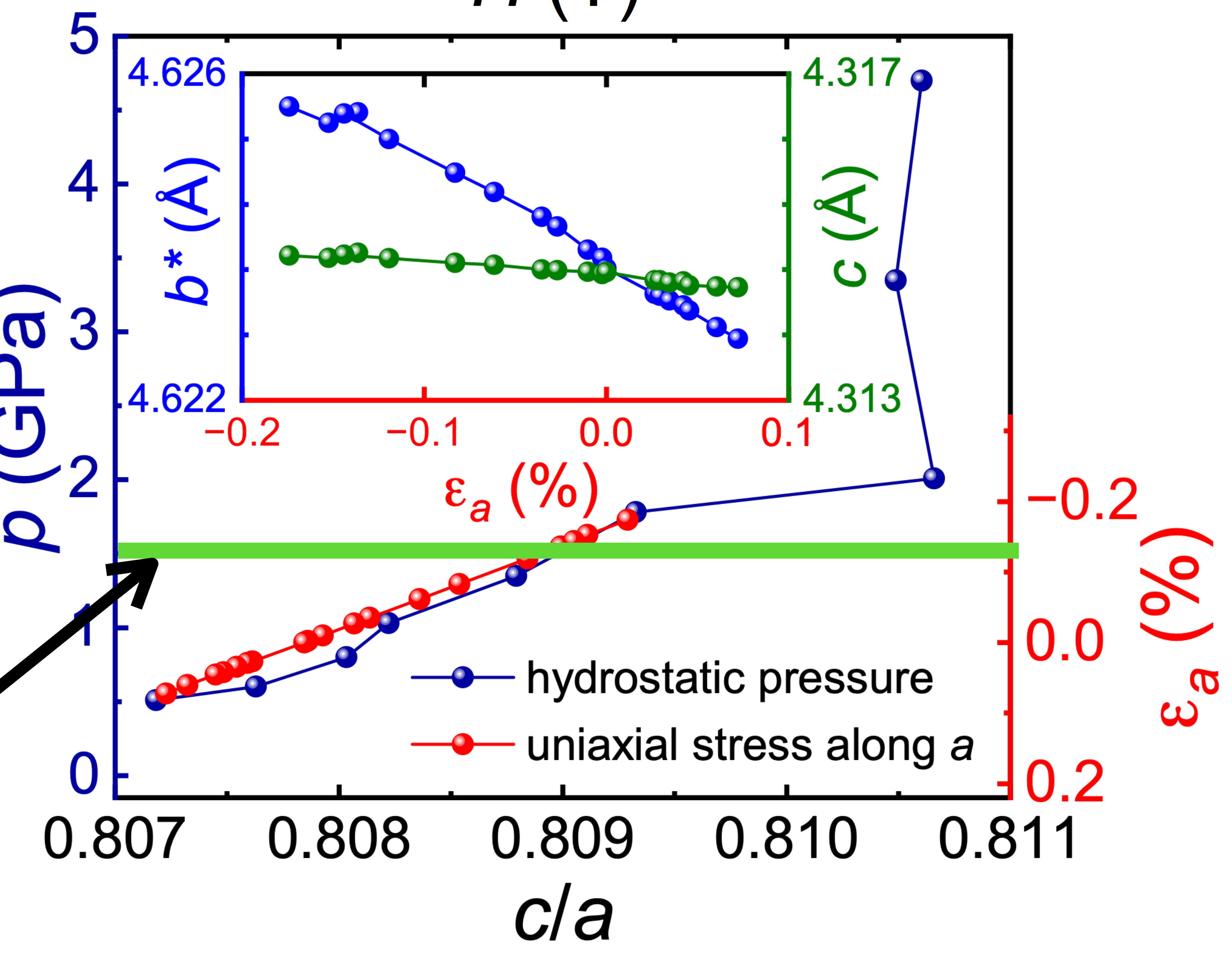
Mn3Ge hydrostatic pressure





Suppression AHE

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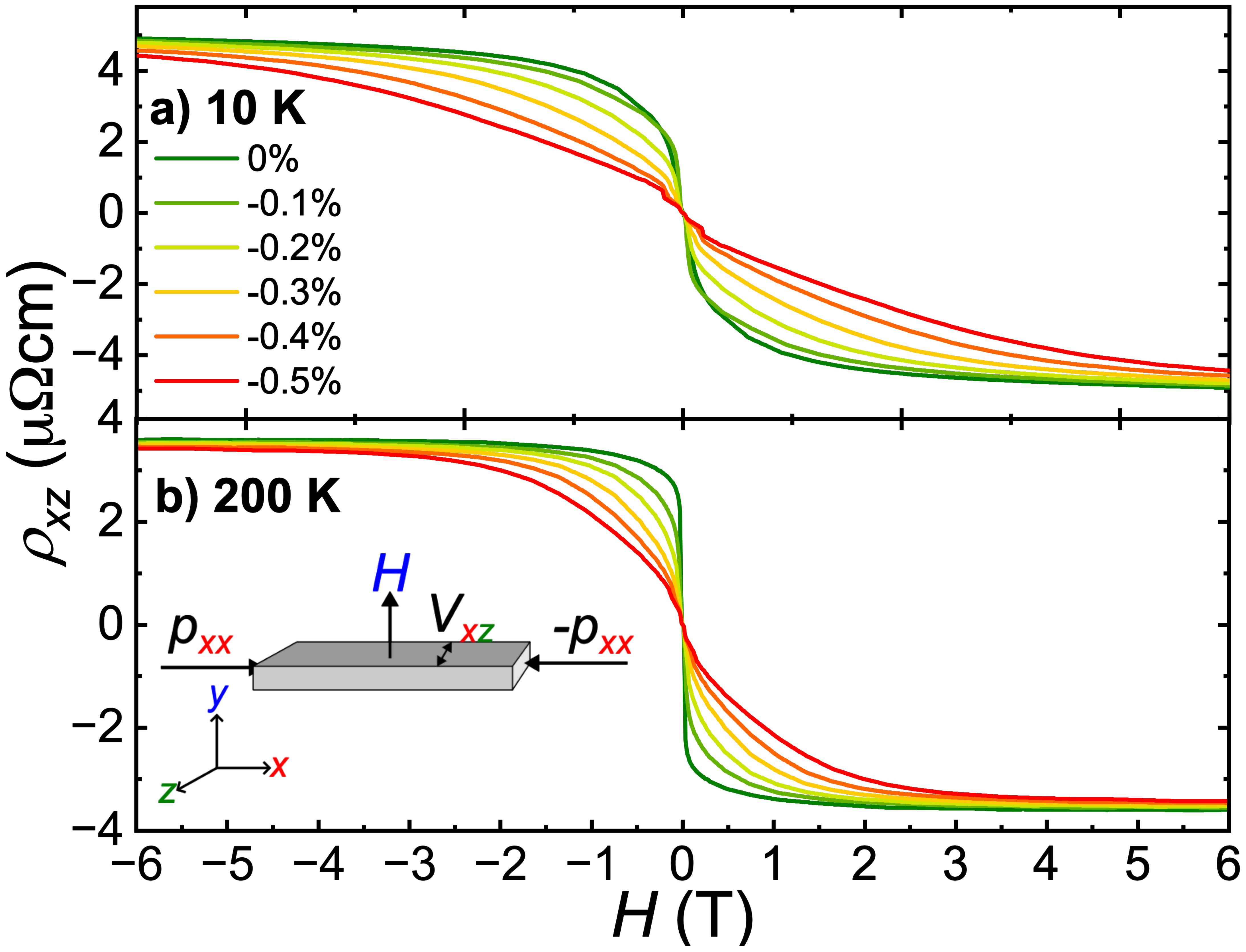
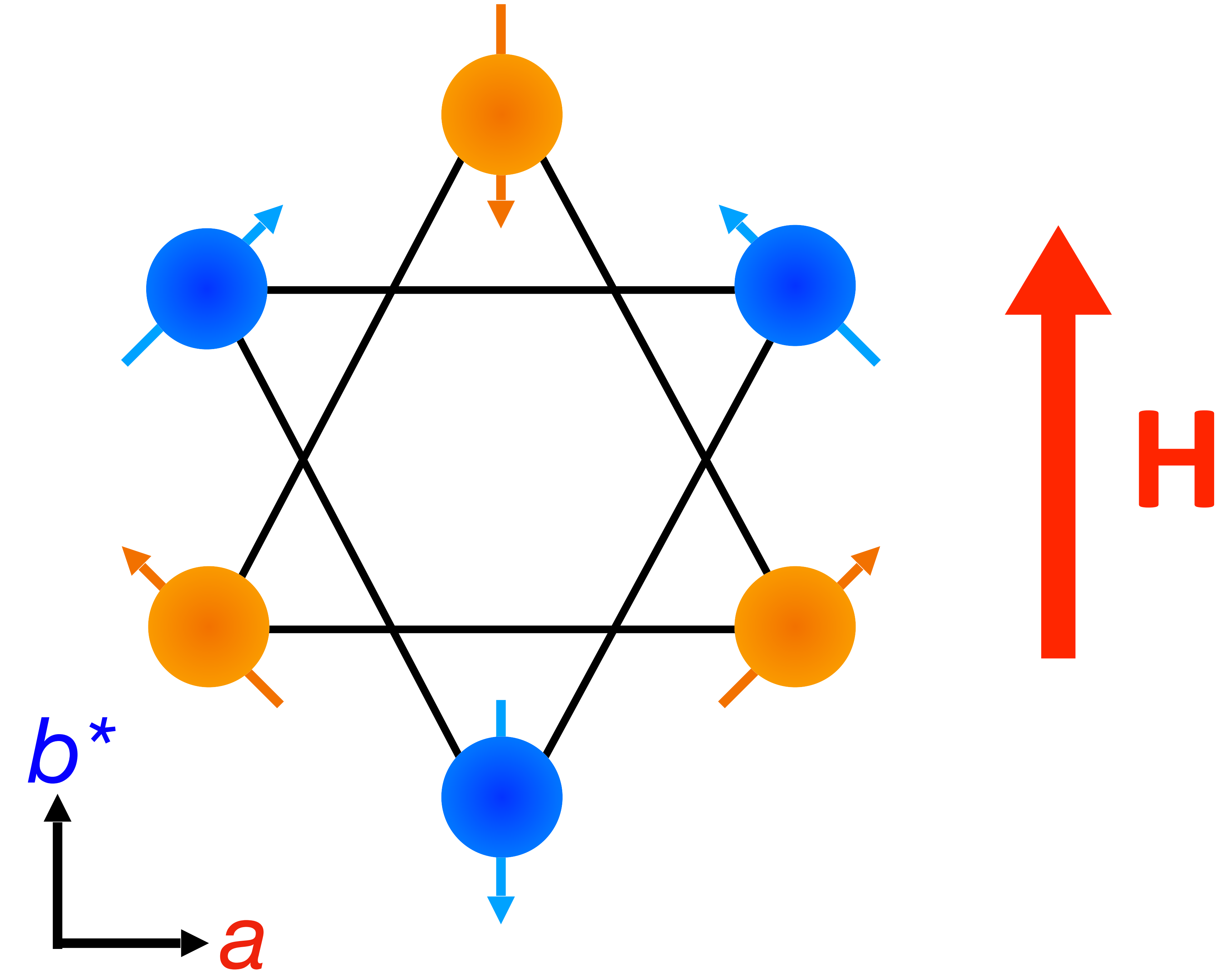
Results



Triangular magnetic structure



S. Dasgupta et al., Phys. Rev. B 102, 144417 (2020).
S. Dasgupta, Phys. Rev. B 106, 064431 (2022).
M. Ikhlas et al., Nat. Phys. 18, 1086 (2022).
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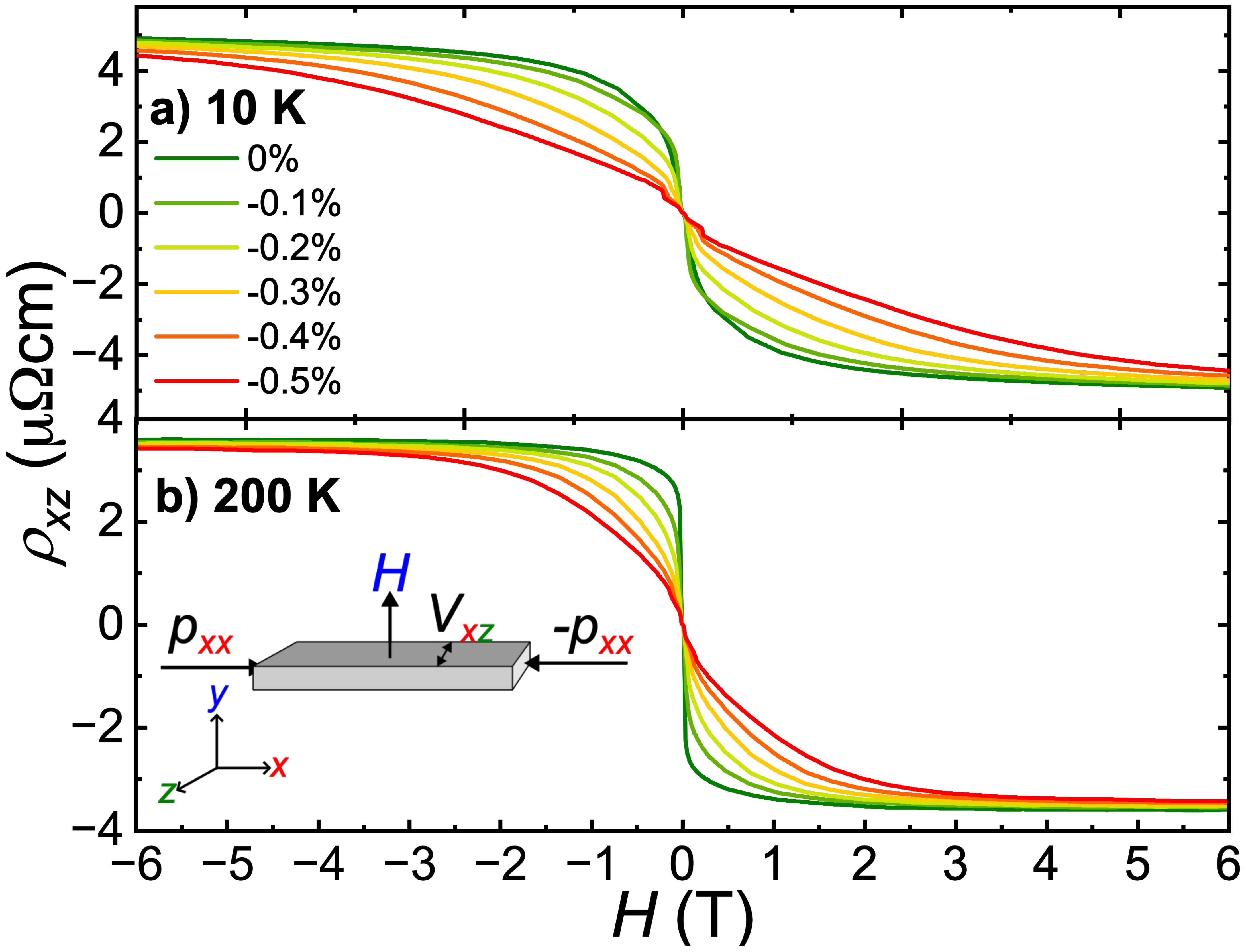

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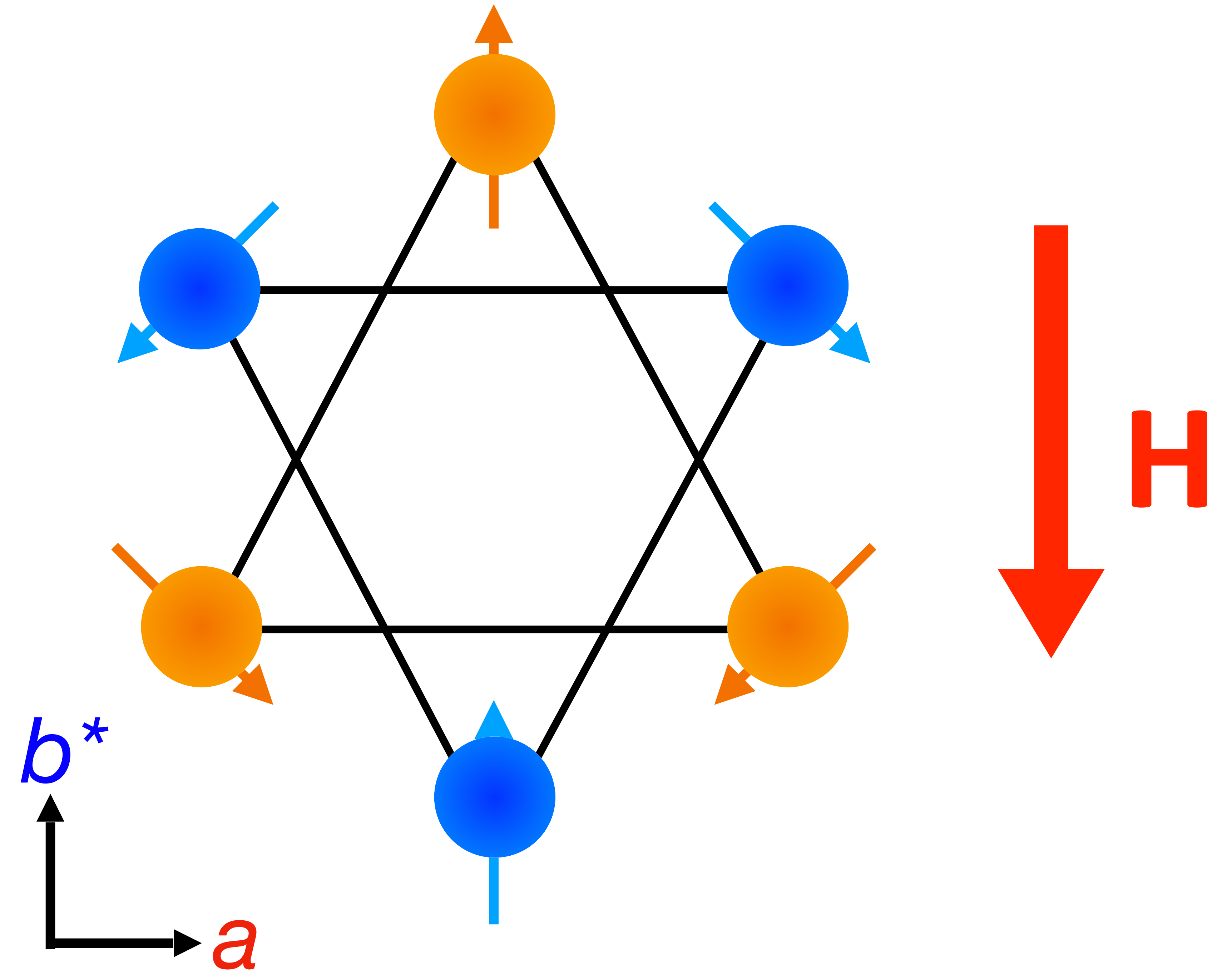

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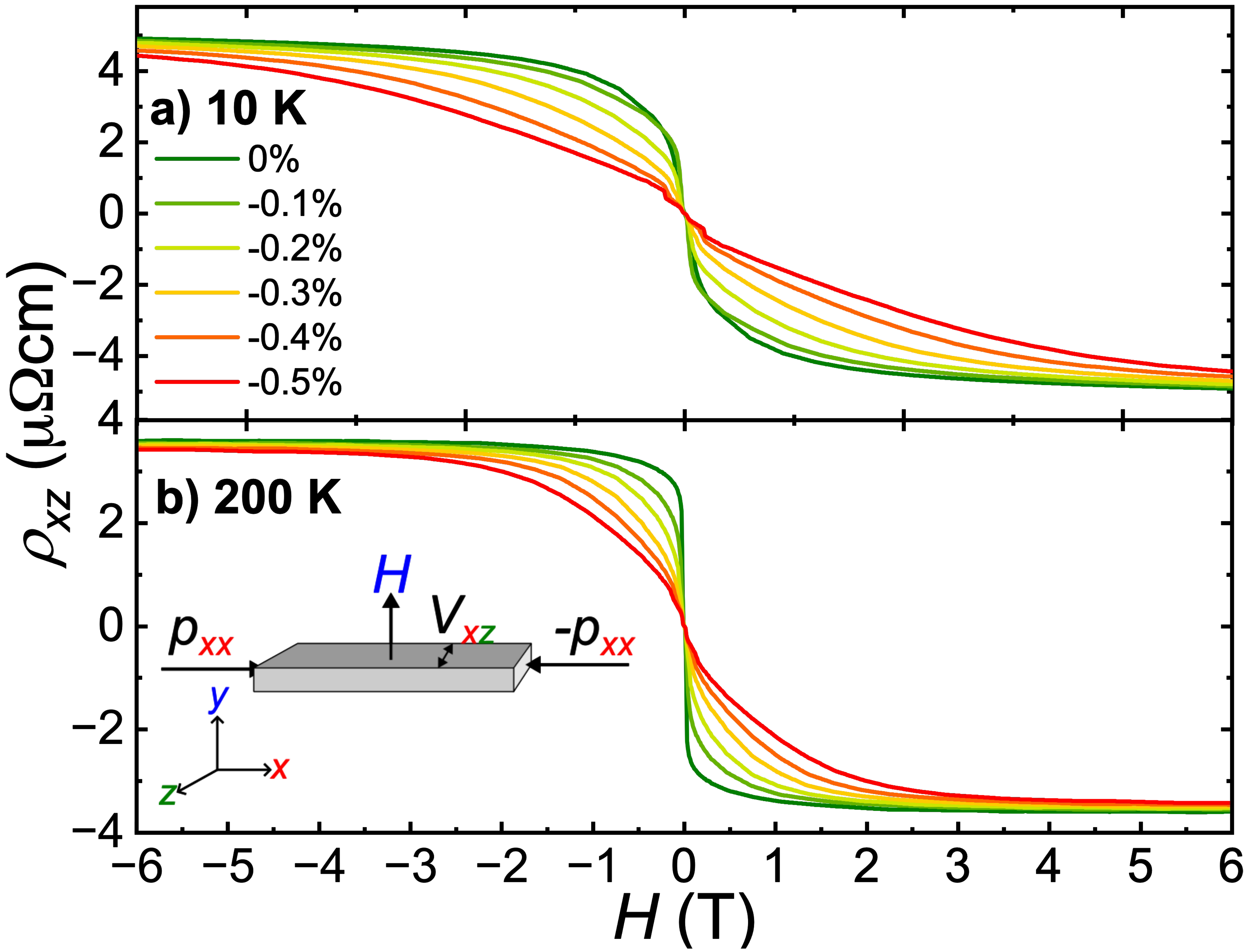

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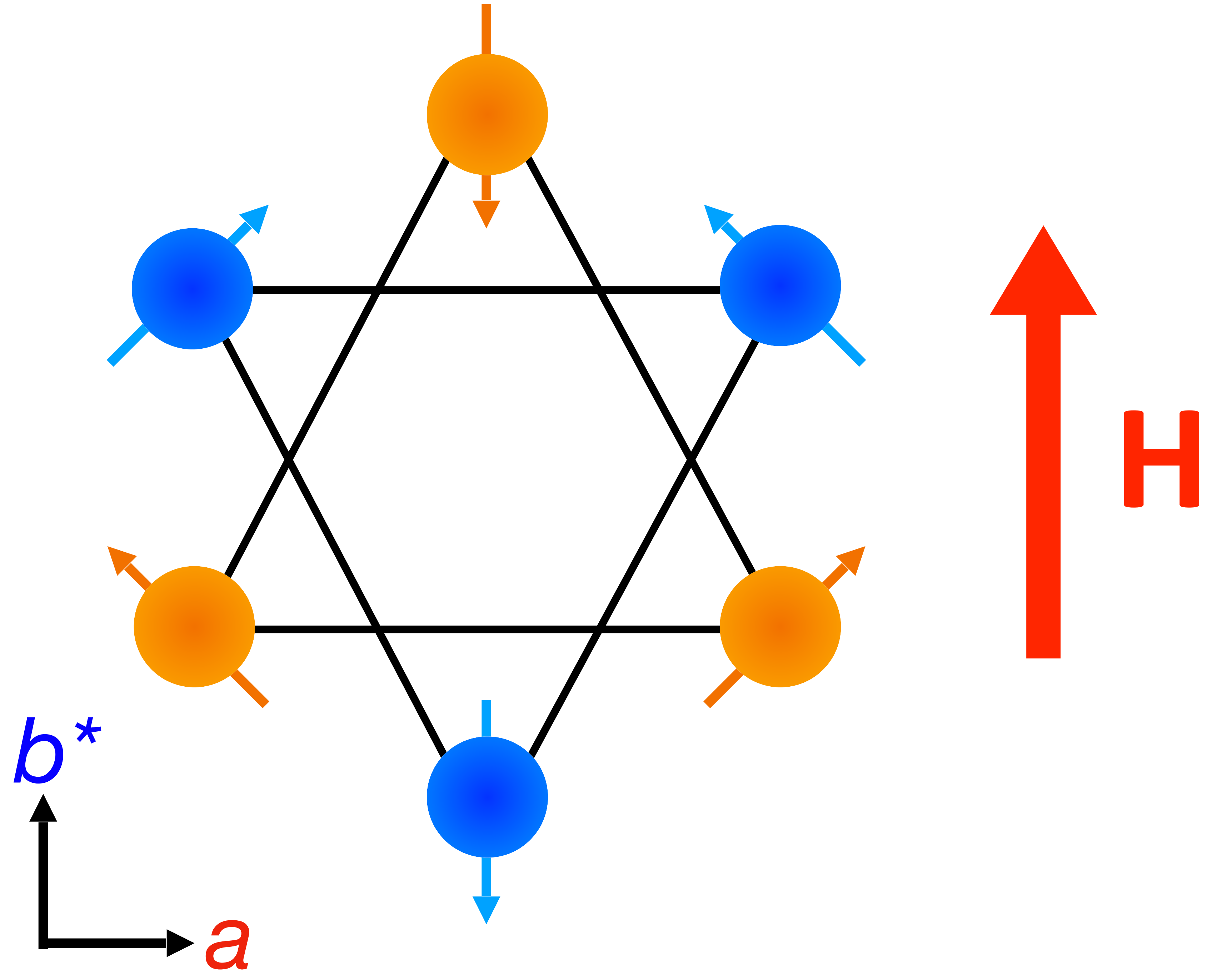

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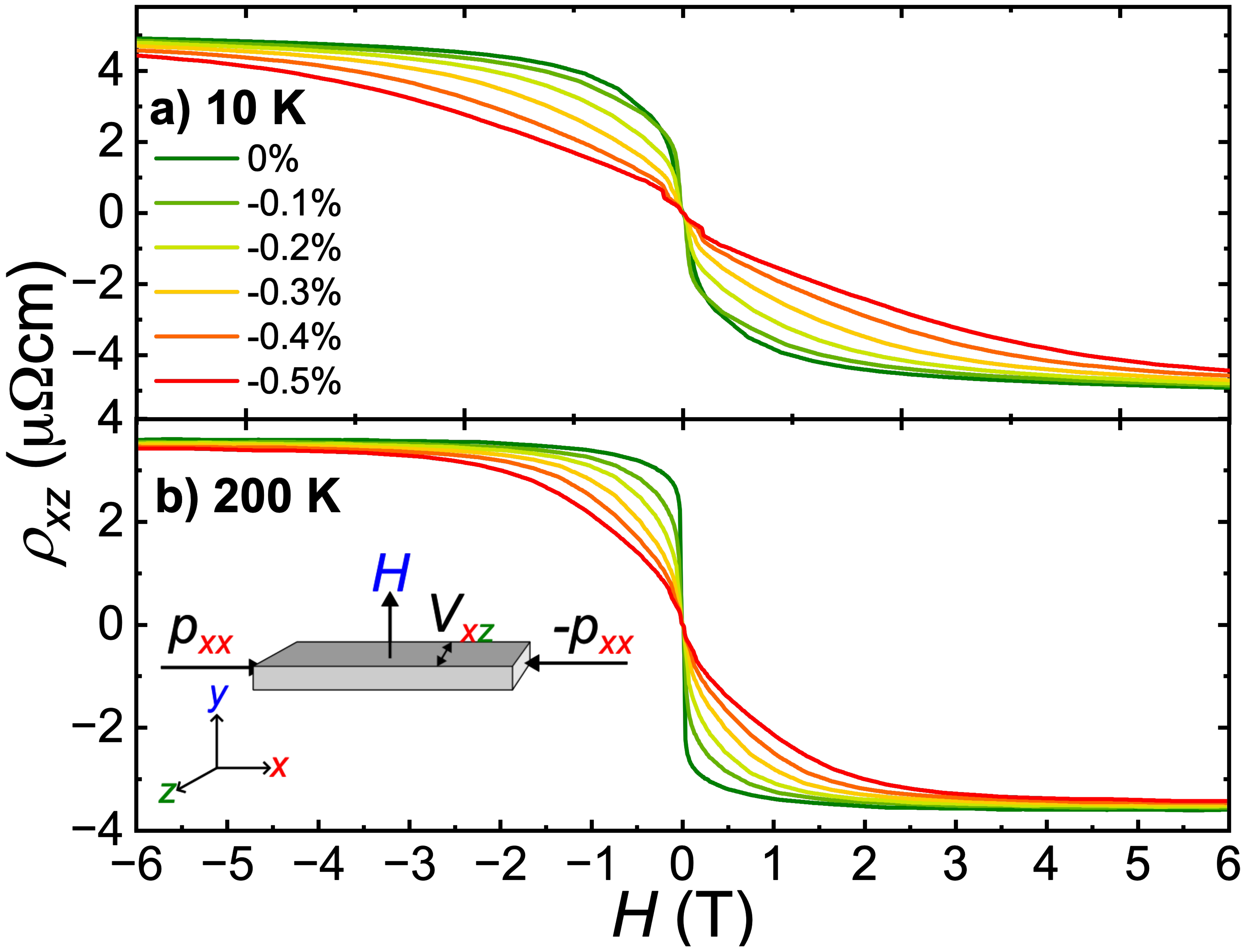
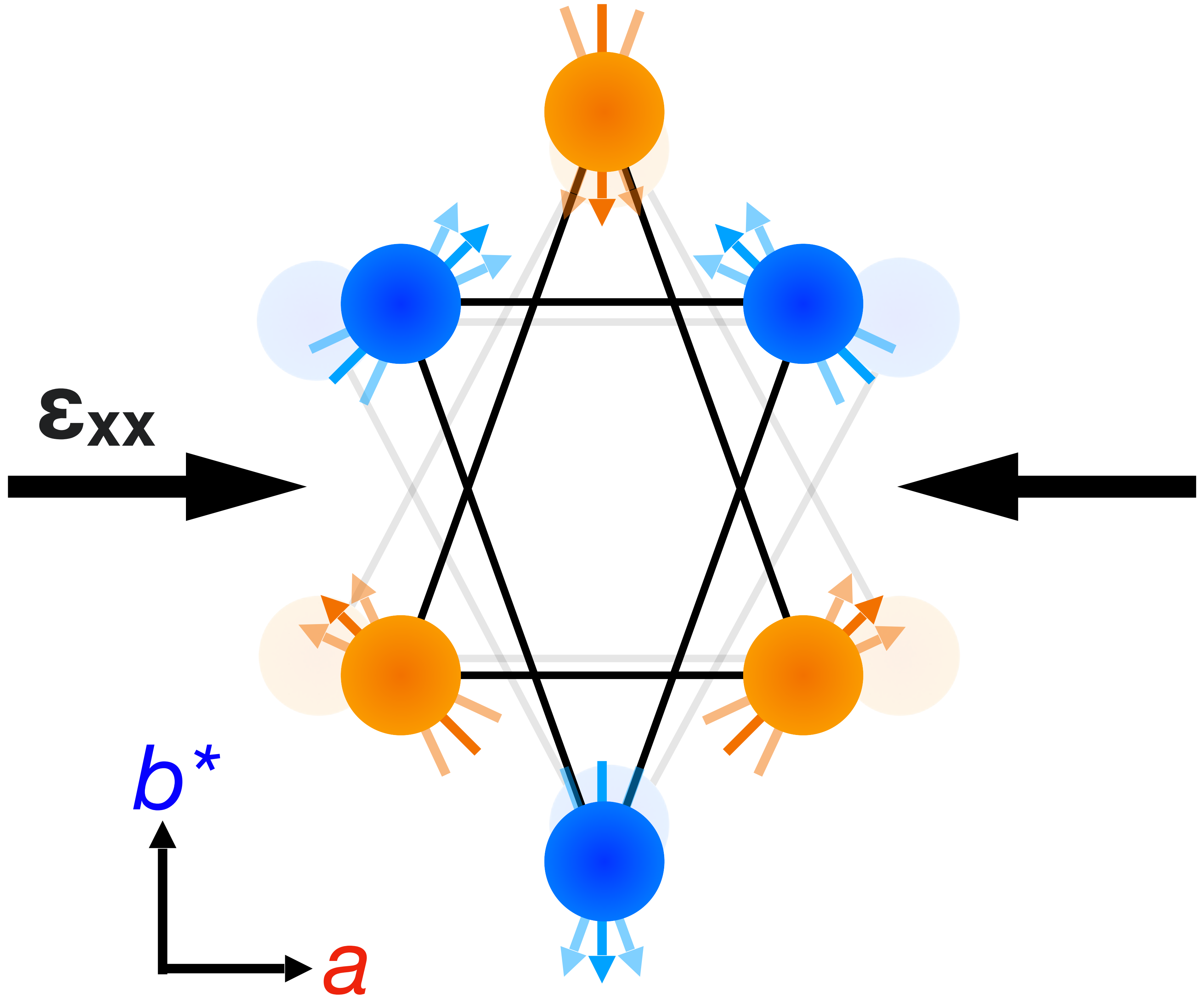
Results

Deformation of the triangular structure



Strain-dependent easy axis



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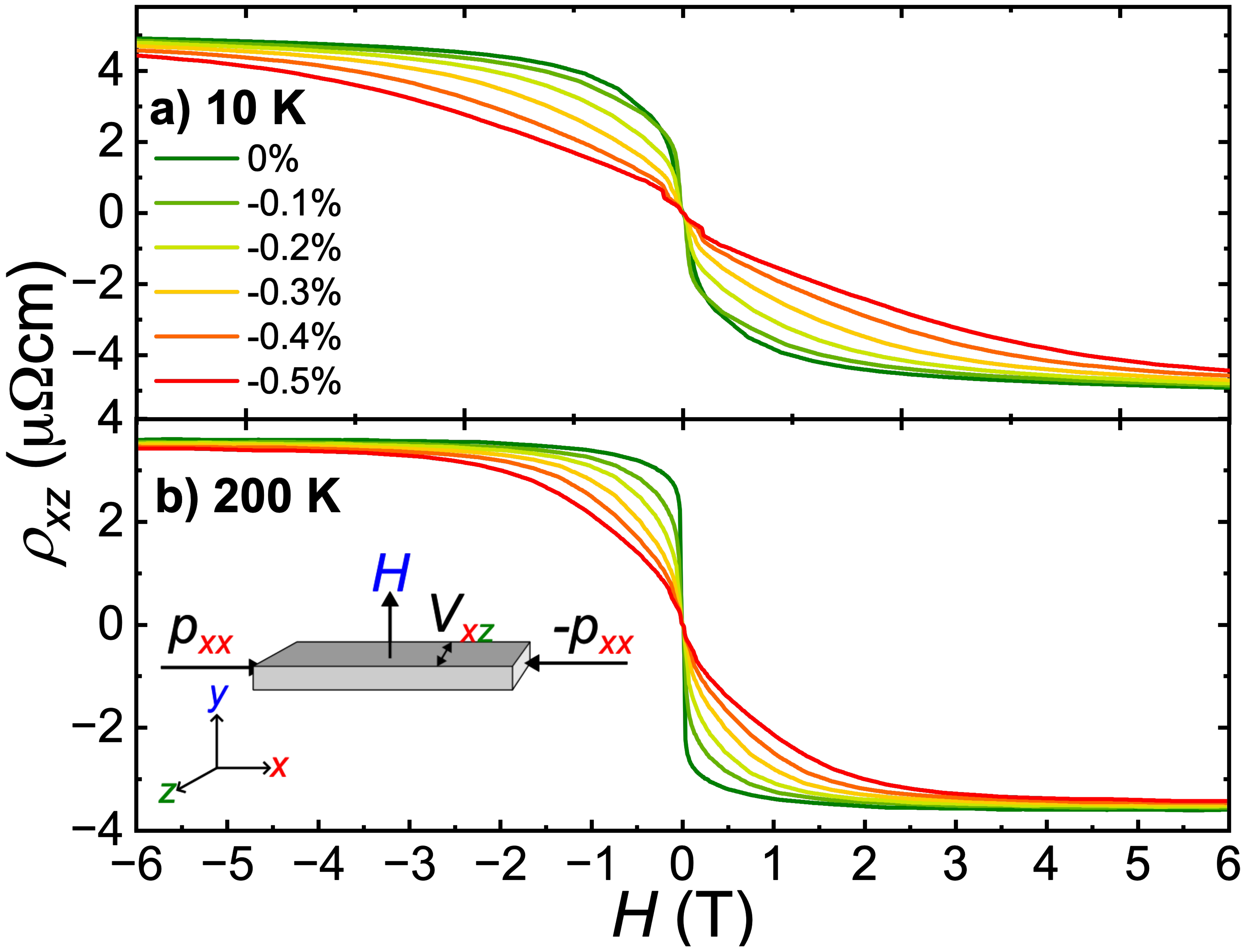

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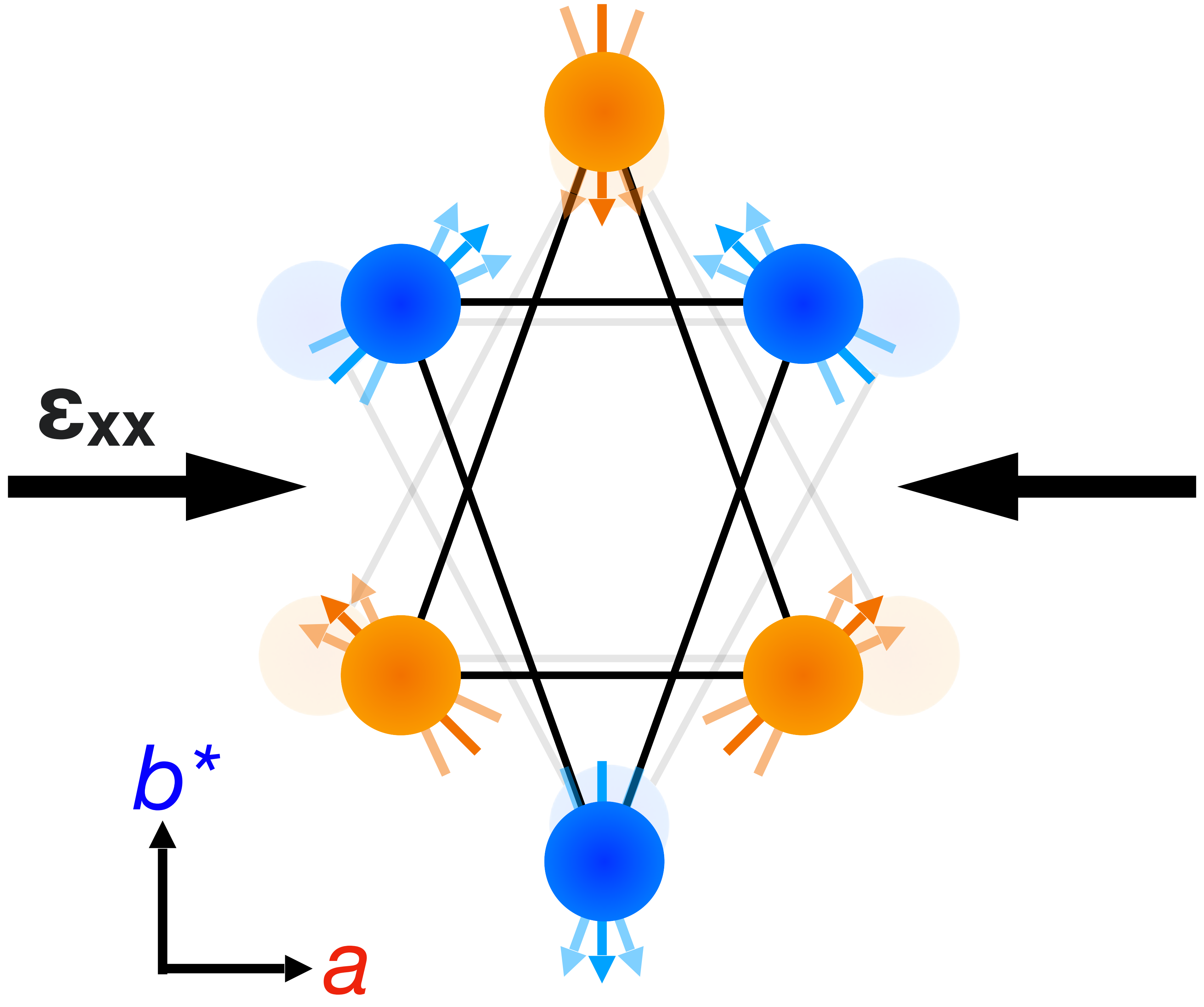

In-plane spin rotation

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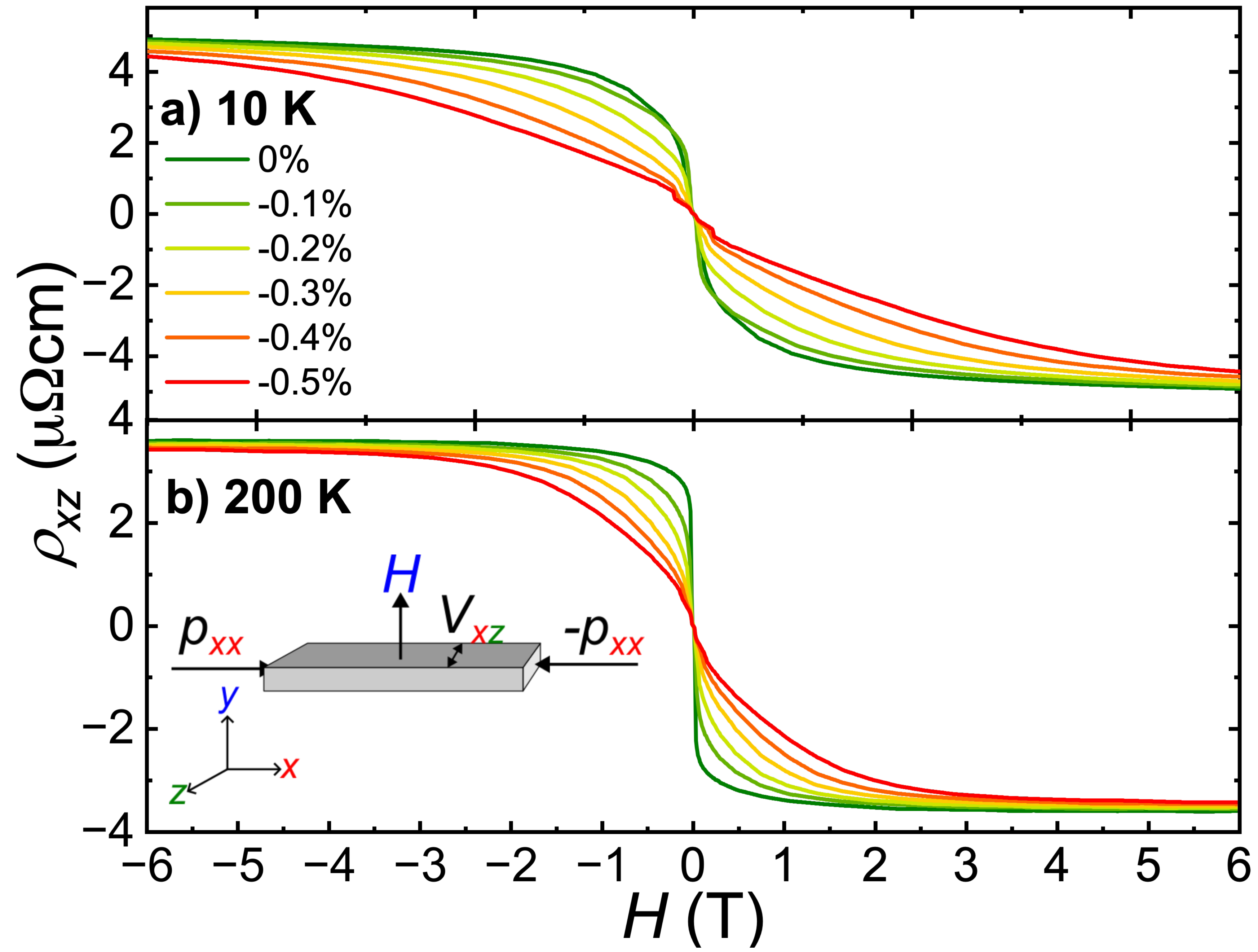
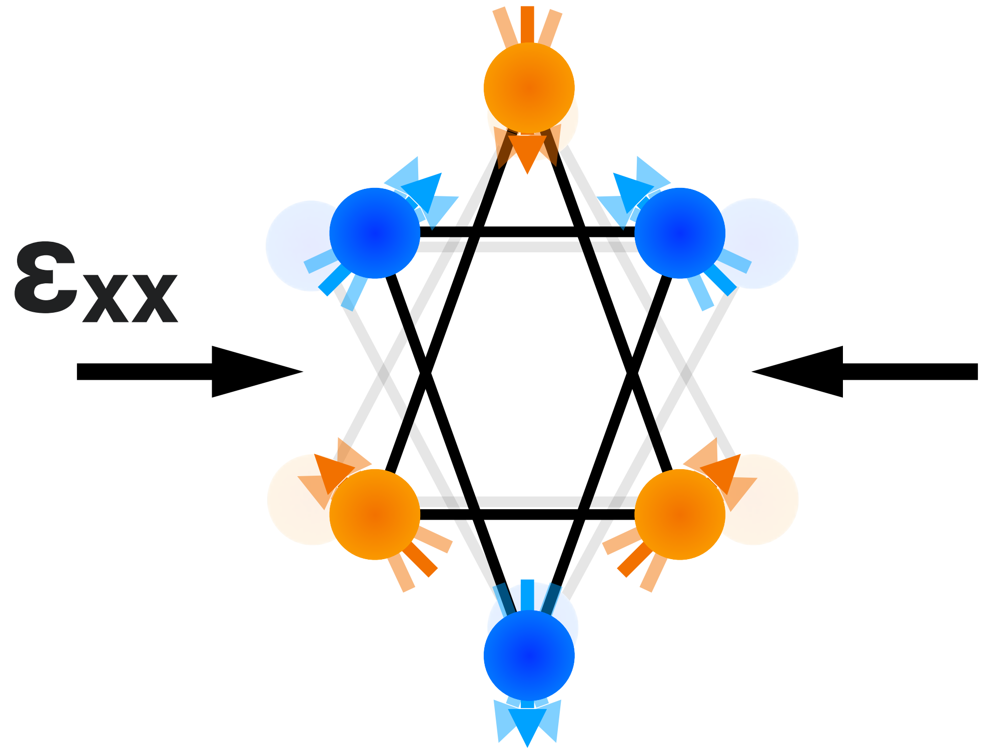
Conclusions

Effective tool to tune
Mn_3Ge spin structure

G. A. Lombardi et al., Phys. Rev. Mater. 9, 104204 (2025).





In-plane spin rotation

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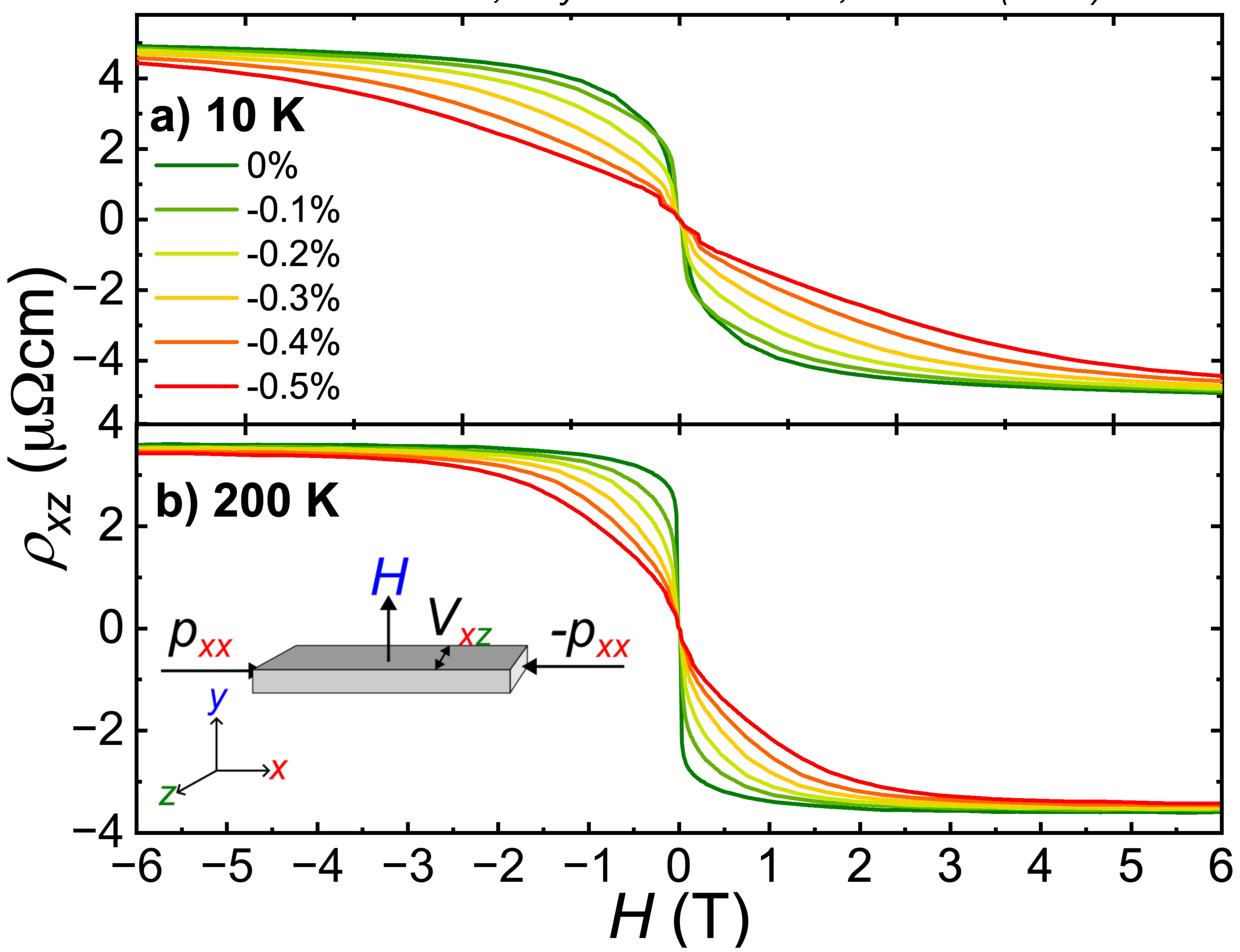

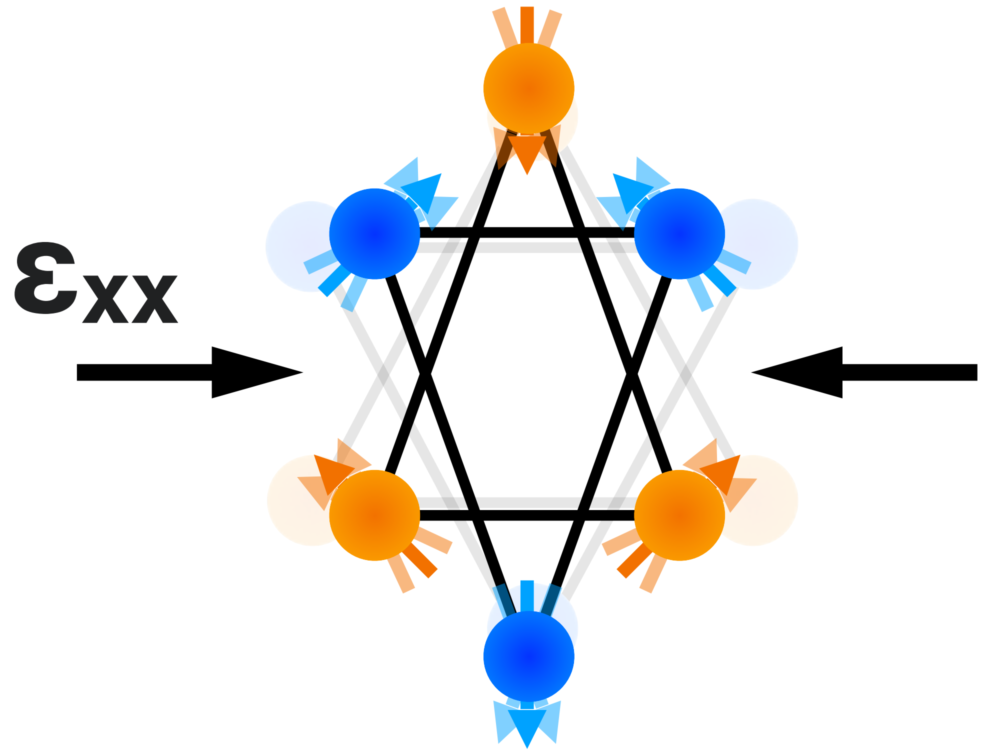

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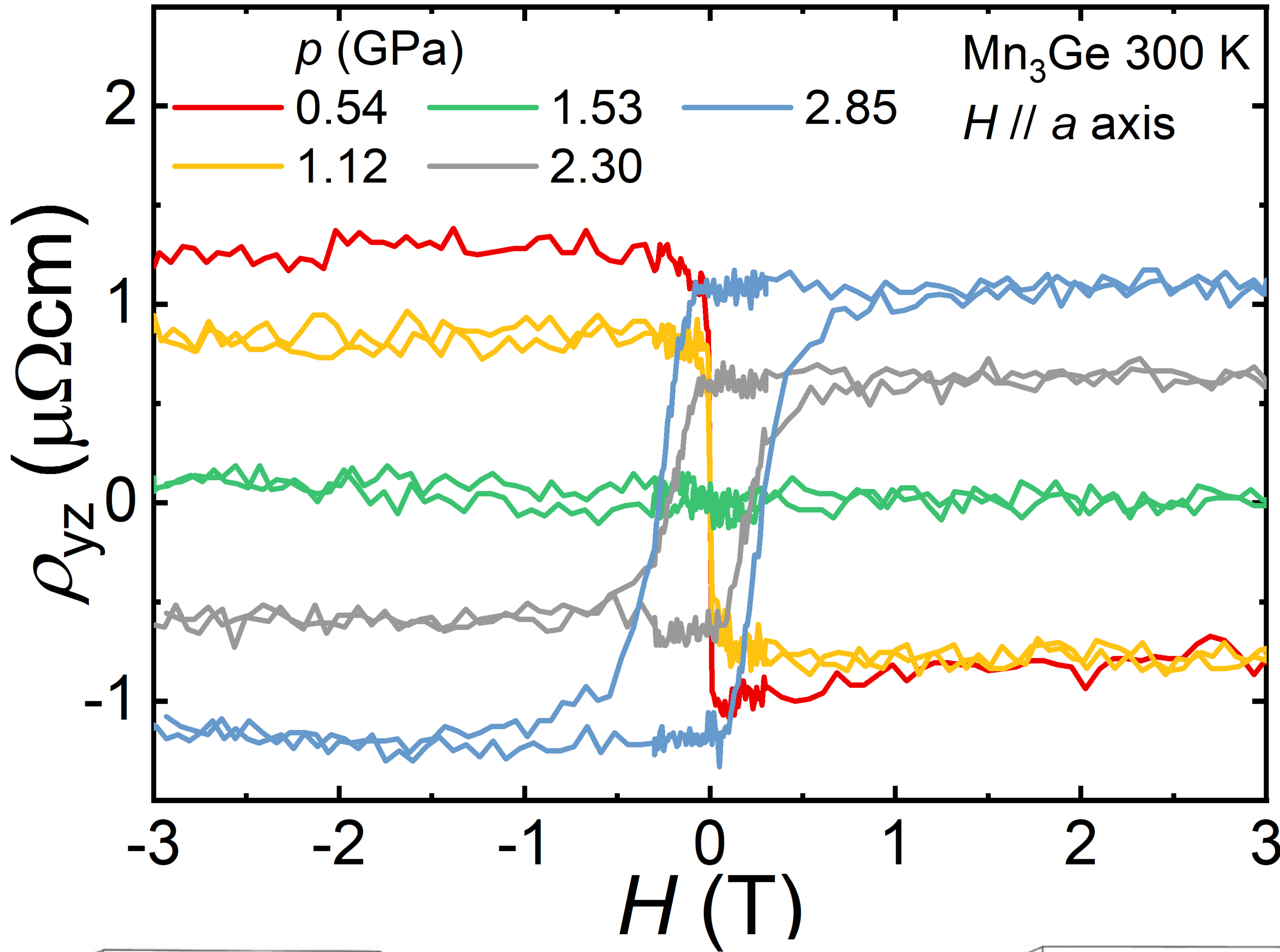
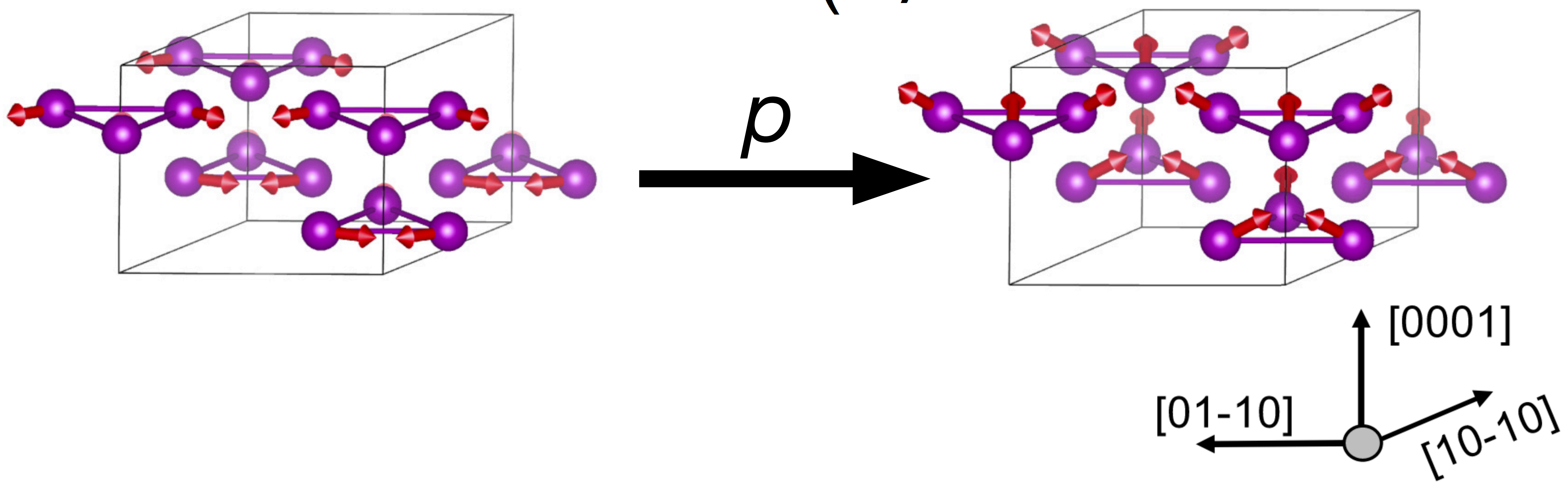
R. D. Dos Reis et al., Phys. Rev. Mater. 4, 51401 (2020).





Out-of-plane spin rotation

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Thank you!

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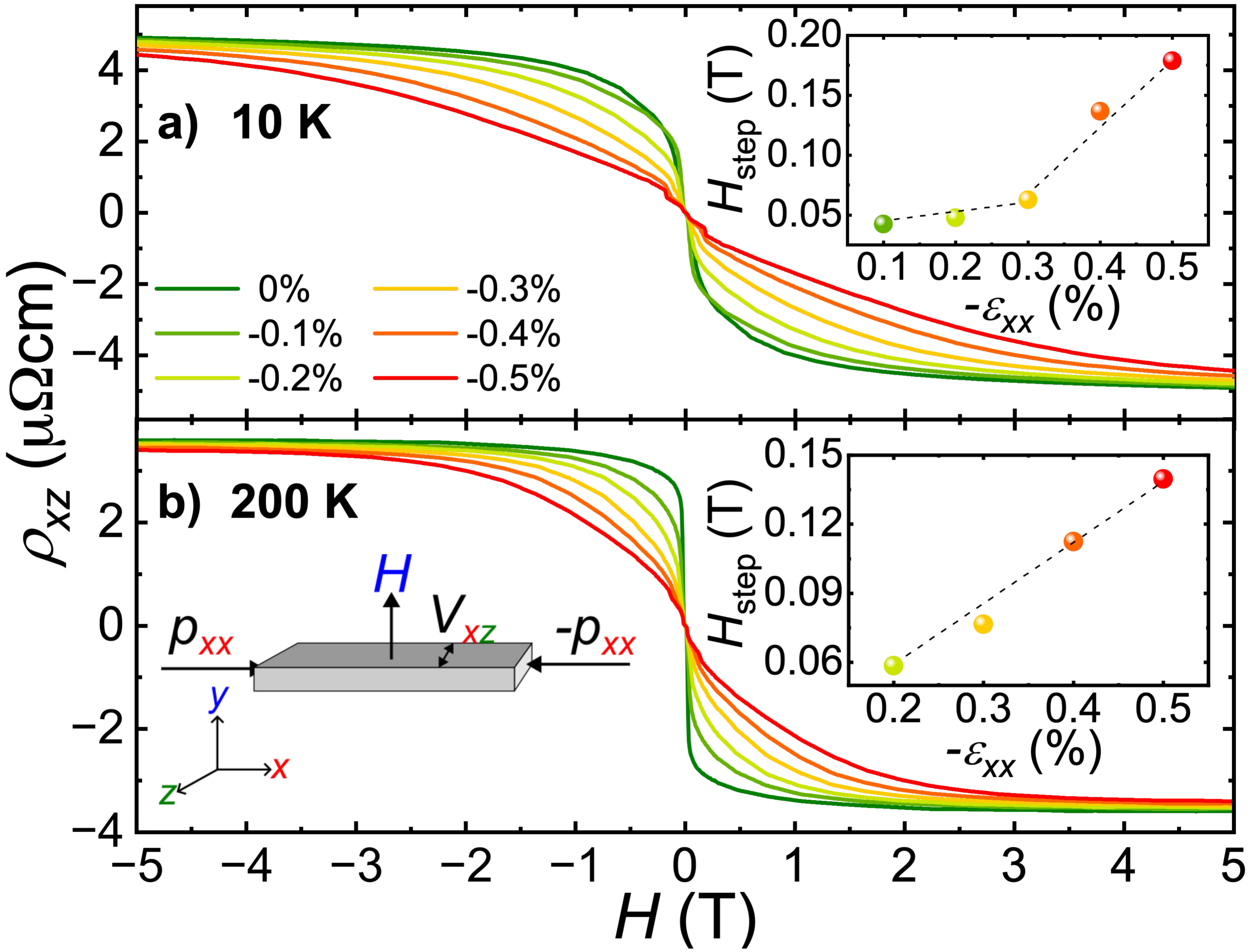

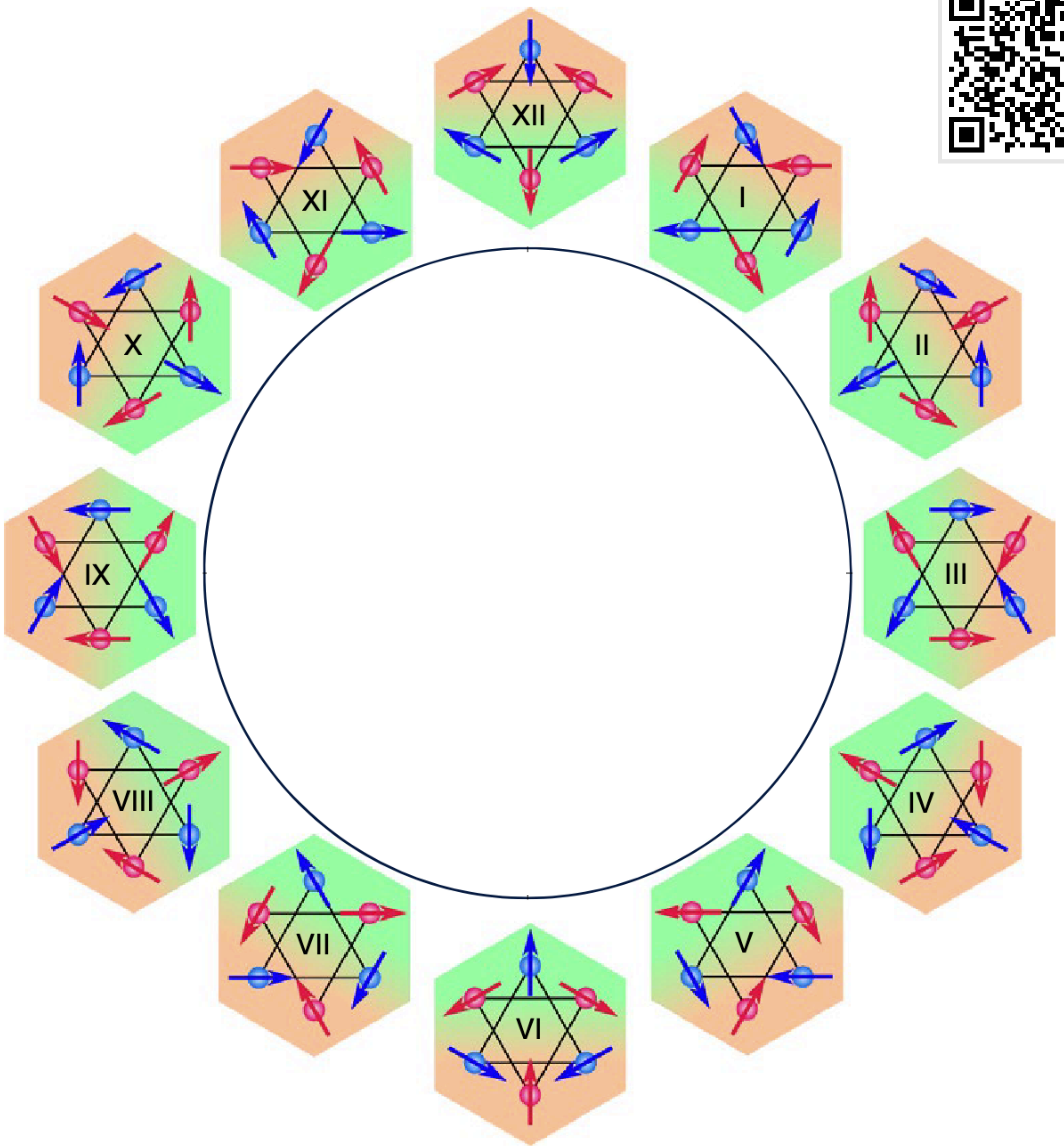

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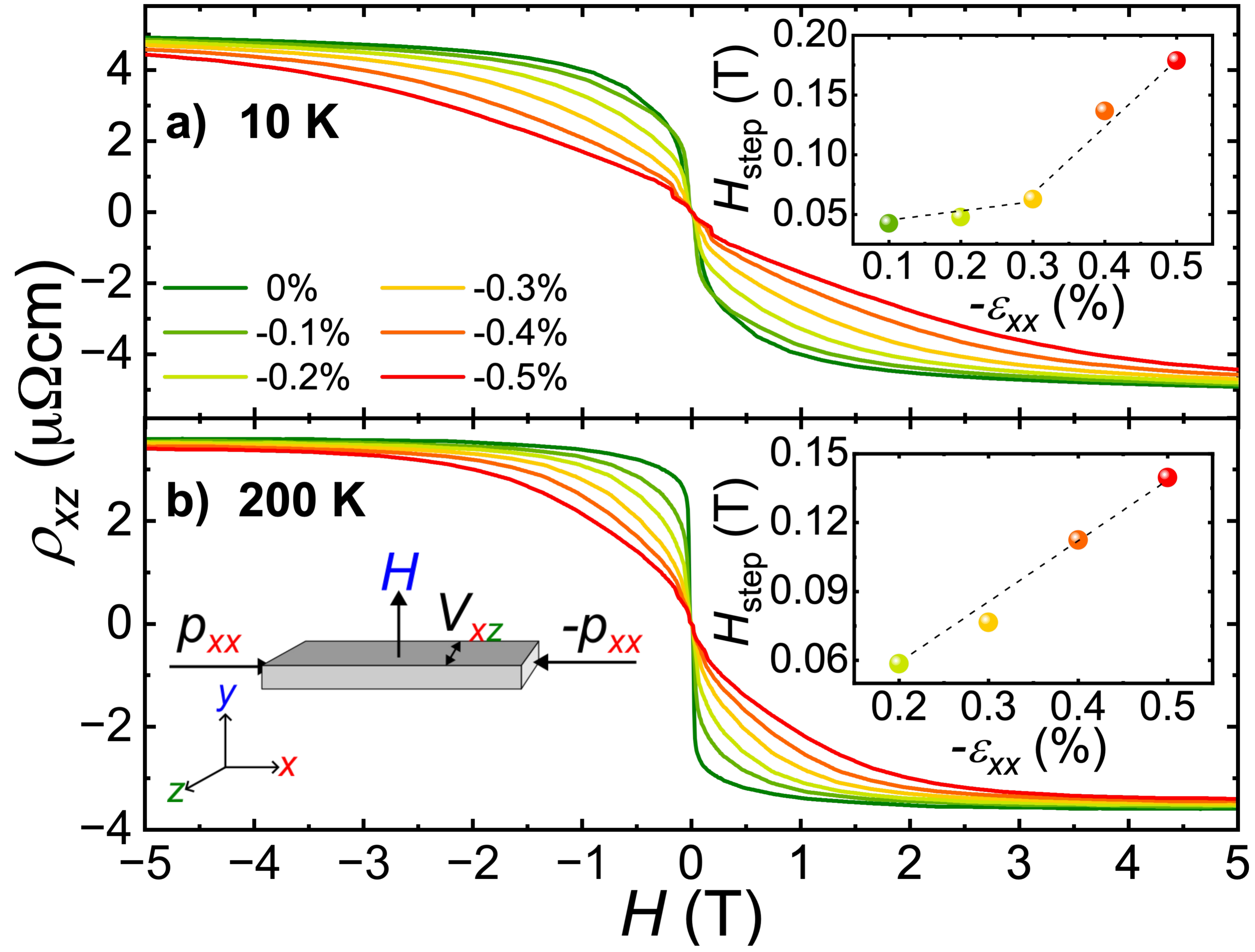

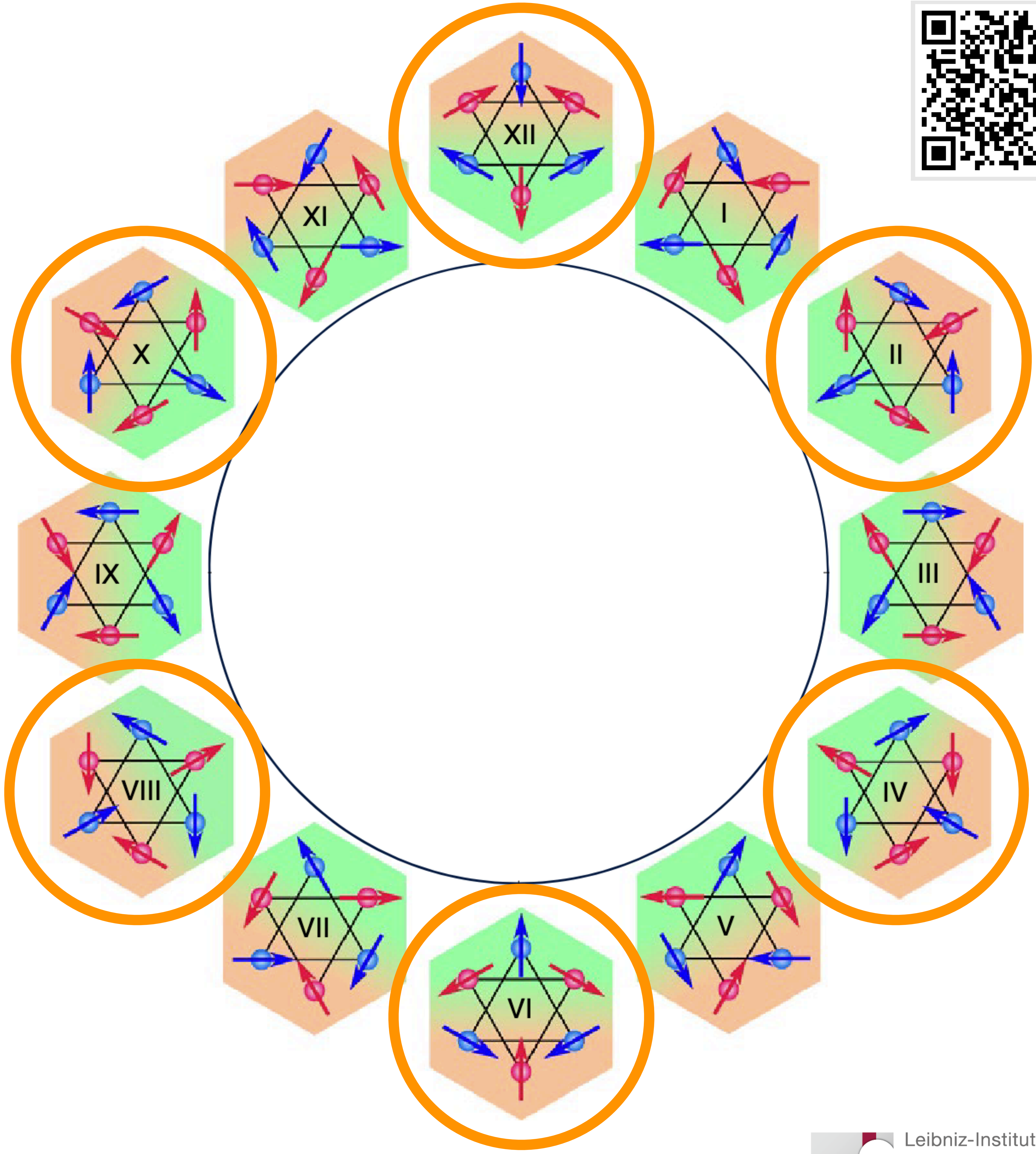

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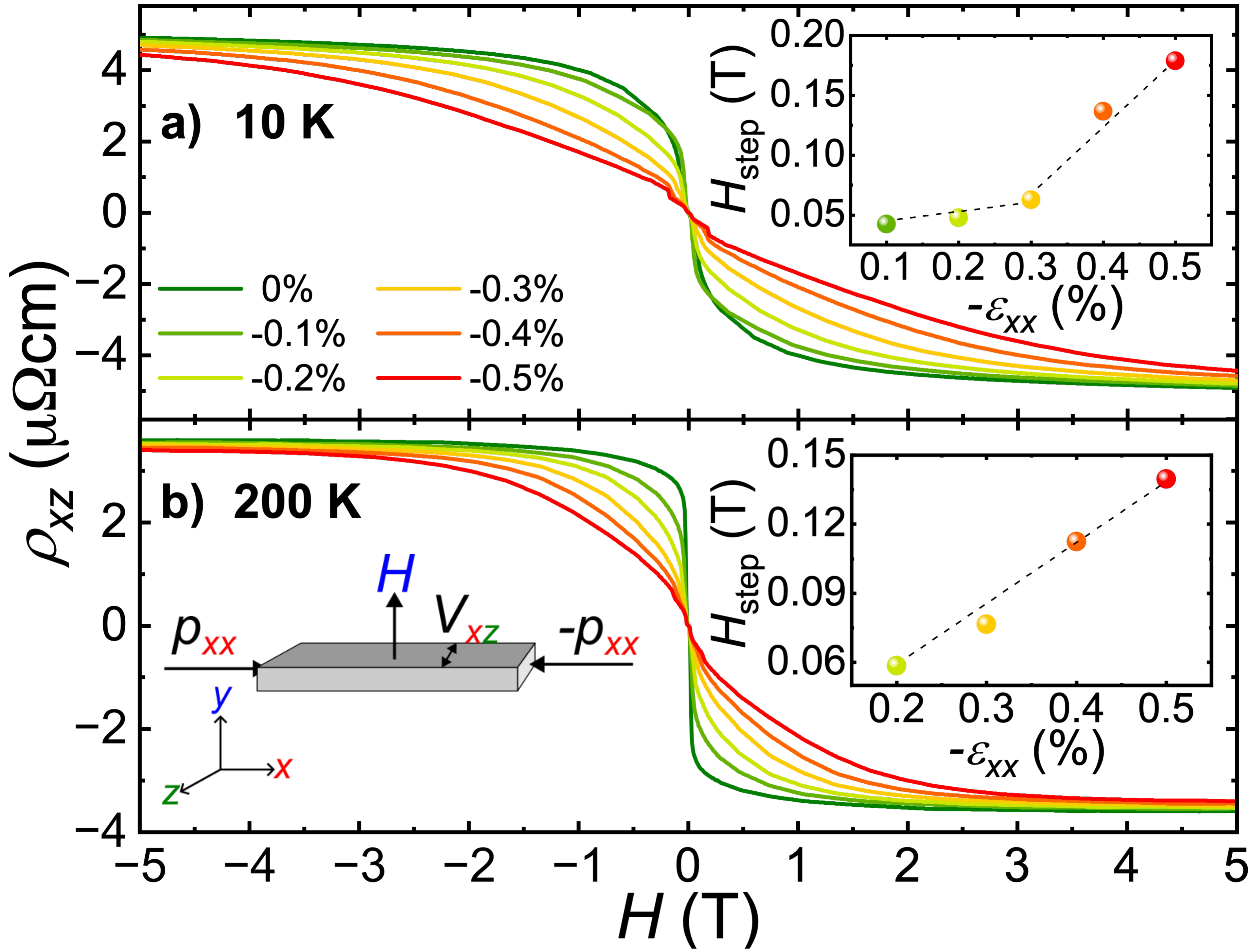

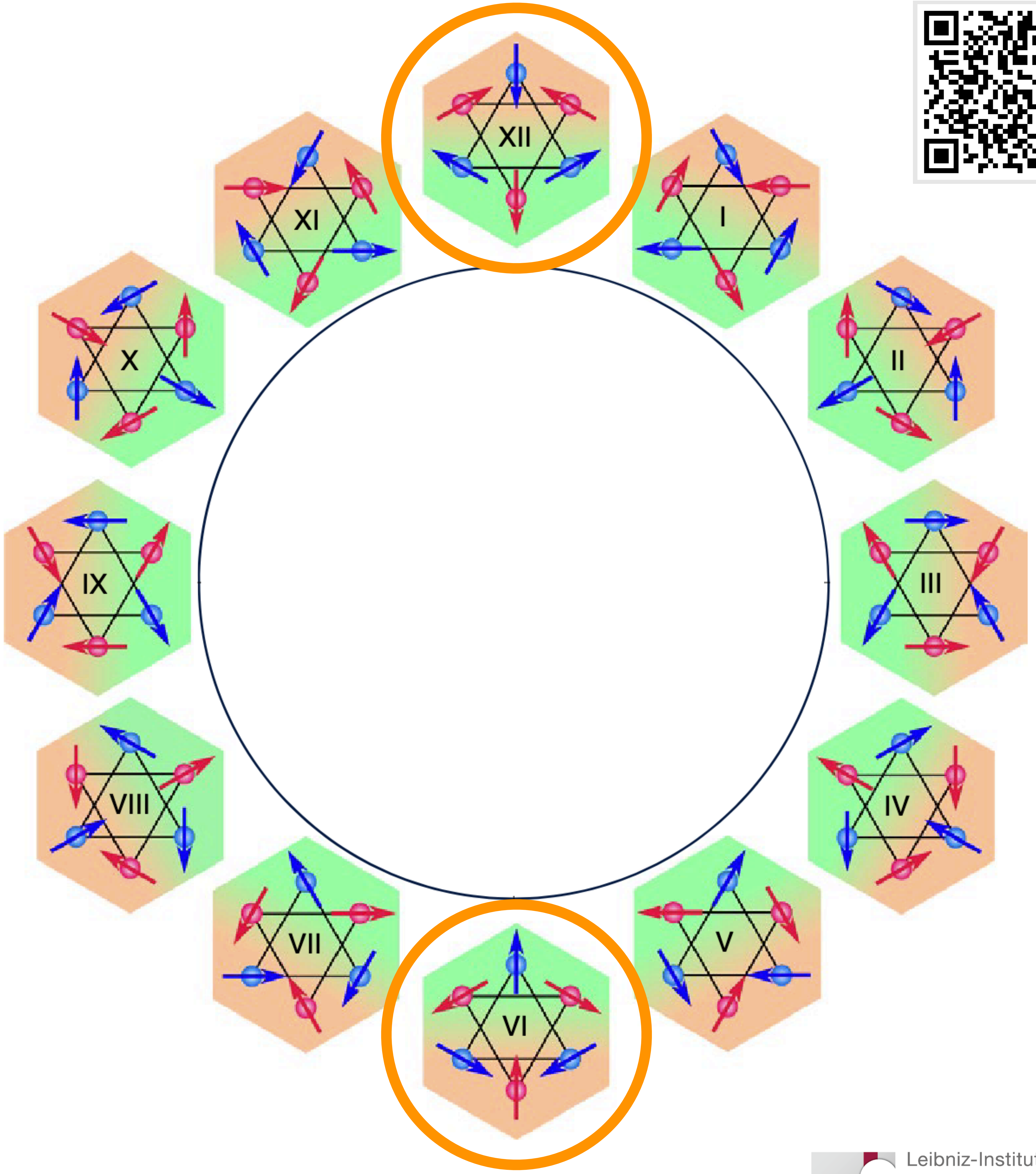

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