



Magnetic Phase Transitions and Magnetoelastic Coupling in a Two-Dimensional Stripy Antiferromagnet

Pingfan Gu^{1,2}, Yujiu Sun¹, Gong Wang¹, (...) , Zheng Han¹, Jun Zhang¹, Wei Ji¹ and Yu Ye¹

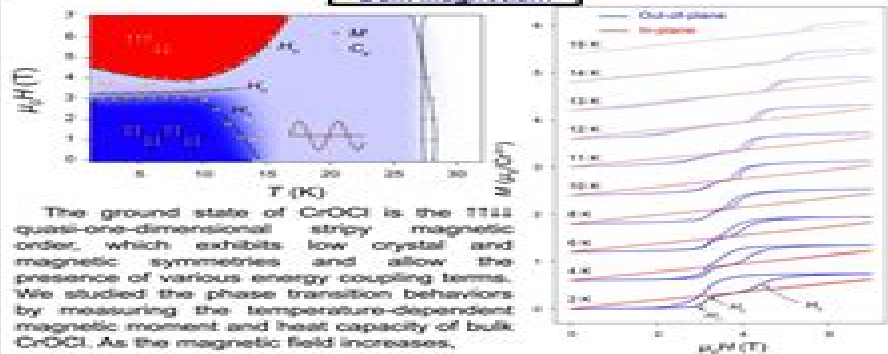
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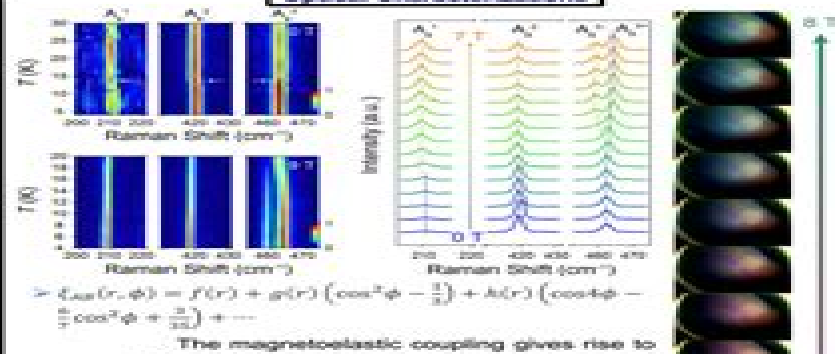
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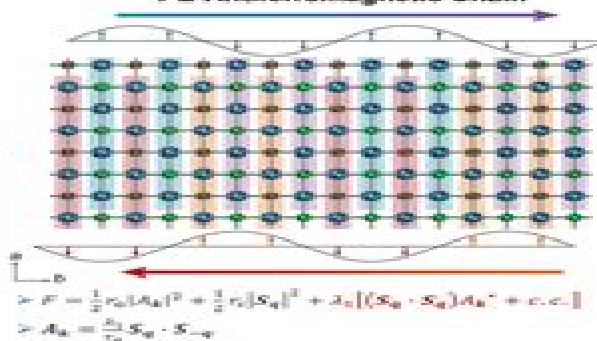
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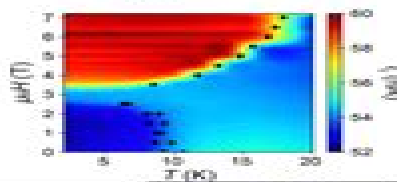
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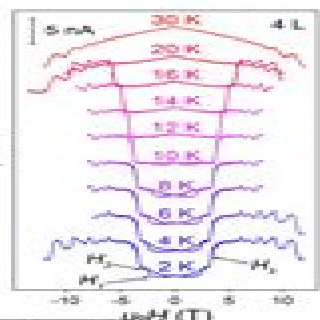
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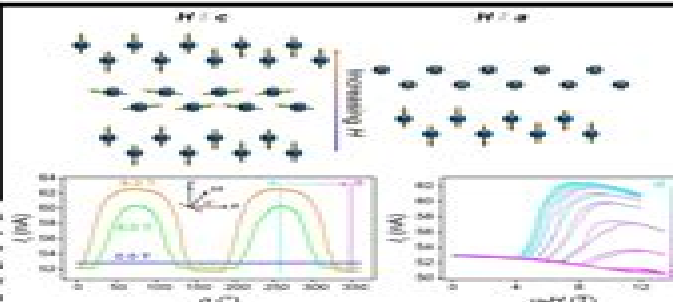
Tunneling magnetoresistance is another sensitive probe to detect the magnetic phase transitions and structural transitions in ultra-thin magnets. We constructed the phase diagram of a 4-L CrOCl sample using the tunneling current data, confirming the persistence of magnetic order and magnetoelastic coupling in 2D limit.



Tunneling Magnetoresistance



DFT shows that the single-ion anisotropy makes the a -axis the secondary easy axis. When



the external field is rotated in the ab -plane of the sample, the tunneling current shows exactly 180° periodic symmetry, implying the C_2 in-plane symmetry of CrOCl. The external field along the a axis drives the system into the collinear 1111 phase where the spins point towards along a . The remarkable in-plane anisotropic magnetic field response is a compelling evidence for the stripy antiferromagnetic order of CrOCl, which has been proved to be the physical origin of numerous fantastic quantum phenomena.

$$H = \sum_{i,j} J_{ij} (S_i \cdot S_j + 2 S_i^z S_j^z) - D \sum_i (S_i^z)^2 - g \mu_B \sum_i \mathbf{H} \cdot \mathbf{S}_i$$

CrOCl	Lattice constant (Å)			Exchange Parameters (meV/Cr)					
Axis	a	b	c	J_{ab}	J_{bc}	J_{ac}	D_a	D_b	D_c
bulk	3.89	3.20	7.68	0.059	0.061	0.060	0.043	0	0.045

Anisotropy

Summary and Reference

We verified the magnetoelastic coupling effect in exfoliated CrOCl by Raman spectroscopy and investigated the magnetism of few-layer CrOCl by tunneling magnetoresistance. Combining the characterization results with first-principle calculations, we uncovered the multi-step magnetic phase transitions under the external field along the easy axis down to 2D limit. Our findings not only advance the understanding of this unexplored promising material, but also reveal the rich physics and potential for spintronic devices of magnetoelastic materials.

[1] *Nano Letters* **22**, 3 (2022).

Magnetic Phase Transitions

Mohamad Reza Esfandiari



Magnetic Phase Transitions:

Magnetic Phase Transitions, 1983 *Magnetic Phase Transitions In Single Crystals* David P Belanger, 2022-07-27

Magnetic crystals are ideal systems to study the universal properties of phase transitions particularly systems with quenched randomness and frustration Pure systems with different symmetries provide the foundation for studies in corresponding systems with quenched randomness Because phenomena near phase transitions have universal properties results from bulk magnetic crystals provide a basis for understanding phase transitions in films and nanoparticles as well as many non magnetic materials This motivates the subject of this book which discusses phase transitions studies in magnetic crystals from the perspective of an experimentalist who has done extensive work in the field The advantage is that many experimental techniques are described in sufficient detail for a good understanding of the results and their comparison to theory

Magnetic Phase Transitions (Volume 48). Ausloos M., 1983 *Magnetic Phase Transitions* M. Ausloos, R.J.

Elliott, 2012-12-06 The present volume contains the courses given at a Summer School on Magnetic Phase Transitions held at the Ettore Majorana Centre for Scientific Culture at Erice Trapani Italy in July 1983 under the auspices of the Condensed Matter Division of the European Physical Society in their series on Materials Science and Technology The student participants came from West Germany Great Britain Brazil Greece Switzerland Sweden Italy USA and The Netherlands The lecturers came from various European countries Israel USA and Canada The atmosphere at the meeting was excellent and a good spirit of companionship developed during two weeks of working together The spread of interests among the lecturers and students was diversified but balanced The main lecturing contributions are reported in this volume They represent up to date reviews in a pedagogical style In addition informal presentations on current research interests were made which have not been included The school attempted to summarize the current position on the properties of magnetic phase transitions from several points of view The range and scope of the theoretical techniques and of particular aspects of materials or phenomena as observed experimentally were very well put forward by the lecturers The grouping of manuscripts in chapters does not represent however the schedule followed during the school Contributions on mean field approximations and renormalization group methods either for static or dynamic phenomena can be found at various places in the following sections

Structural and Magnetic Phase Transitions in Minerals S. Ghose, J.M.D. Coey, E. Salje, 2012-12-06 This volume in *Advances in Physical Geochemistry* presents the latest synthesis of theory and experimental data pertaining to structural and magnetic phase transitions in a variety of geochemically important minerals The book is the first to cover the impact of this rapidly progressing area of solid state physics in earth sciences and reflects its growing significance for mineralogy and petrology

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under the auspices of the Condensed Matter Division of the European Physical Society in their series on Materials Science and Technology The student participants came from West Germany Great Britain Brazil Greece Switzerland Sweden Italy USA and The Netherlands The lecturers came from various European countries Israel USA and Canada The atmosphere at the meeting was excellent and a good spirit of companion ship developed during two weeks of working together The spread of interests among the lecturers and students was diversified but balanced The main lecturing contributions are reported in this volume They represent up to date reviews in a pedagogical style In addition informal presentations on current research interests were made which have not been included The school attempted to summarize the current position on the properties of magnetic phase transitions from several points of view The range and scope of the theoretical techniques and of particular aspects of materials or phenomena as observed experimentally were very well put forward by the lecturers The grouping of manuscripts in chapters does not represent however the schedule followed during the school Contributions on mean field approximations and renormalization group methods either for static or dynamic phenomena can be found at various places in the following sections

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Experimental Investigations of Magnetic Phase Transitions James Alexander Brug,1984 **Magnetic Resonance of Phase Transitions** Frank J. Owens,Charles P. Poole,Horacio A. Farach,2013-10-22 Magnetic Resonance of Phase Transitions shows how the effects of phase transitions are manifested in the magnetic resonance data The book discusses the

basic concepts of structural phase and magnetic resonance various types of magnetic resonances and their underlying principles and the radiofrequency methods of nuclear magnetic resonance The text also describes quadrupole methods the microwave technique of electron spin resonance and the Mossbauer effect Phase transitions in various systems such as fluids liquid crystals and crystals including paramagnets and ferroelectrics are also considered Physicists and scientists working in energetic materials laboratories will find the book invaluable Integral Systems, Solid State Physics and Theory of Phase Transitions V. V. Dodonov, Vladimir Ivanovich Man'ko, 1991

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Table of Contents Magnetic Phase Transitions

1. Understanding the eBook Magnetic Phase Transitions
 - The Rise of Digital Reading Magnetic Phase Transitions
 - Advantages of eBooks Over Traditional Books
2. Identifying Magnetic Phase Transitions
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Magnetic Phase Transitions
 - User-Friendly Interface
4. Exploring eBook Recommendations from Magnetic Phase Transitions
 - Personalized Recommendations
 - Magnetic Phase Transitions User Reviews and Ratings
 - Magnetic Phase Transitions and Bestseller Lists
5. Accessing Magnetic Phase Transitions Free and Paid eBooks
 - Magnetic Phase Transitions Public Domain eBooks
 - Magnetic Phase Transitions eBook Subscription Services
 - Magnetic Phase Transitions Budget-Friendly Options

6. Navigating Magnetic Phase Transitions eBook Formats
 - ePub, PDF, MOBI, and More
 - Magnetic Phase Transitions Compatibility with Devices
 - Magnetic Phase Transitions Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Magnetic Phase Transitions
 - Highlighting and Note-Taking Magnetic Phase Transitions
 - Interactive Elements Magnetic Phase Transitions
8. Staying Engaged with Magnetic Phase Transitions
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Magnetic Phase Transitions
9. Balancing eBooks and Physical Books Magnetic Phase Transitions
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Magnetic Phase Transitions
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Magnetic Phase Transitions
 - Setting Reading Goals Magnetic Phase Transitions
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Magnetic Phase Transitions
 - Fact-Checking eBook Content of Magnetic Phase Transitions
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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