μSR applied to Superconducting & Magnetic Materials

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University of Zurich

Time reversal symmetry breaking

Cr-based superconductivity

Kagome systems: Charge order & superconductivity

Anomalous Hall effect

Collaborators

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Changsheng Chen

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PSI

Ola Forslund

Muoniverse – A Swiss Muon Science Initiative

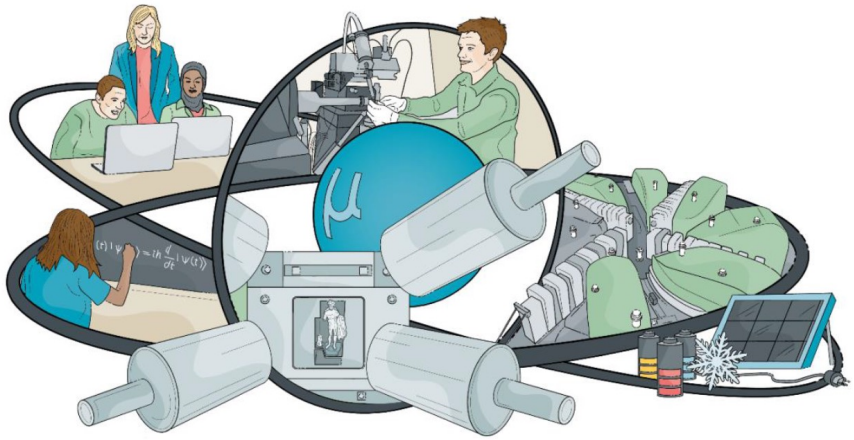
In the wake of the IMPACT/HIMB project (but not restricted to it) an initiative was launched in 2024 within Switzerland to foster muon science and collaborations – **Muoniverse**

Swiss partners from

- Universities
- Research institutes
- Museums

Fundamental science, technology and applications

- Particle physics
- Condensed matter physics
- Material science
- Electrochemistry and batteries
- Cultural heritage and archeology



Example

- PSI and University of Zürich are working on the appointment of a joint professorship on μSR

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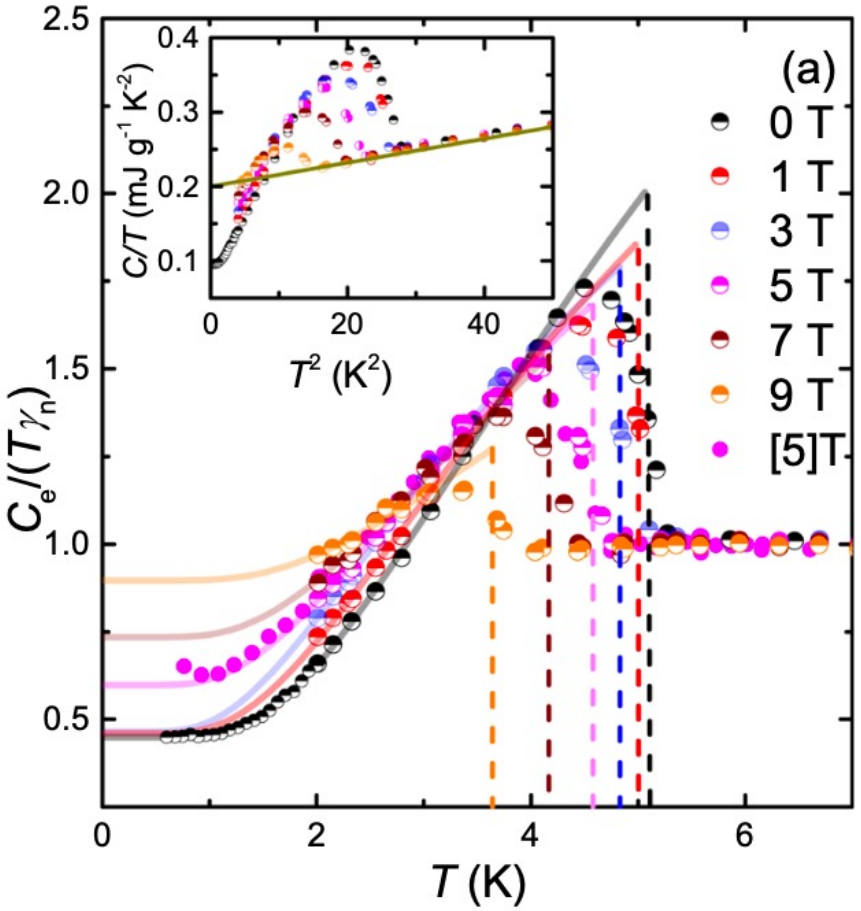
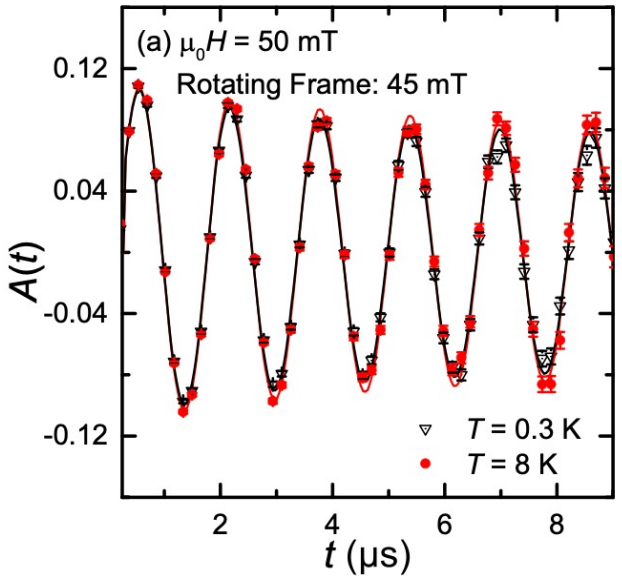
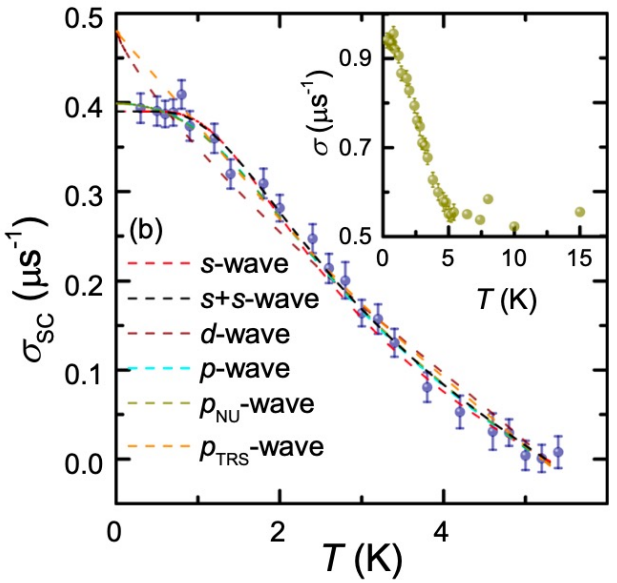
Cr-based superconductor: $Pr_3Cr_{10-x}N_{11}$







C.S. Chen et al.,
npj Quantum Materials 9, 22 (2024)

Evidence of p-wave superconductivity

Table 1 | Fitting parameters for different gap symmetry models

Model	s	$s+s$	$p_x \pm ip_y$	$\hat{x}p_x + i\hat{y}p_y$	p_x	$d_{x^2-y^2}$
$g(\varphi)$	1	1	$\lvert \sin\theta \rvert$	$NU(\theta, \varphi)$	$\lvert \sin\theta\cos\varphi \rvert$	$\lvert \sin^2\theta\cos 2\varphi \rvert$
Δ_0	0.46(1) meV	0.52(3) (80%) 0.2(1) (20%)	0.59(1) meV	0.67(3) meV	0.85(1) meV	0.990(3) meV
Δ_0/k_BT_c	1.02(3)	1.19(4) 0.46(9)	1.30(4)	1.5(2)	1.88(5)	2.18(1)
Nodes	\	\	Point	Point	Line	Line
TRS	Conserved	Conserved	Broken	Broken	Conserved	Surface state broken bulk state conserved
χ^2	0.663	0.618	0.676	0.775	1.73	1.98
Plot						

C.S. Chen et al.,
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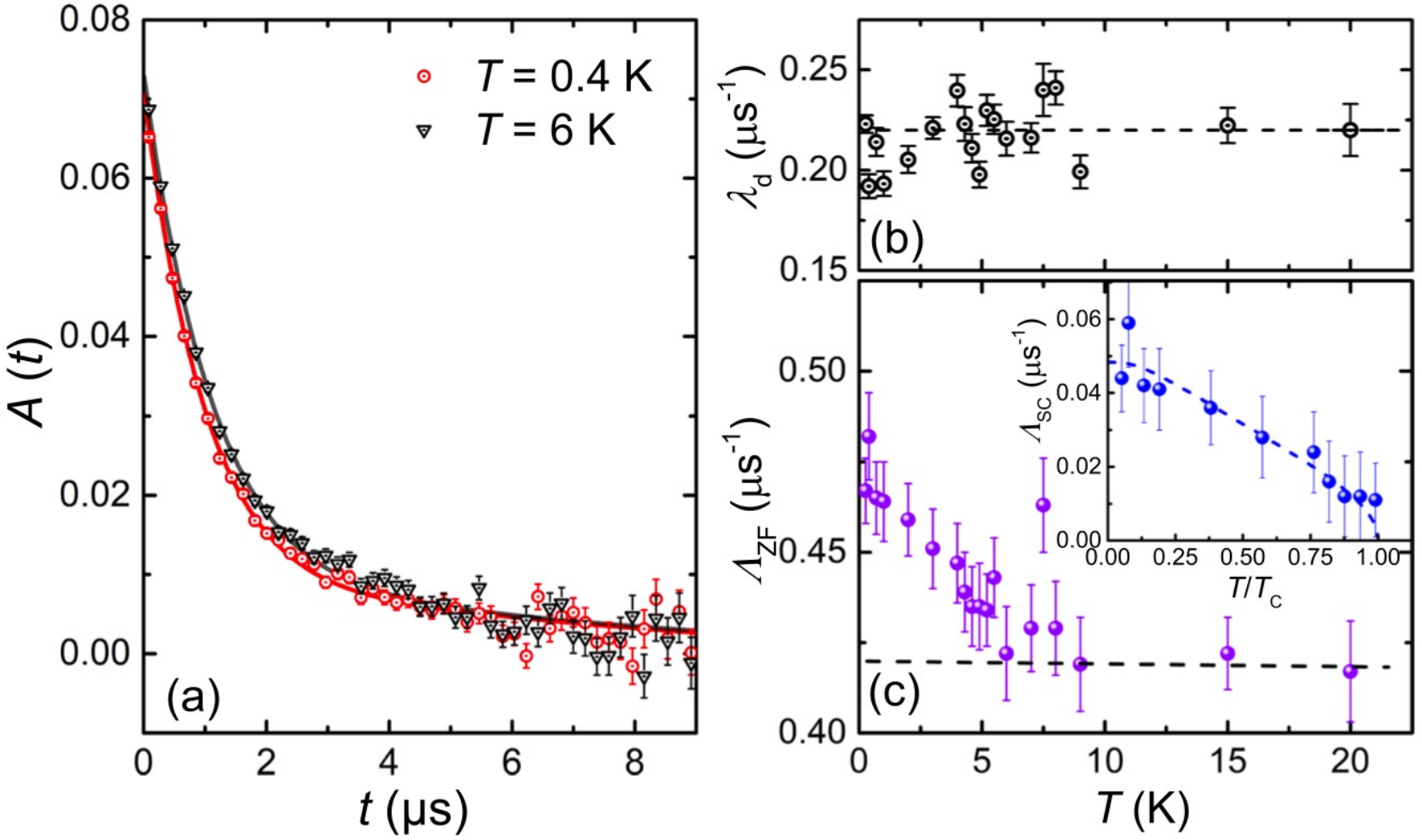
Time-reversal symmetry breaking



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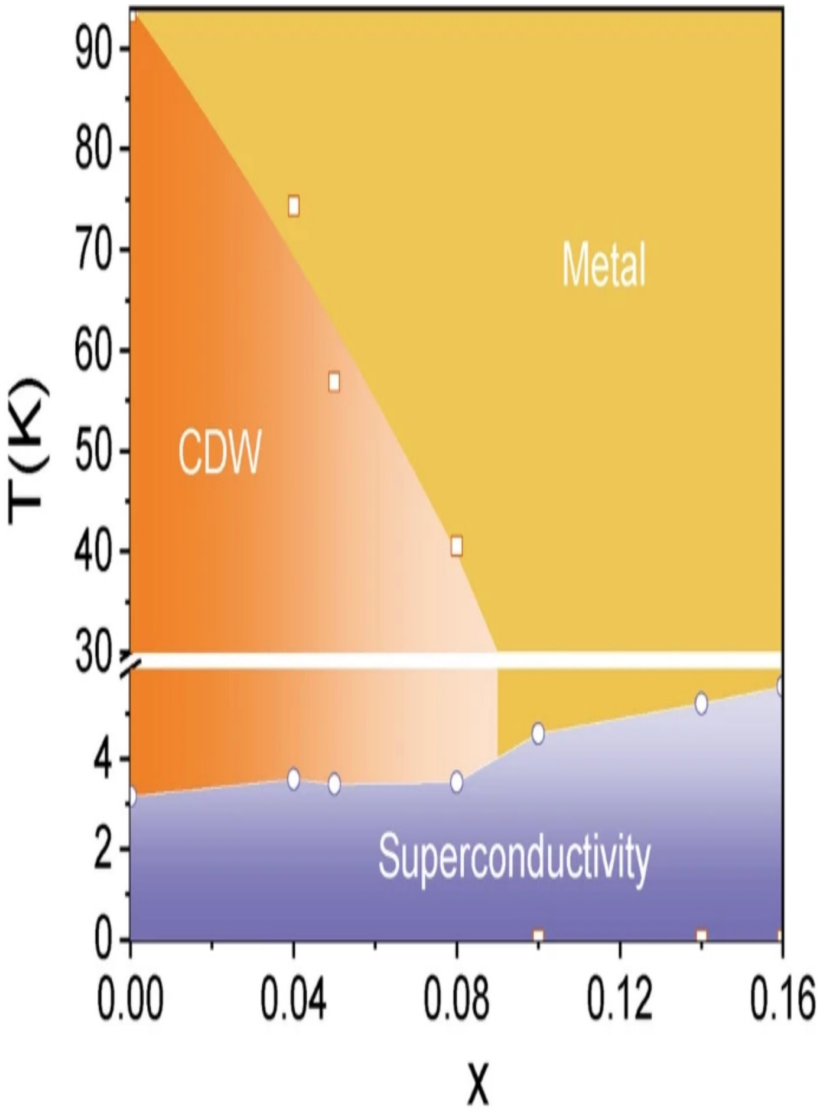
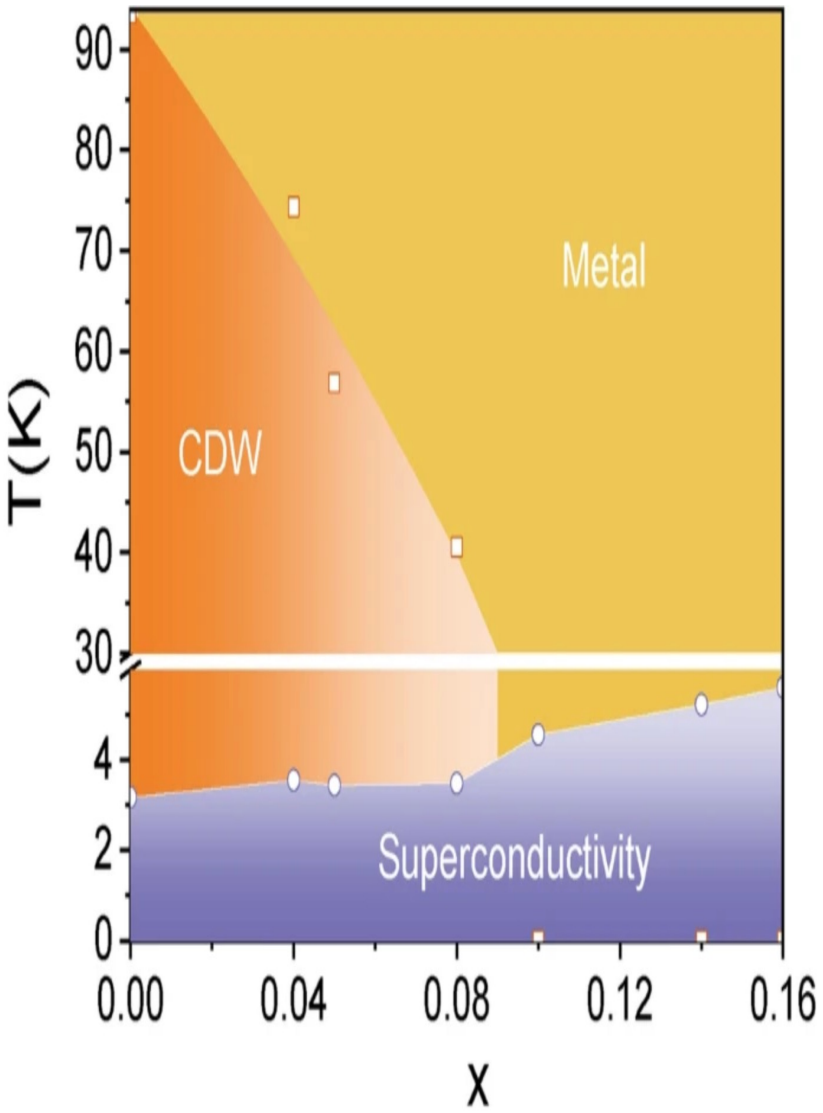
Kagome metals

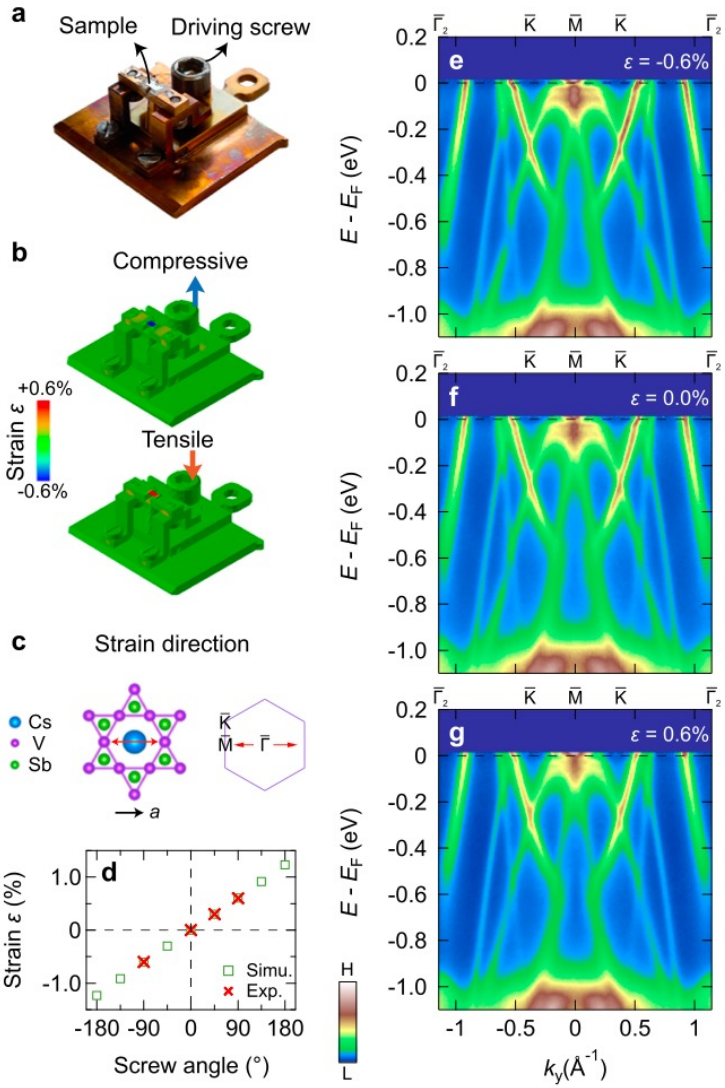


Jinjin Liu et al., *Scientific Reports* 14, 9580 (2024)

Kagome metals



Jinjin Liu et al., *Scientific Reports* 14, 9580 (2024)



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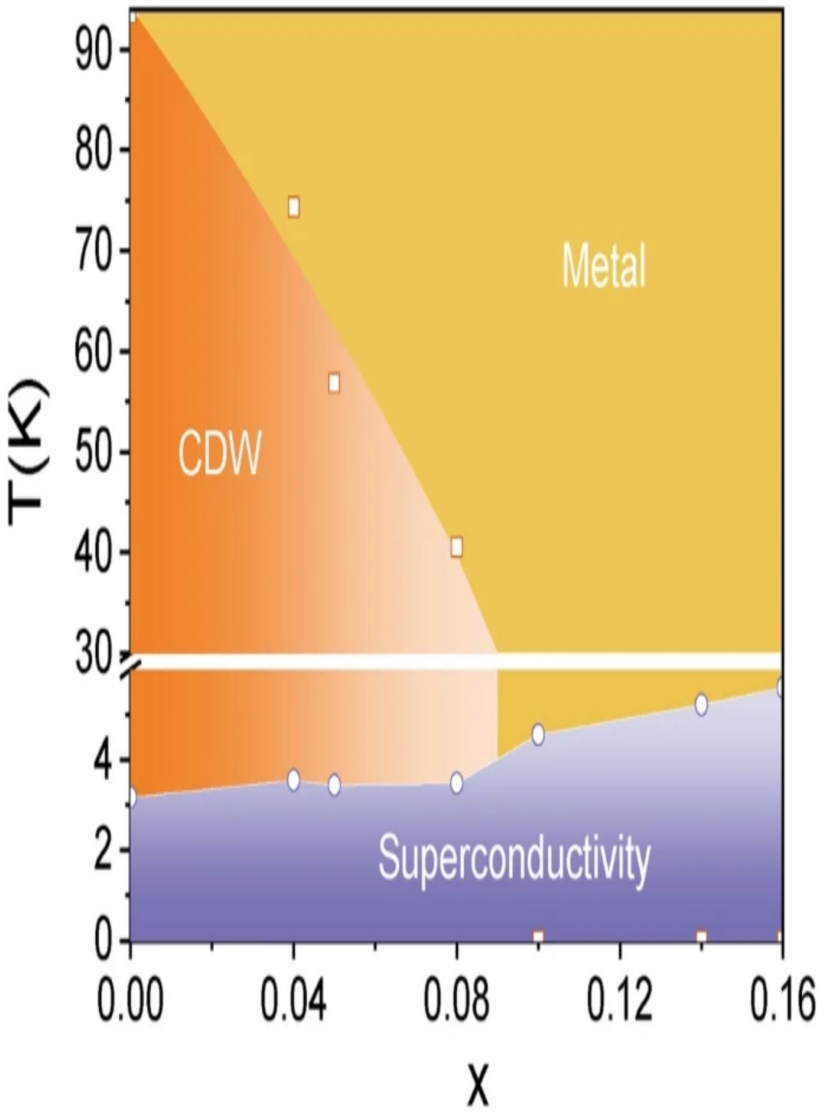
Nat. Comm. 15, 10466 (2024)

Kagome metals



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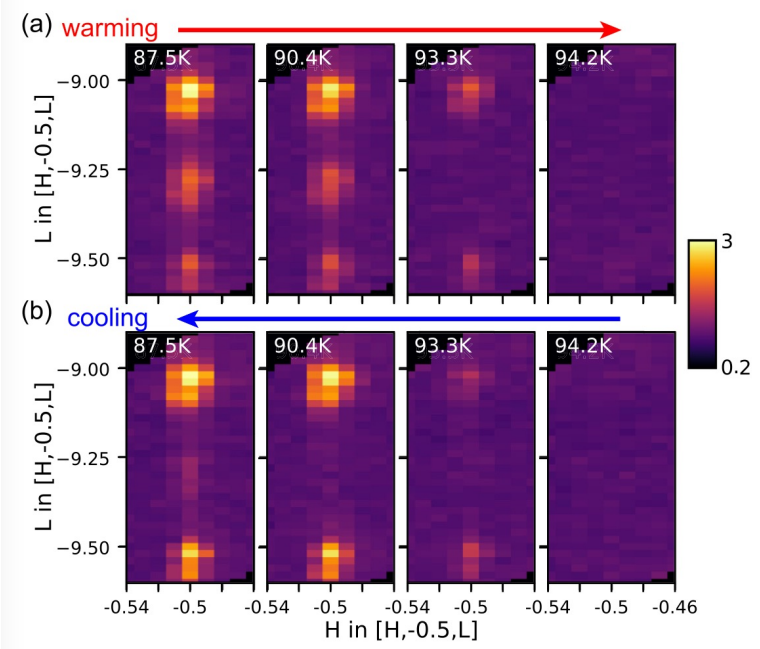

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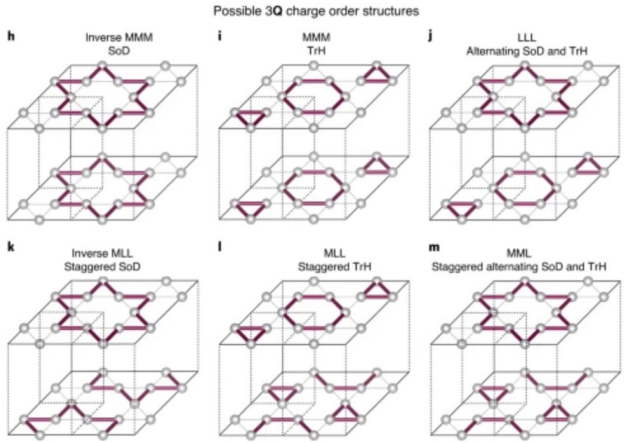
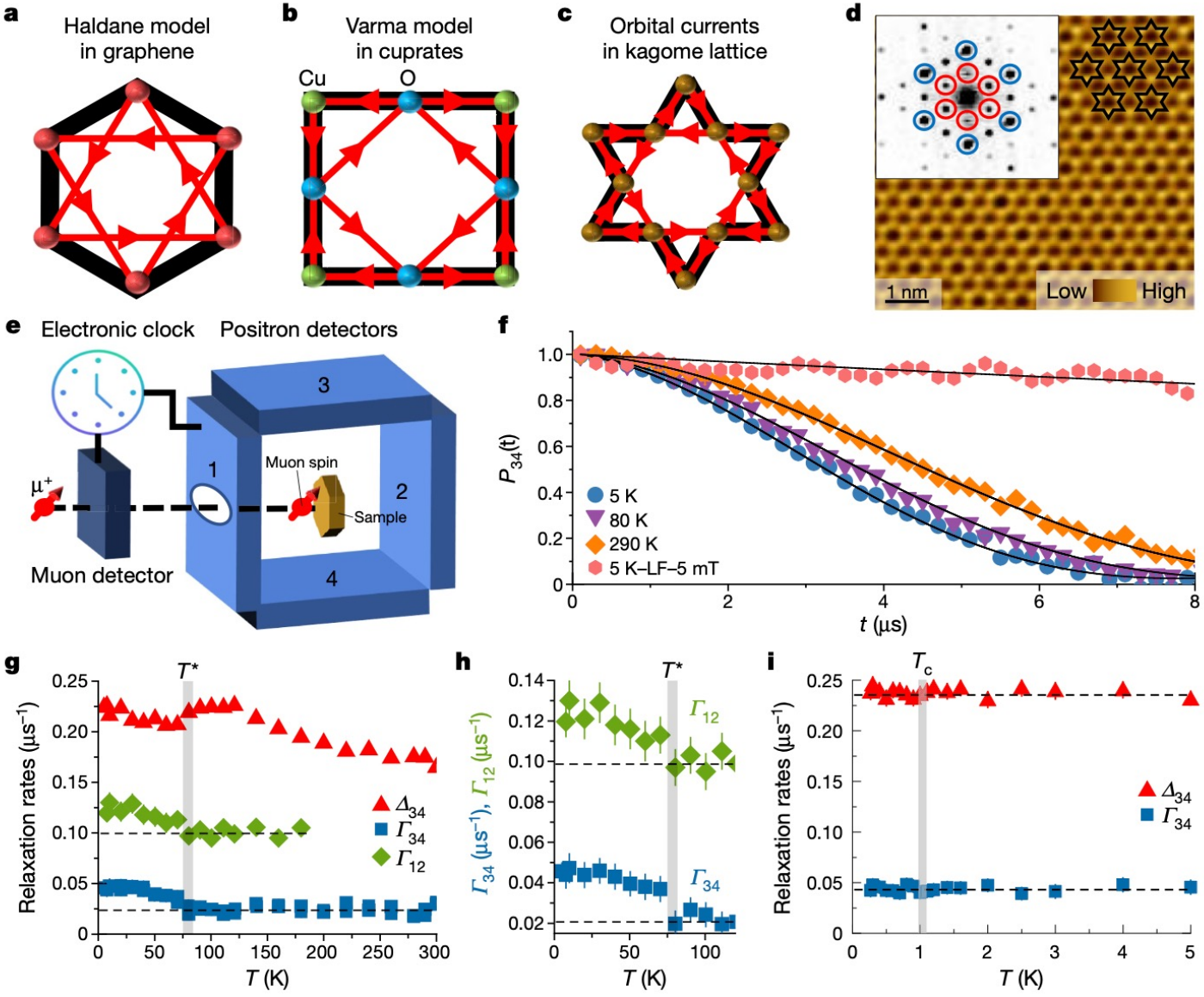
PRR **5**, L012032 (2023)



M. Kang et al.,
Nat. Mat. **22**, 186 (2023)

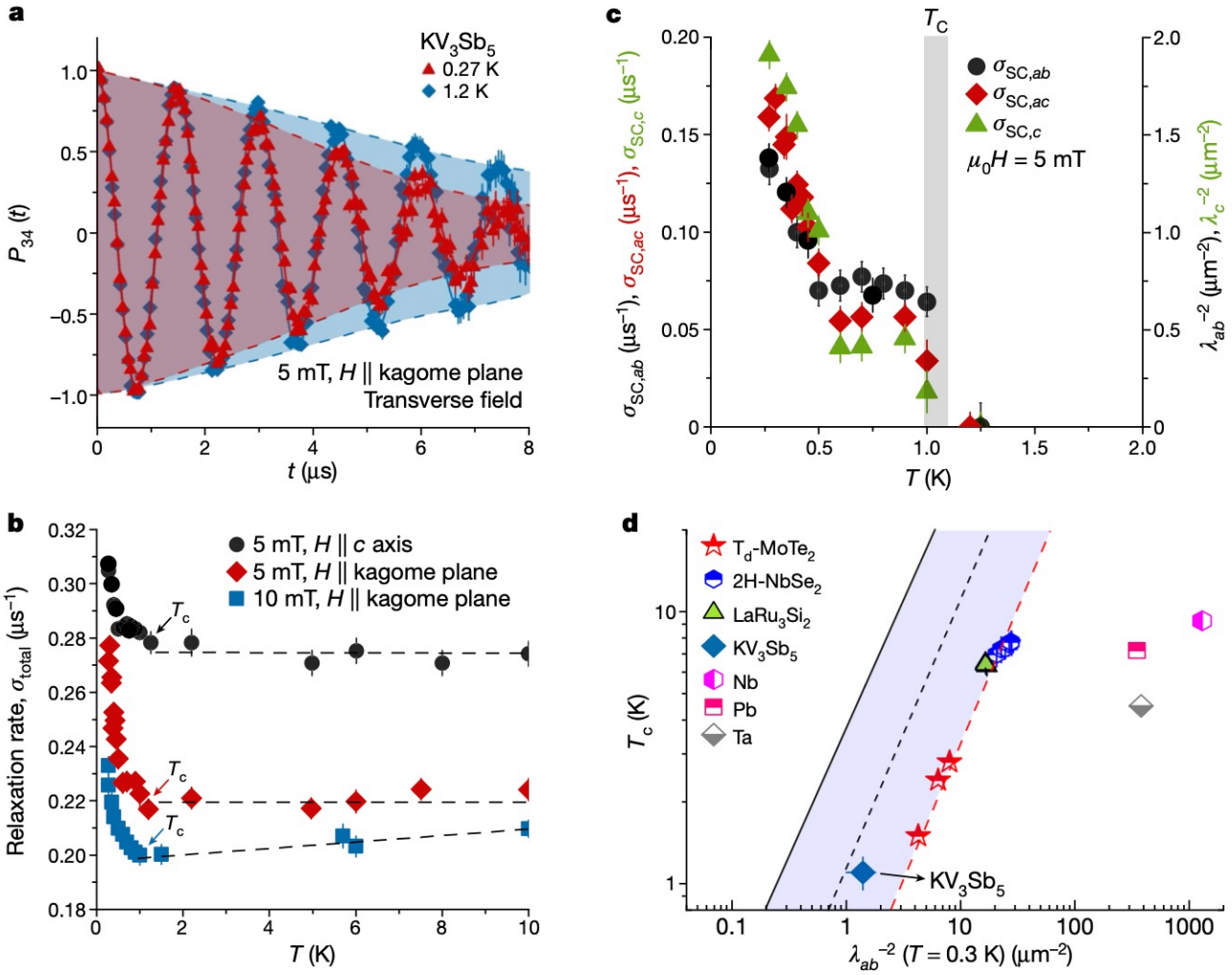
Loop current order



KV_3Sb_5

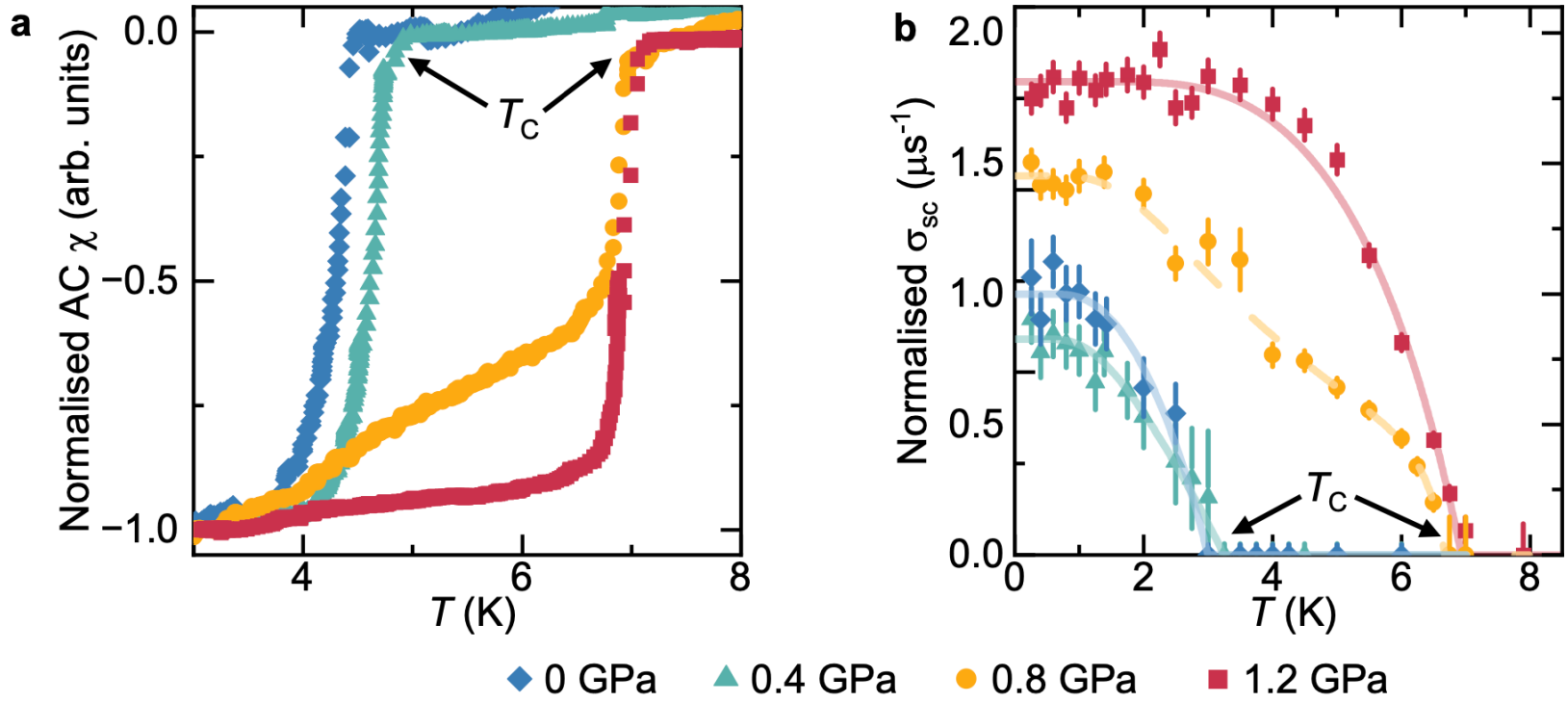
Charles Mielke et al.,
Nature **602**, 245 (2022)

Superconductivity & TRSB



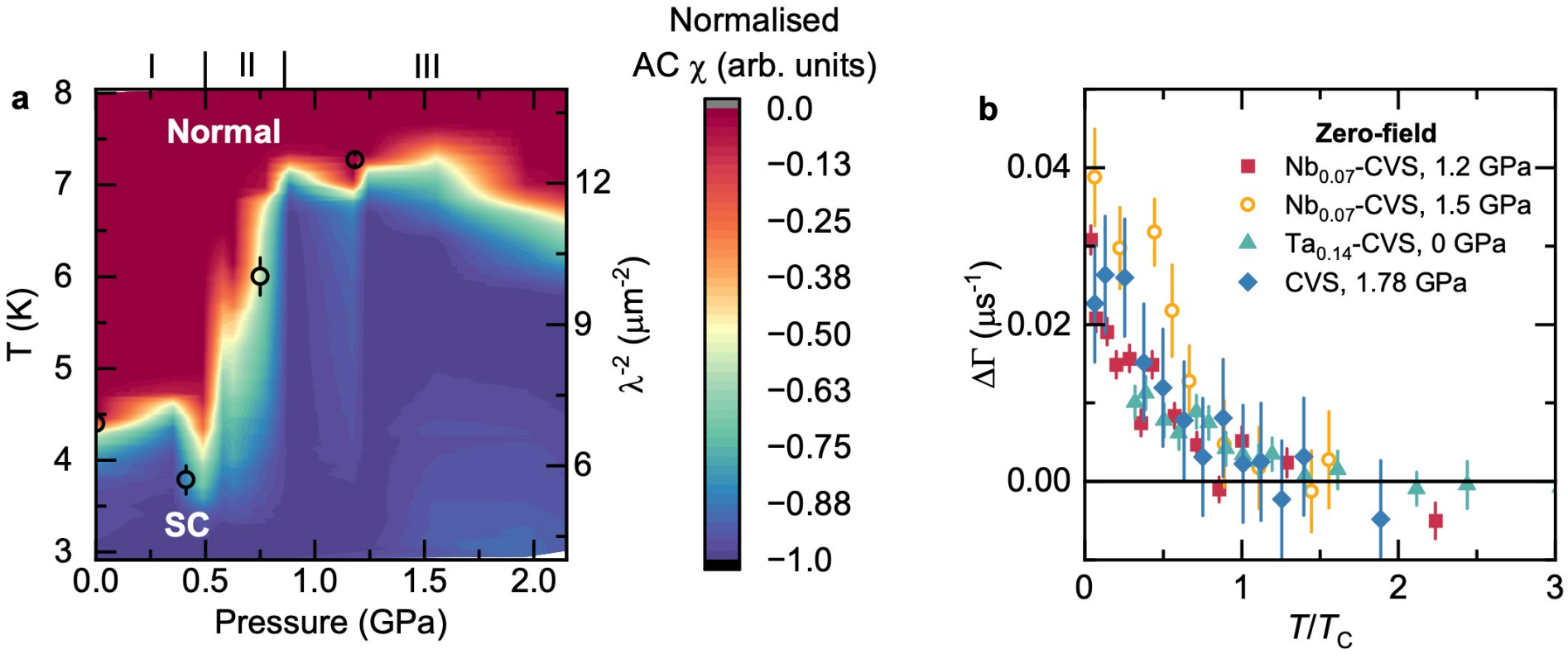
Charles Mielke et al.,
Nature **602**, 245 (2022)

Superfluid density



J.N. Graham et al.,
arXiv:2411.18744

Time reversal symmetry breaking



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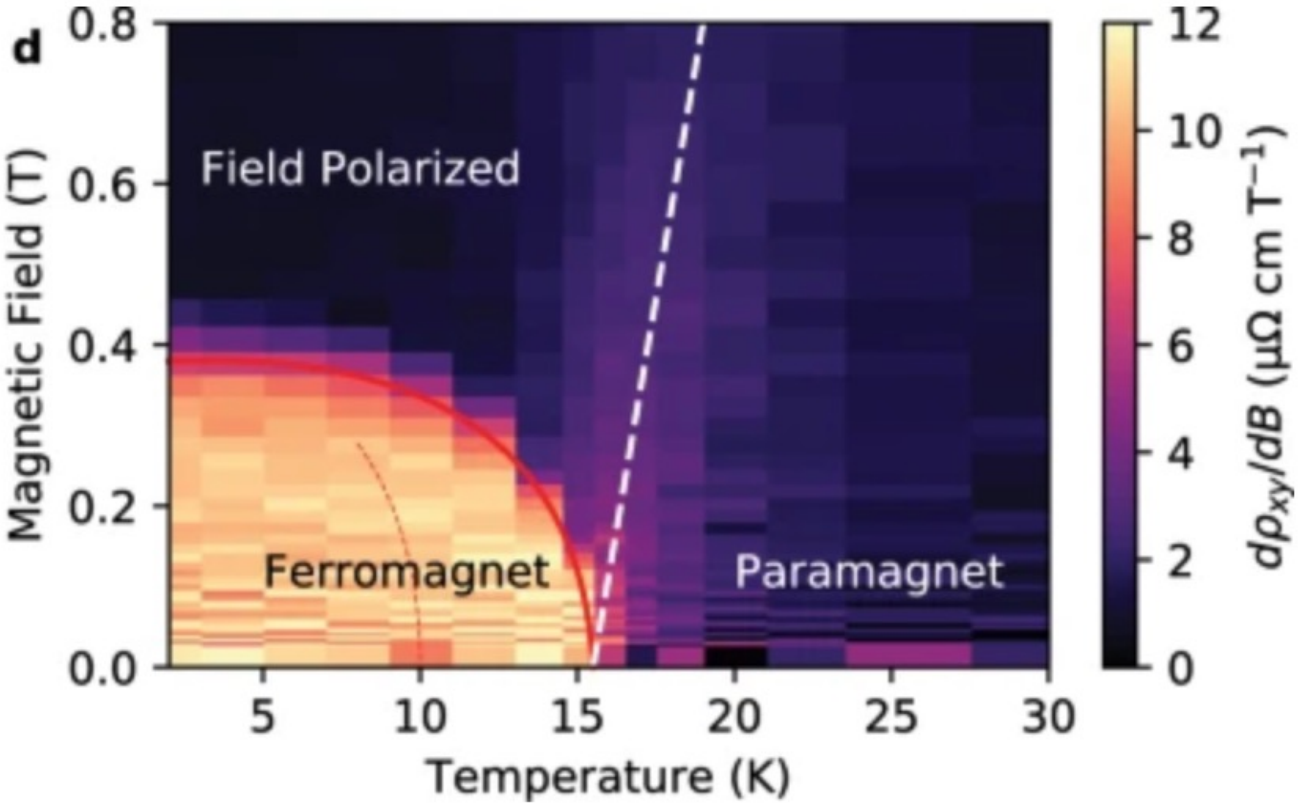
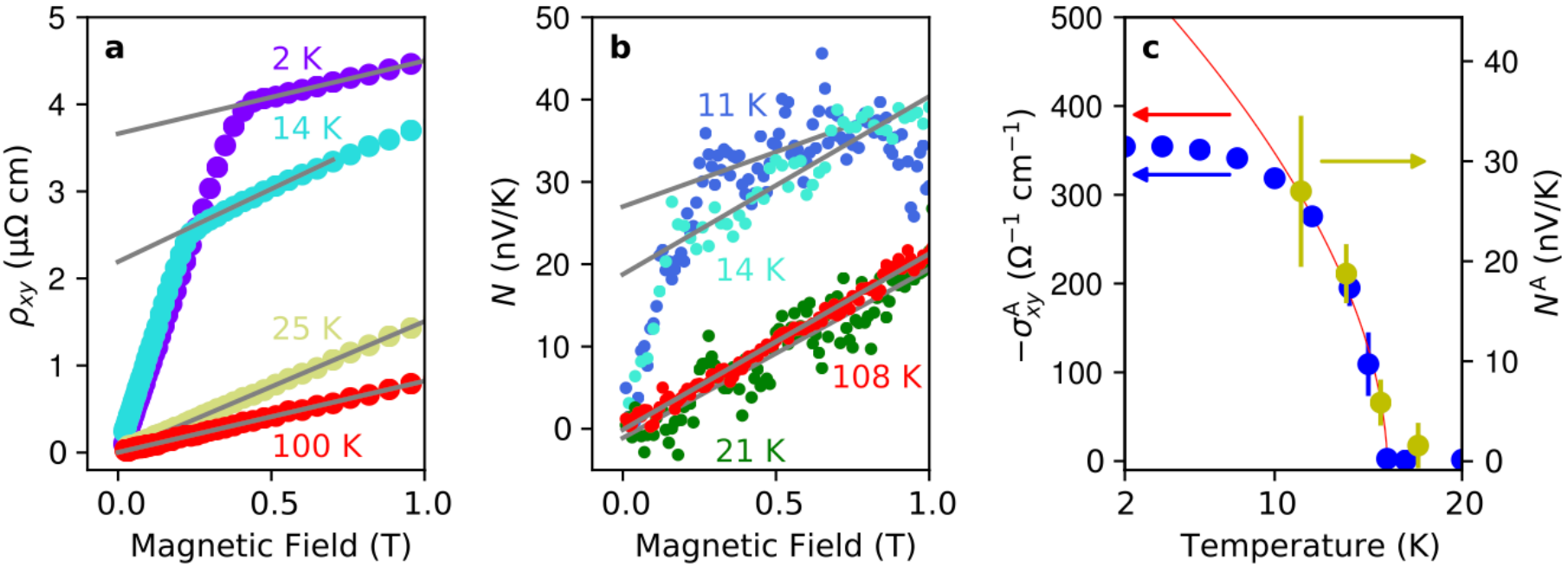
Anomalous Hall & Nernst effect in PrAlGe



Daniel Destraz, Lakshmi Das et al.,
npj Quantum Materials 5, 5 (2020)

Anomalous Hall & Nernst effect in PrAlGe



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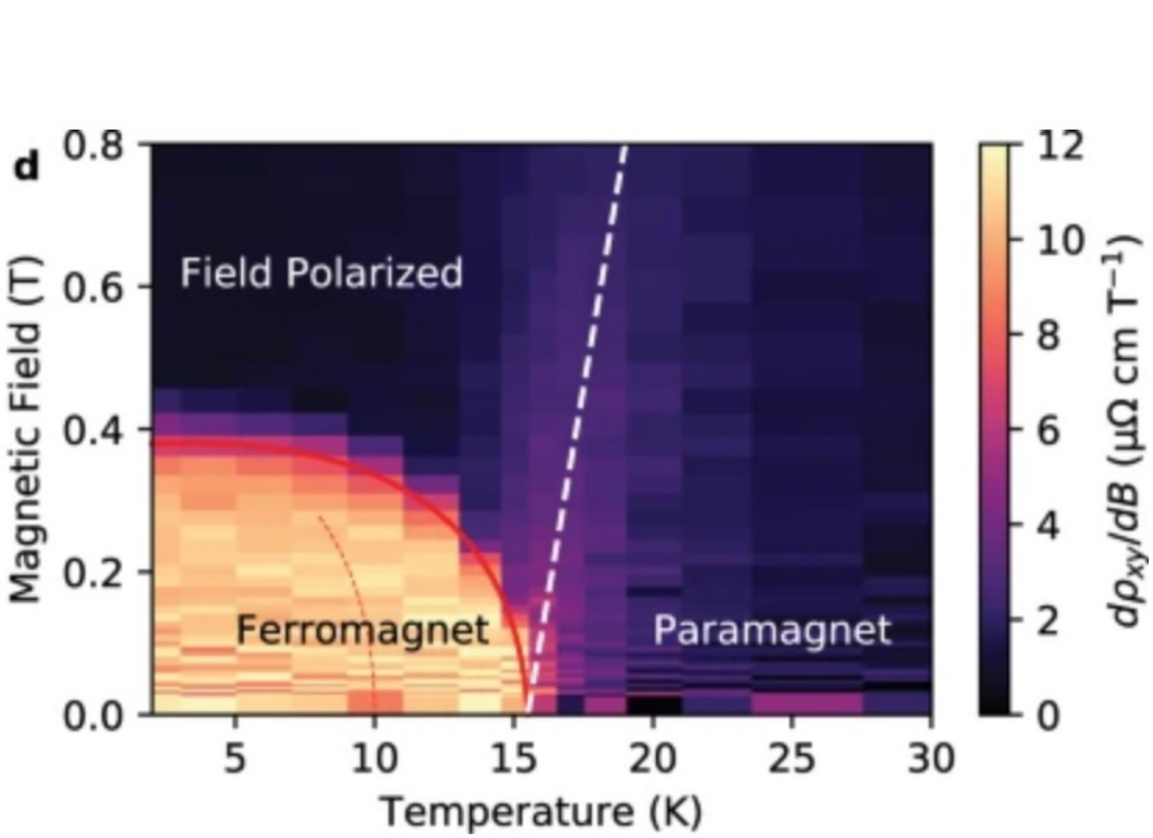

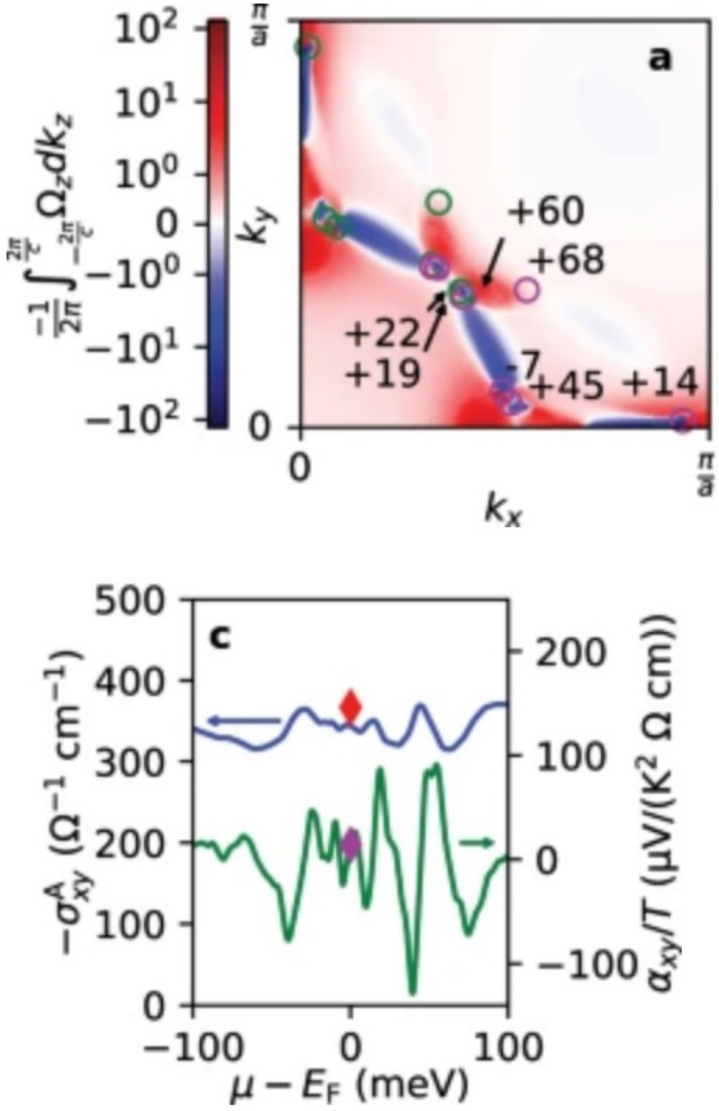

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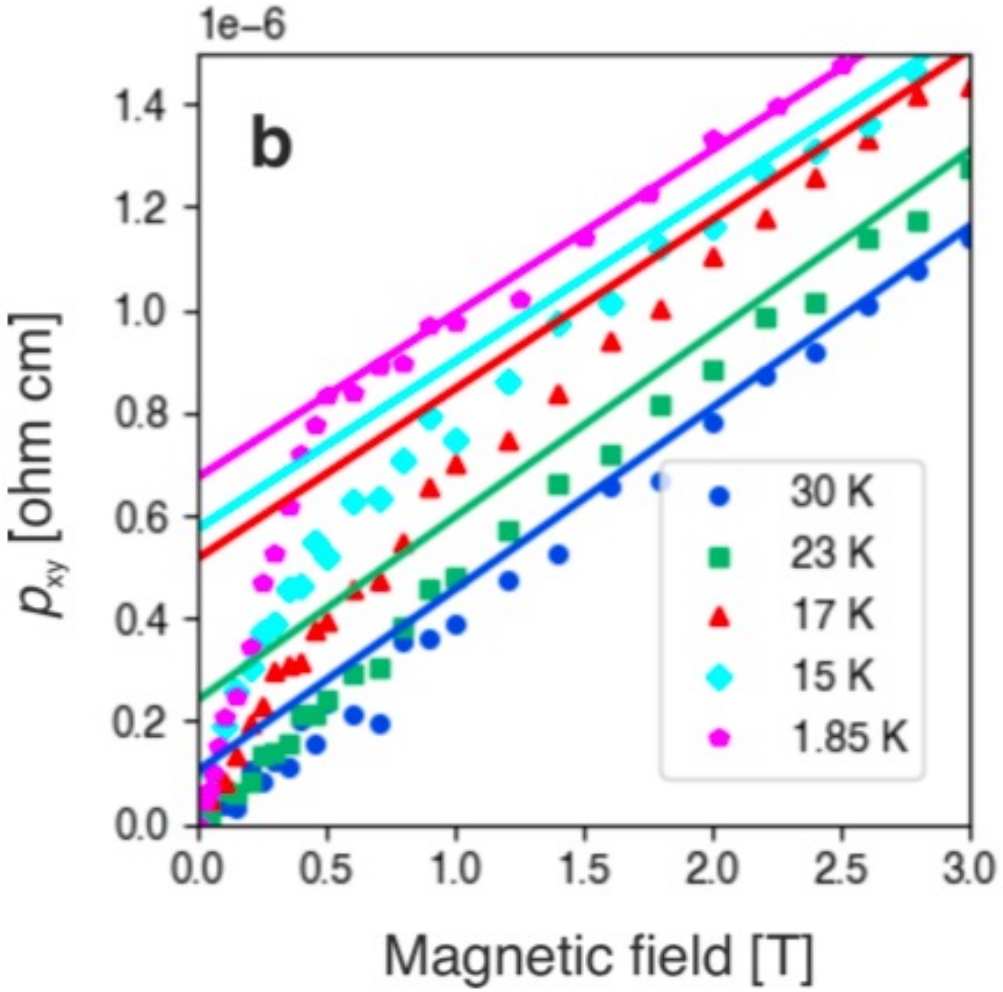

Ola Forslung et al.,
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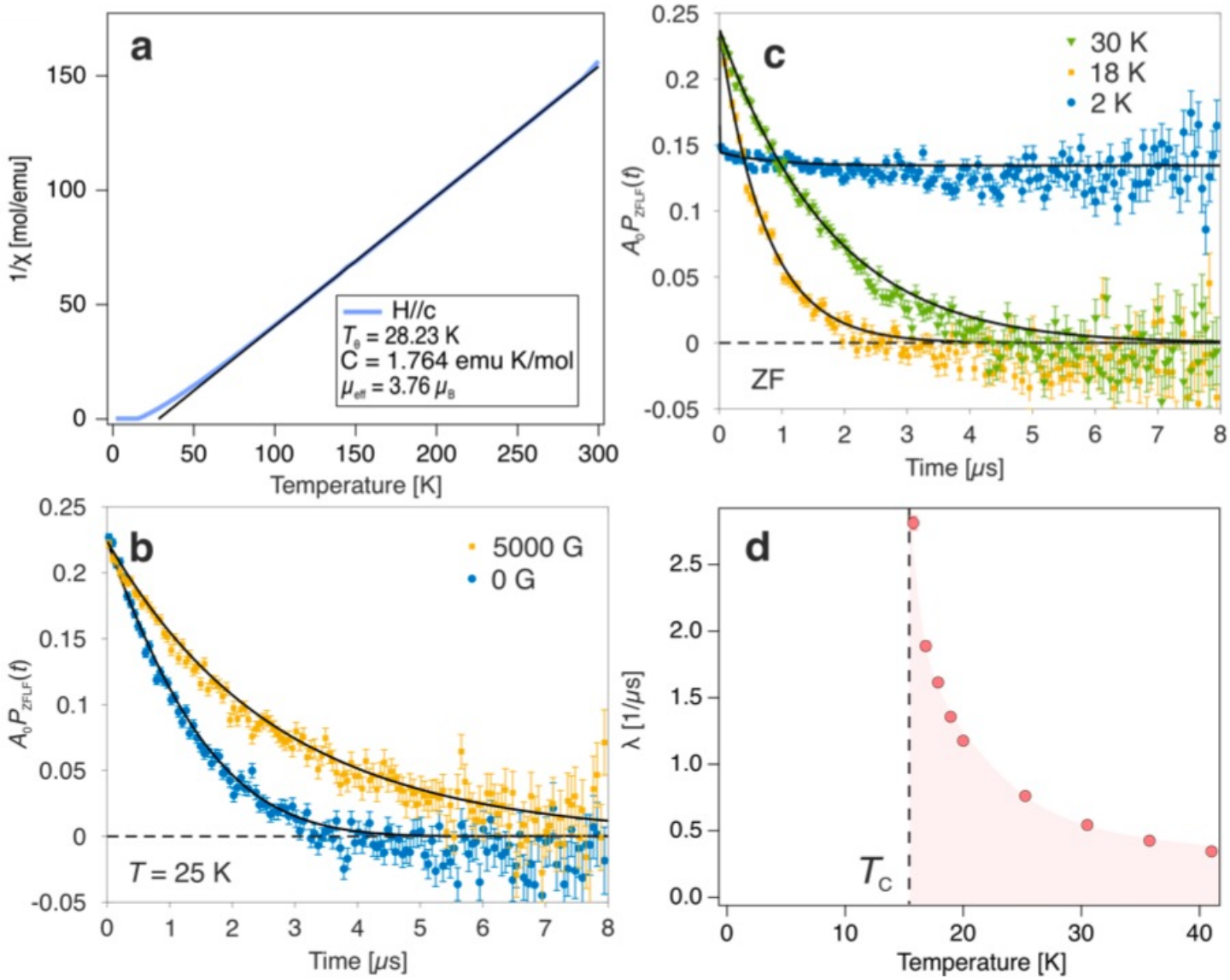
Absence of static FM order



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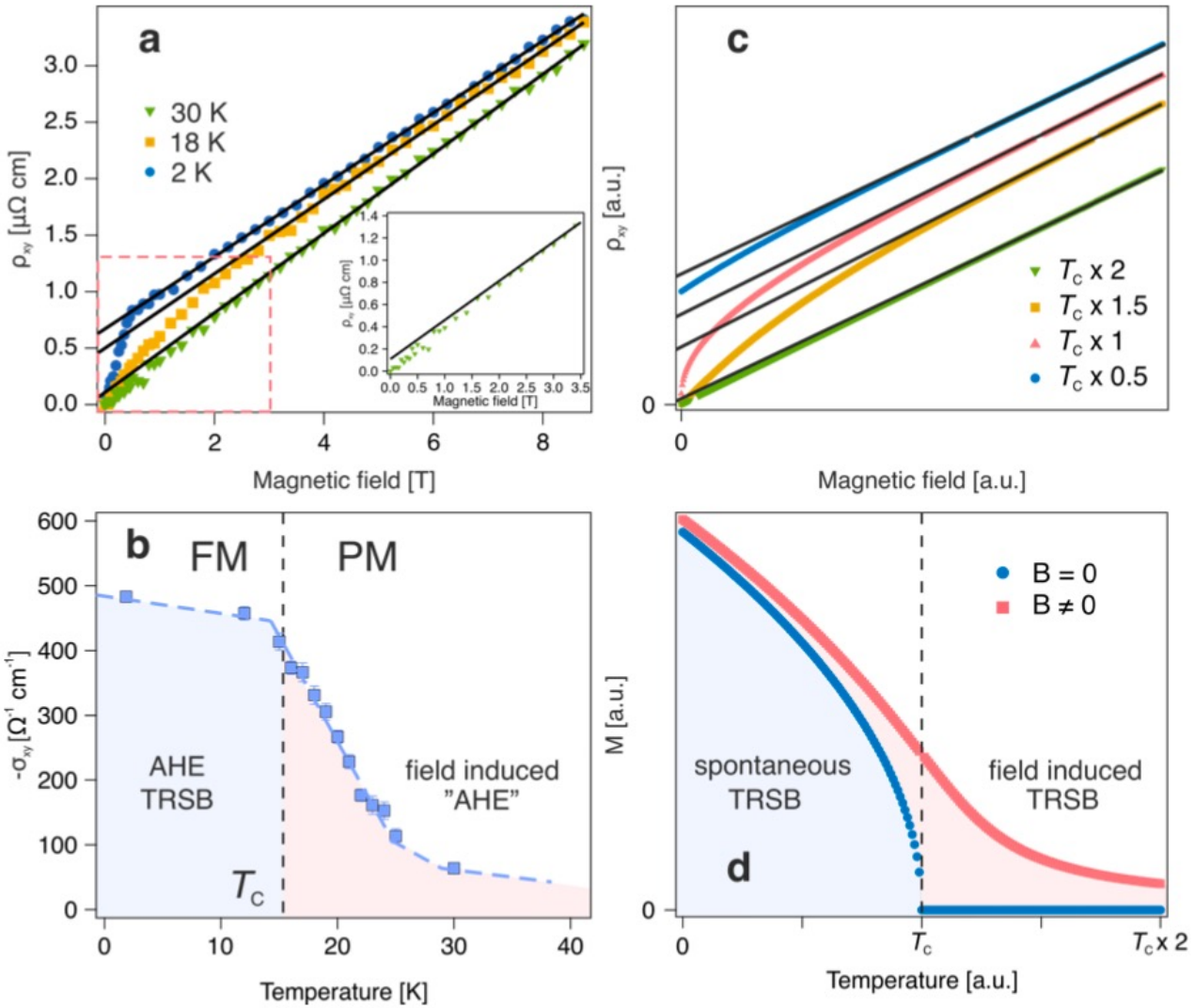
Field Induced TRSB



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