Research overview

DENIS VASIUKOV

PhD project

Multidisciplinary PhD research

Phys Chem Minerals
DOI 10.1007/s00269-017-0928-8

ORIGINAL PAPER

Sound velocities of skiagite–iron–majorite solid solution to 56 GPa probed by nuclear inelastic scattering

D. M. Vasiukov[1,2] · L. Ismailova[3] · I. Kupenko[4] · V. Cerantola[5] · R. Sinmyo[2] · K. Glazyrin[6] · C. McCammon[2] · A. I. Chumakov[5] · L. Dubrovinsky[2] · N. Dubrovinskaia[1]

LETTER

https://doi.org/10.1038/s41586-019-1254-8

Magnetism in cold subducting slabs at mantle transition zone depths

I. Kupenko[1*], G. Aprilis[2,3], D. M. Vasiukov[2,3,4], C. McCammon[2], S. Chariton[2], V. Cerantola[2,5], I. Kantor[6], A. I. Chumakov[5], R. Rüffer[5], L. Dubrovinsky[2] & C. Sanchez-Valle[1]

REVIEW OF SCIENTIFIC INSTRUMENTS **88**, 084501 (2017)

Portable double-sided pulsed laser heating system for time-resolved geoscience and materials science applications

G. Aprilis,[1,2,a)] C. Strohm,[3] I. Kupenko,[4,5] S. Linhardt,[1] A. Laskin,[6] D. M. Vasiukov,[1,2] V. Cerantola,[1,5] E. G. Koemets,[1] C. McCammon,[1] A. Kurnosov,[1] A. I. Chumakov,[5] R. Rüffer,[5] N. Dubrovinskaia,[2] and L. Dubrovinsky[1]

THE JOURNAL OF PHYSICAL CHEMISTRY C

Article

Cite This: *J. Phys. Chem. C* 2019, 123, 21676–21684

pubs.acs.org/JPCC

Local Structure of Ferroic Iron Formates at Low Temperature and High Pressure Studied by Mössbauer Spectroscopy

Ines E. Collings,[*,†,‡,∥] Denis M. Vasiukov,[†,§] Catherine A. McCammon,[§] Leonid Dubrovinsky,[§] Valerio Cerantola,[‡] Sylvain Petitgirard,[§] Christian B. Hübschle,[†] Andreas Schönleber,[†] Dmitry Chernyshov,[‡] Sander van Smaalen,[†] and Natalia Dubrovinskaia[†]

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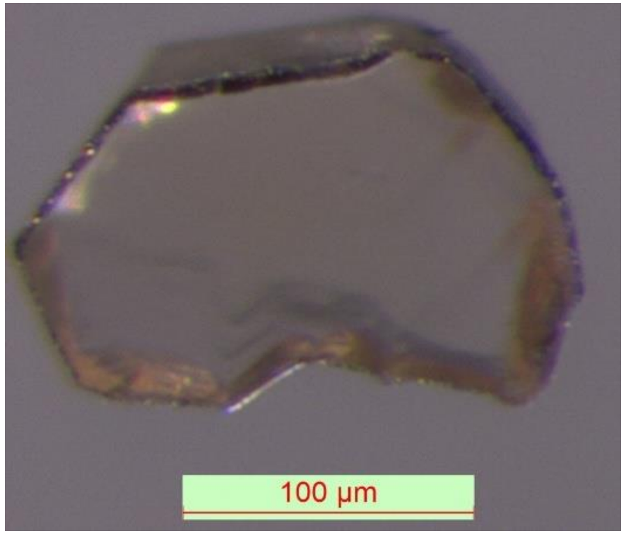
Diffraction study of the garnet inclusions

nature geoscience
ARTICLES
https://doi.org/10.1038/s41561-017-0055-7

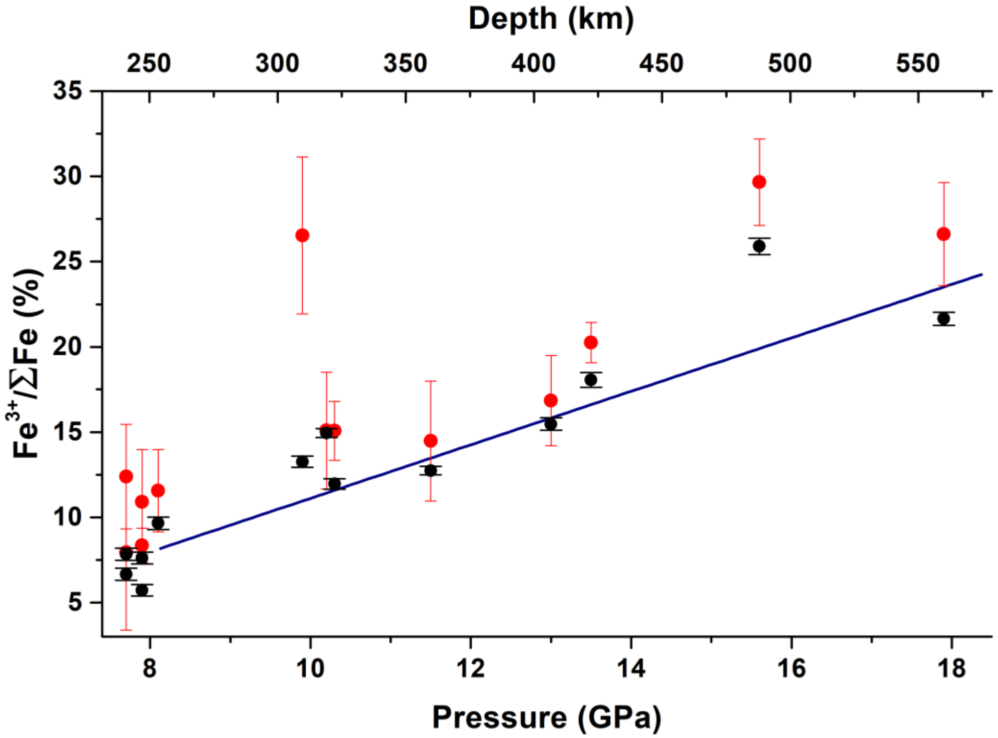
Oxidized iron in garnets from the mantle transition zone

Ekaterina S. Kiseeva[1*], Denis M. Vasiukov[2,3], Bernard J. Wood[1], Catherine McCammon[3], Thomas Stachel[4], Maxim Bykov[3], Elena Bykova[3,5], Aleksandr Chumakov[6], Valerio Cerantola[6], Jeff W. Harris[7] and Leonid Dubrovinsky[3]



$X_3Y_2(ZO_4)_3$

Ca, Fe, Al, Mg, Si, O



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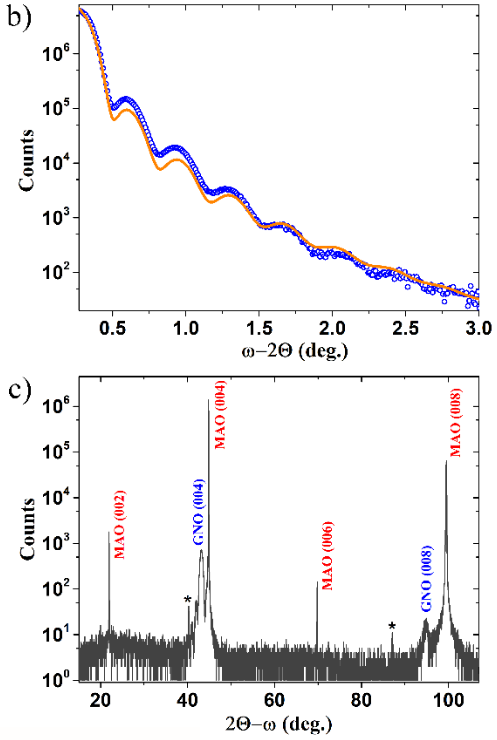
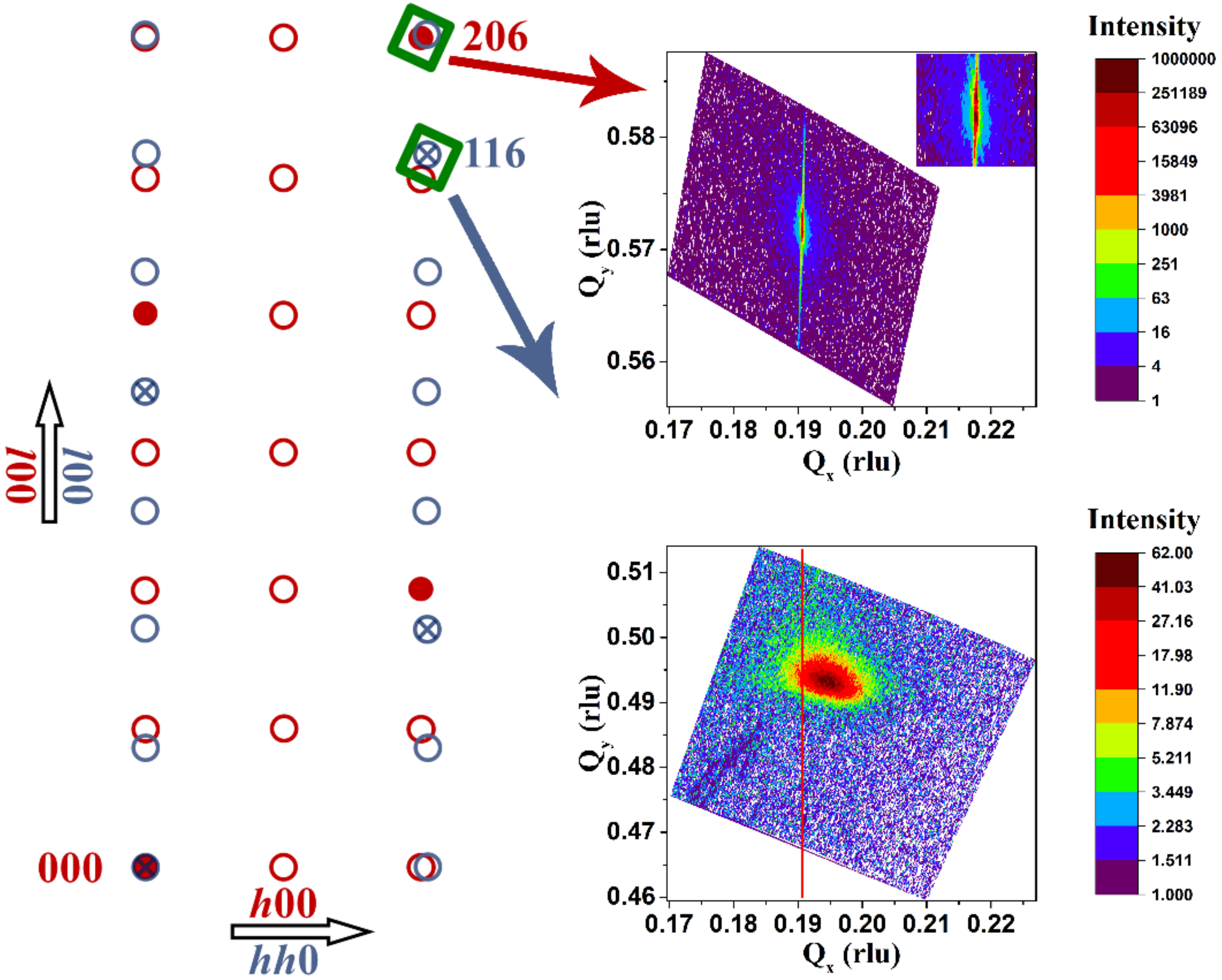
Thin films, Rutgers

PHYSICAL REVIEW MATERIALS **5**, 064419 (2021)

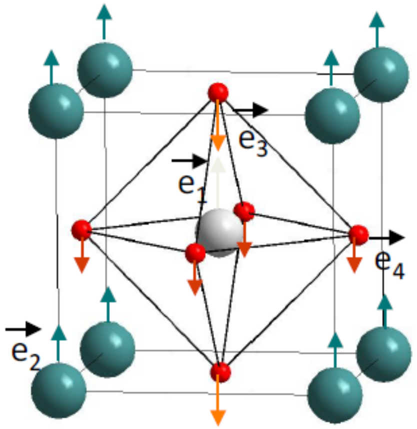
Epitaxial stabilization of thin films of the frustrated Ge-based spinels

Denis M. Vasiukov,[1,2,*] Mikhail Kareev,[1] Fangdi Wen,[1] Liang Wu,[1] Padraic Shafer,[3] Elke Arenholz,[3,4] Xiaoran Liu,[1,5] and Jak Chakhalian[1]





The obscure revolution in crystallography



distortion mode = Amplitude * polarization vector

Description of a displacive “mode”:

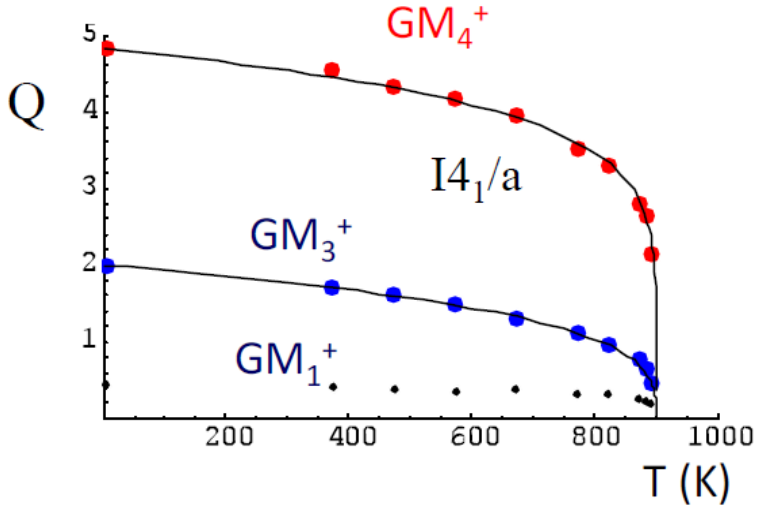
$$\vec{u}(\text{atoms}) = Q\,\vec{e}$$

amplitude → Q

polarization vector → $\vec{e}$

$$e = (\vec{e}_1, \vec{e}_2, \vec{e}_3, \vec{e}_4)$$

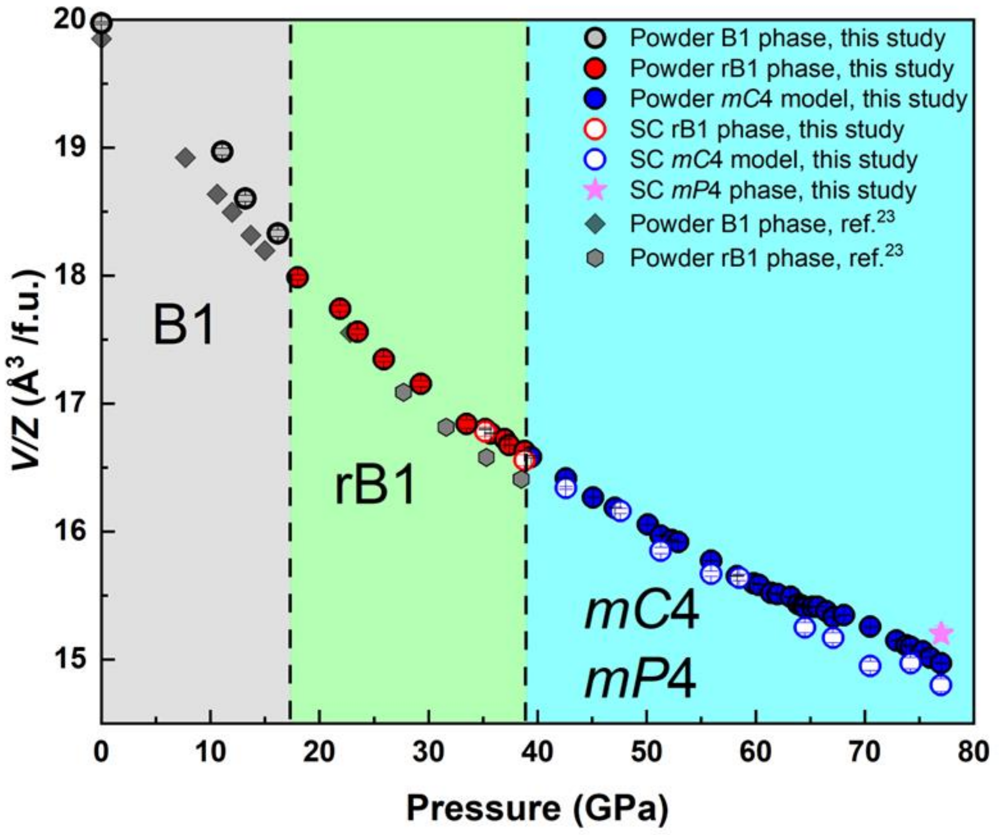
normalization: (within a unit cell) $|\vec{e}_1|^2 + |\vec{e}_2|^2 + |\vec{e}_3|^2 + 2\,|\vec{e}_4|^2 = 1$

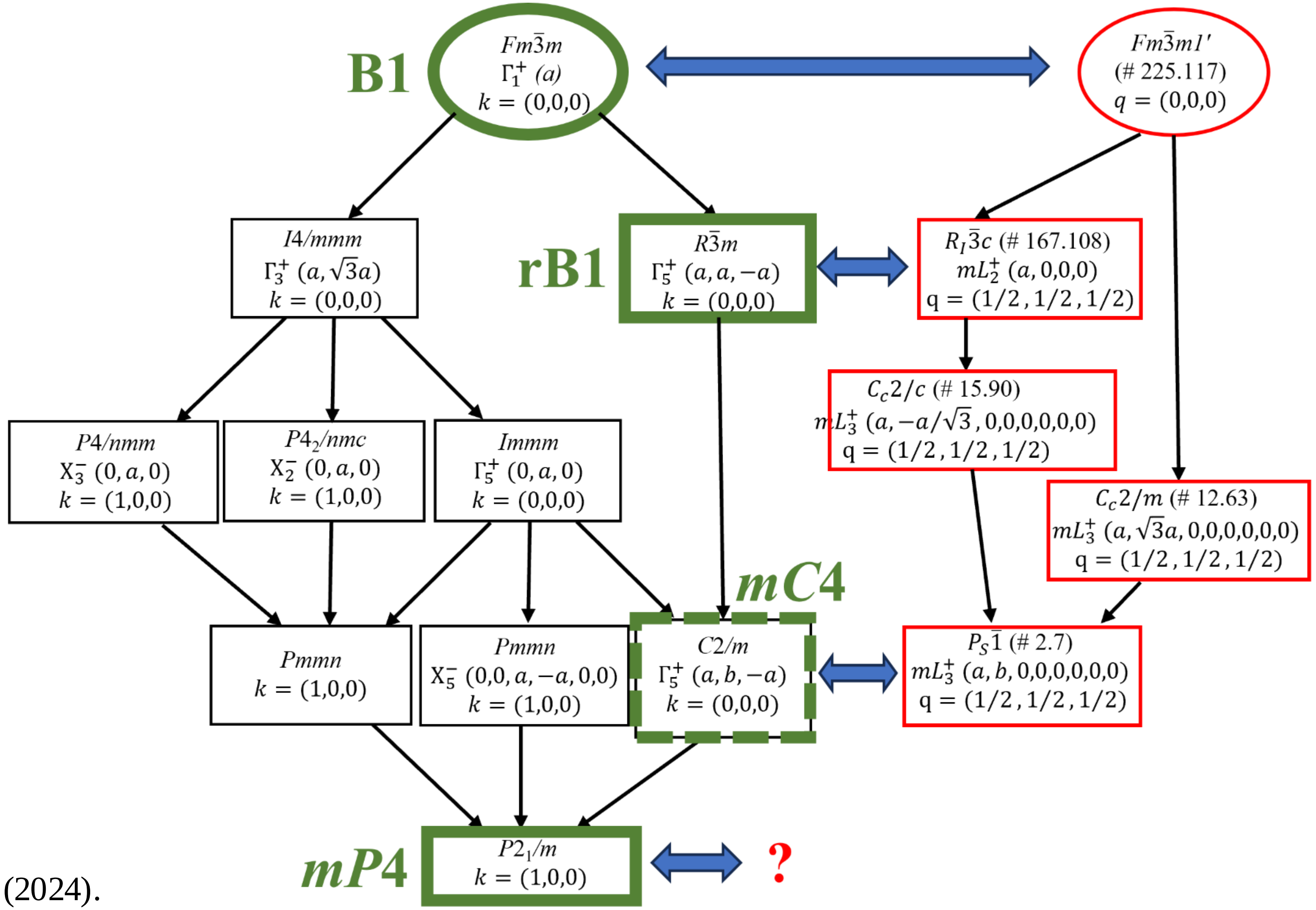


distortion modes:

- displacive type: local variable =atomic displacements
- order-disorder type: local variable: site occupation probabilities
- magnetic type: local variable: atomic magnetic moments

Phase relations of $Fe_{1-x}O$



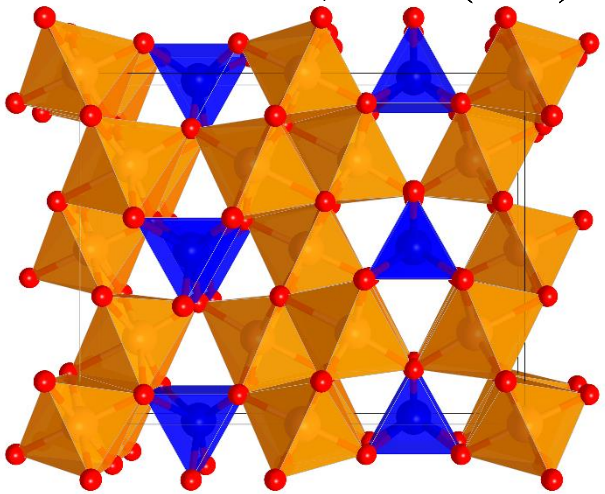


Li, X., Bykova, E., Vasiukov, D. M., Aprilis, G., ... & Kupenko, I. (2024).
Monoclinic distortion and magnetic transitions in FeO under pressure and temperature.
Comm. Physics, **7**(1), 305.

Multiplicity of iron oxides at high pressure

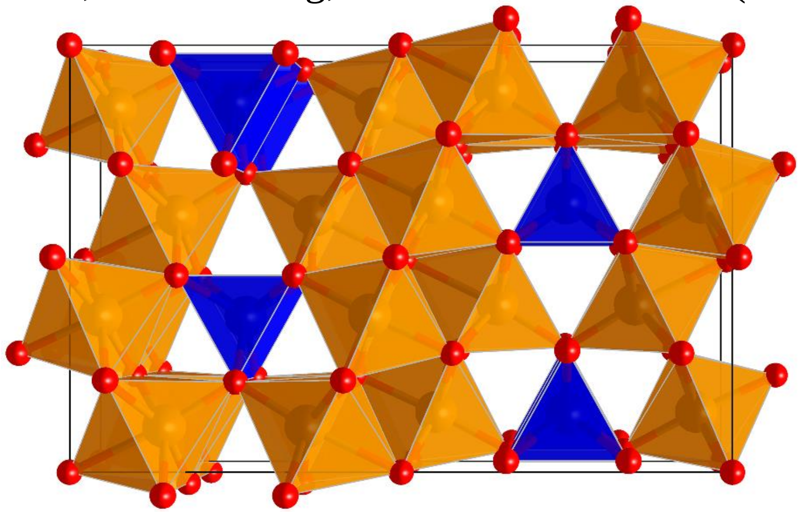
Lavina, B. *et al*. *PNAS*. **108**, 17281 (2011)

Fe_4O_5



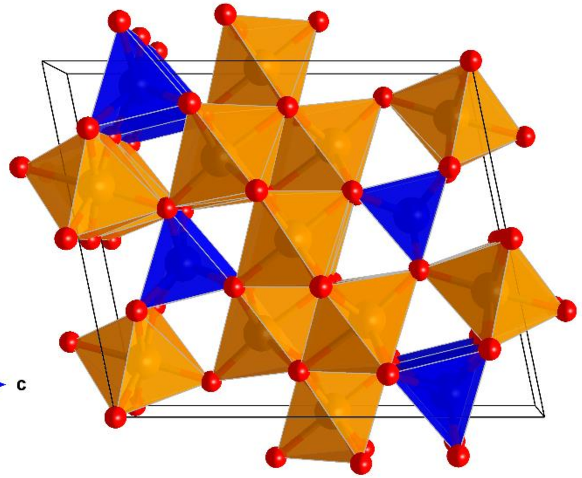
Lavina, B. and Meng, Y. *Sci*. *Adv*. e1400260 (2016)

Fe_5O_6



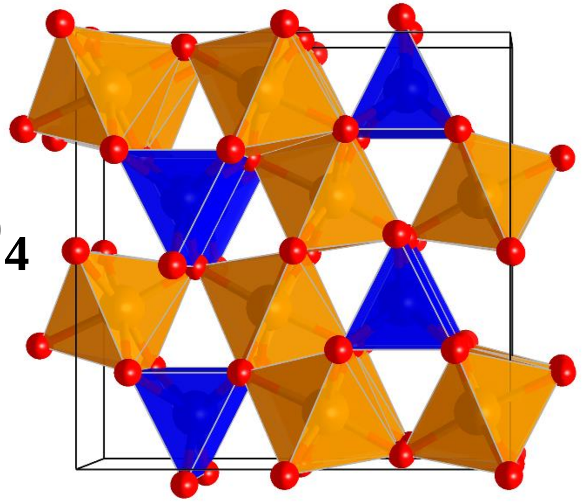
Sinmyo, R. *et al*. *Sci*. *Rep*. **6**, 32852 (2016)

Fe_7O_9

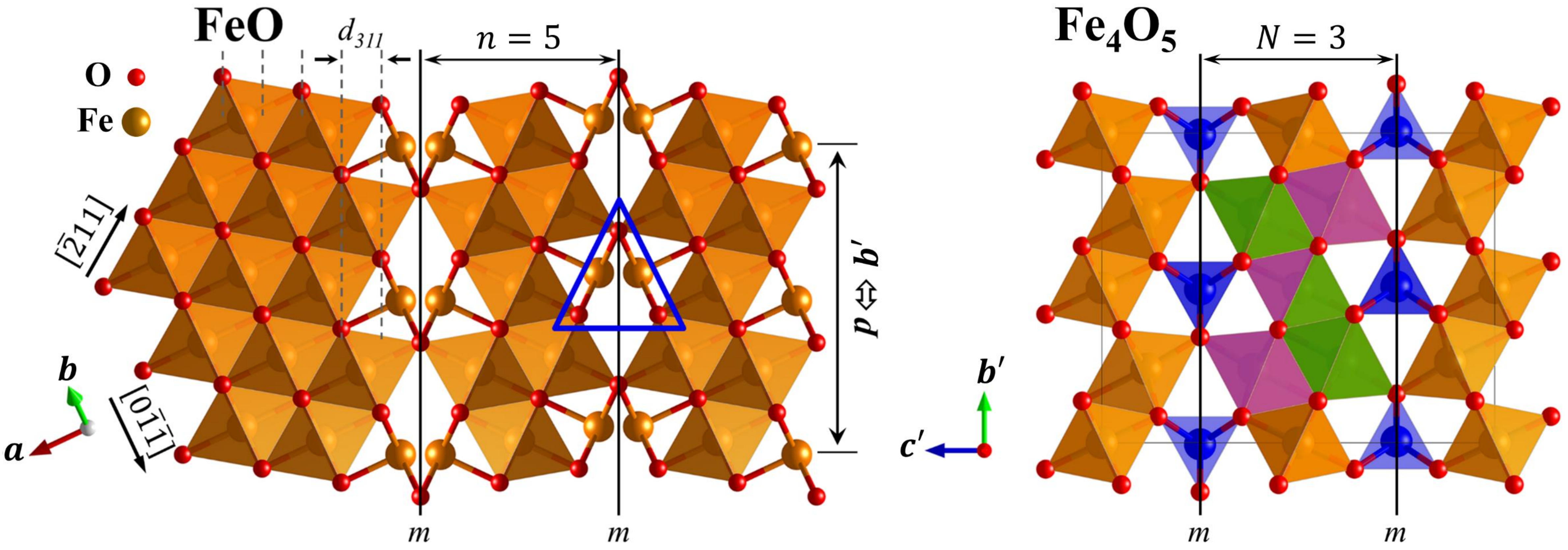


Haavik, C. *et al*. *Am. Mineral*. **85**, 514 (2000)

HP-Fe_3O_4



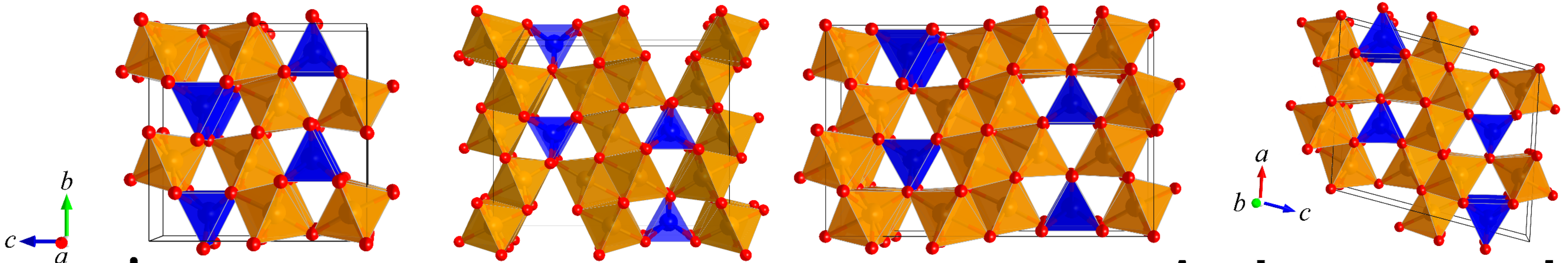
{311} *tropochemical cell-twinning*



Vasiukov, D.M. et al. arXiv preprint arXiv:2207.14111, (2022).

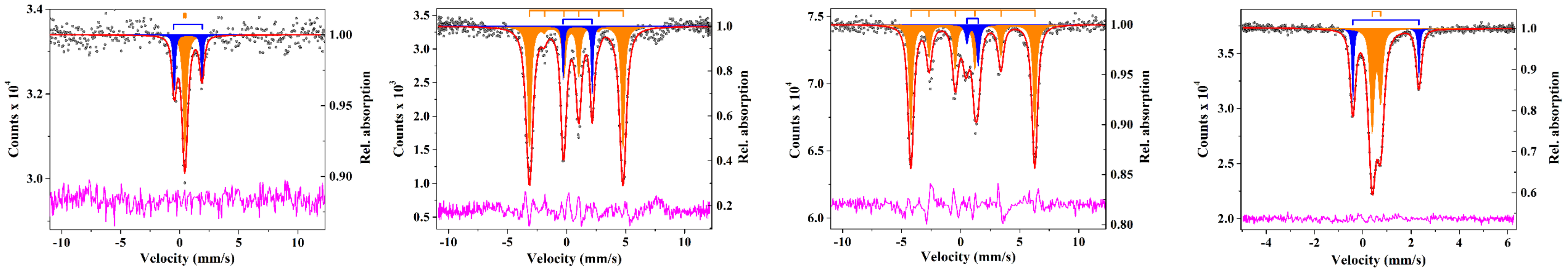
Mössbauer spectra of several oxides at ambient conditions

N = 2	**N = 3**	**N = 4**	**N = 2,3**
HP-Fe_3O_4	**Fe_4O_5**	**Fe_5O_6**	**Fe_7O_9**



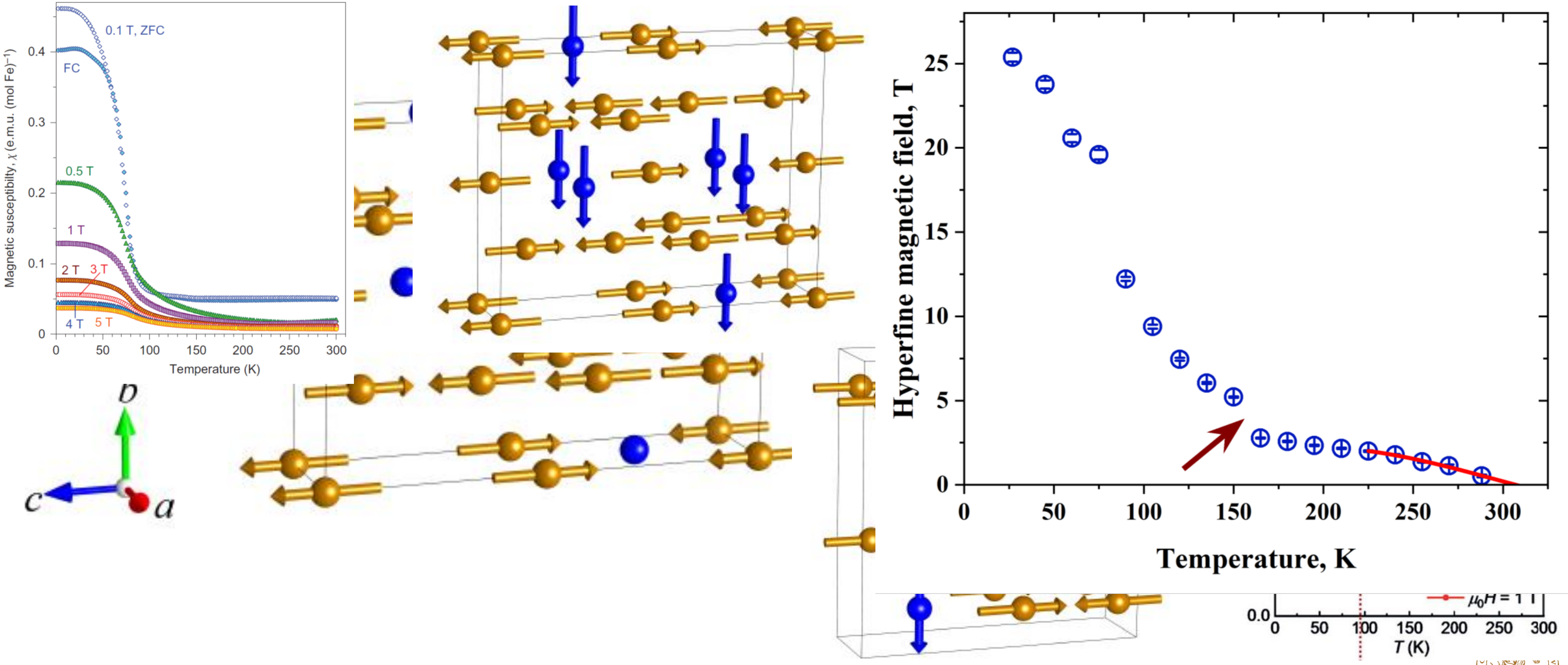
N-family

N,N+1-family



Generic magnetic structure of the N family

Fe_4O_5 $N = 3$



DFT simulations of magnetic structures in Fe_4O_5 and Fe_5O_6

Dalton Transactions

ROYAL SOCIETY OF CHEMISTRY

PAPER

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View Journal

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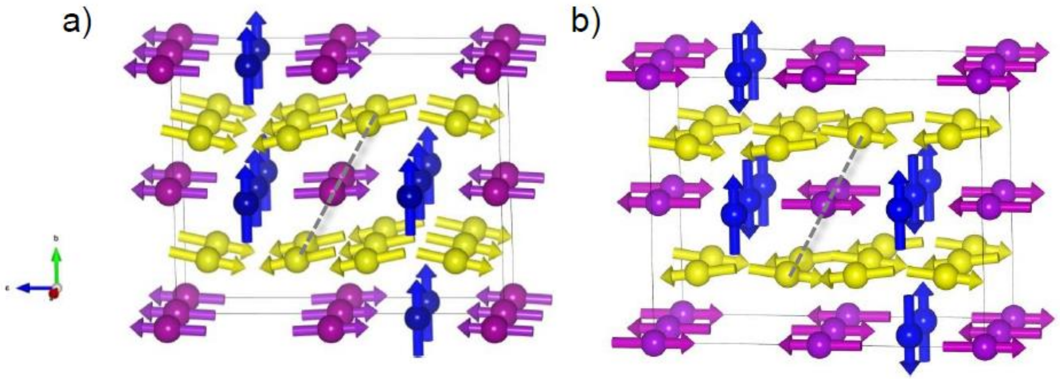
Cite this: DOI: 10.1039/d3dt03437b

Orthogonal magnetic structures of Fe_4O_5: representation analysis and DFT calculations†

Vyacheslav S. Zhandun, *[a] Natalia V. Kazak, [a] Ilya Kupenko,[b] Denis M. Vasiukov, [c,d] Xiang Li,[b] Elizabeth Blackburn [c] and Sergei G. Ovchinnikov [a]



CONDENSED MATTER

Magnetic Structure of Fe_5O_6: Group-Theoretical Analysis and DFT Calculations

V. S. Zhandun[a, b, *], N. V. Kazak[a], and D. M. Vasiukov[c, d]

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[b] *Krasnoyarsk State Medical University named after Professor L.F. Voino-Yasenetsky, Krasnoyarsk, 660022 Russia*

[c] *Division of Synchrotron Radiation Research, Department of Physics, Lund University, Lund, 221 00 Sweden*

[d] *Materials Science and Applied Mathematics, Malmö University, Malmö, 204 06 Sweden*

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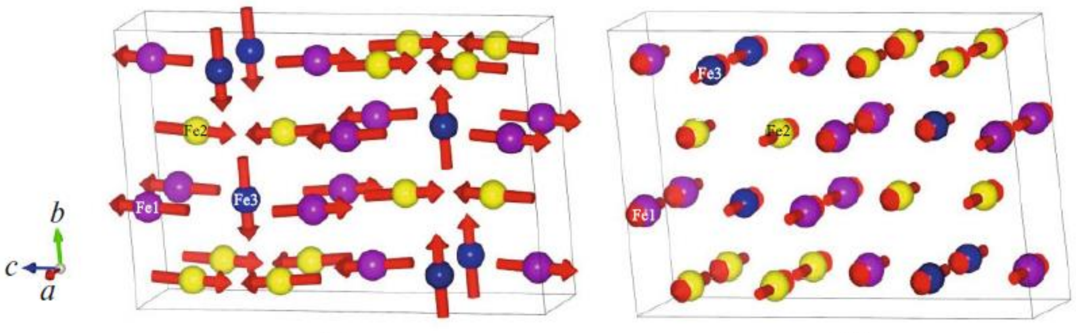

(a) (b)

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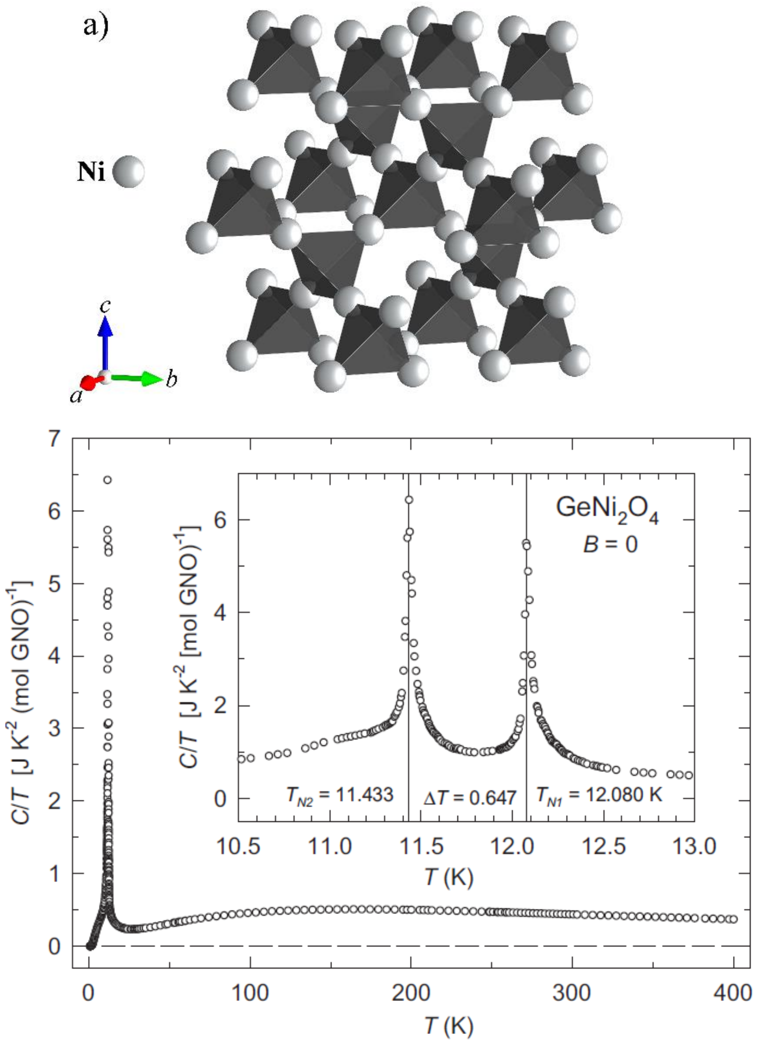
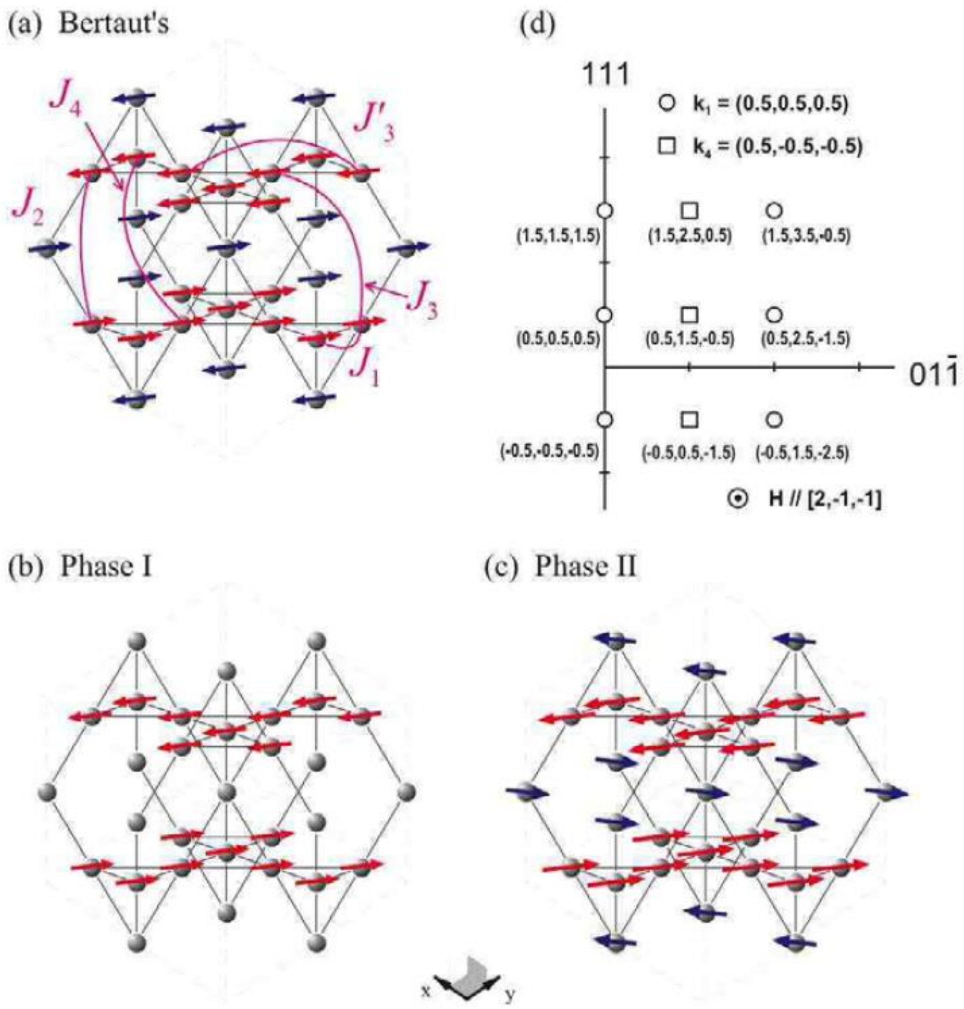
Multi-k problem, $GeNi_2O_4$





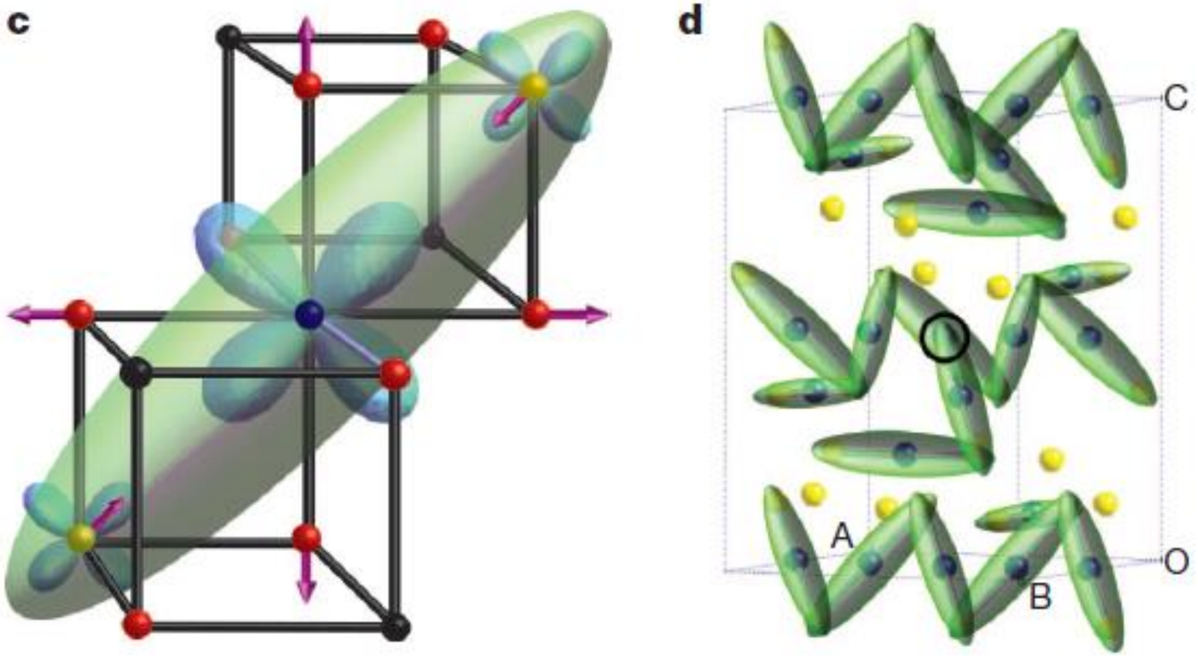
Charge-ordering in magnetite below Verwey transition

LETTER

doi:10.1038/nature10704

Charge order and three-site distortions in the Verwey structure of magnetite

Mark S. Senn[1], Jon P. Wright[2] & J. Paul Attfield[1]



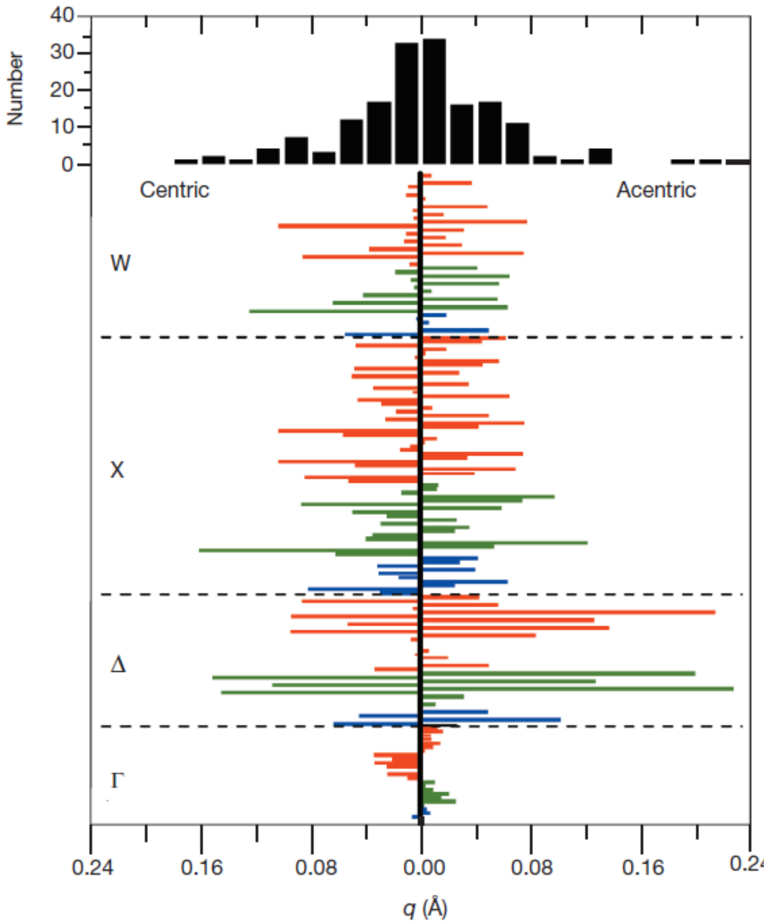
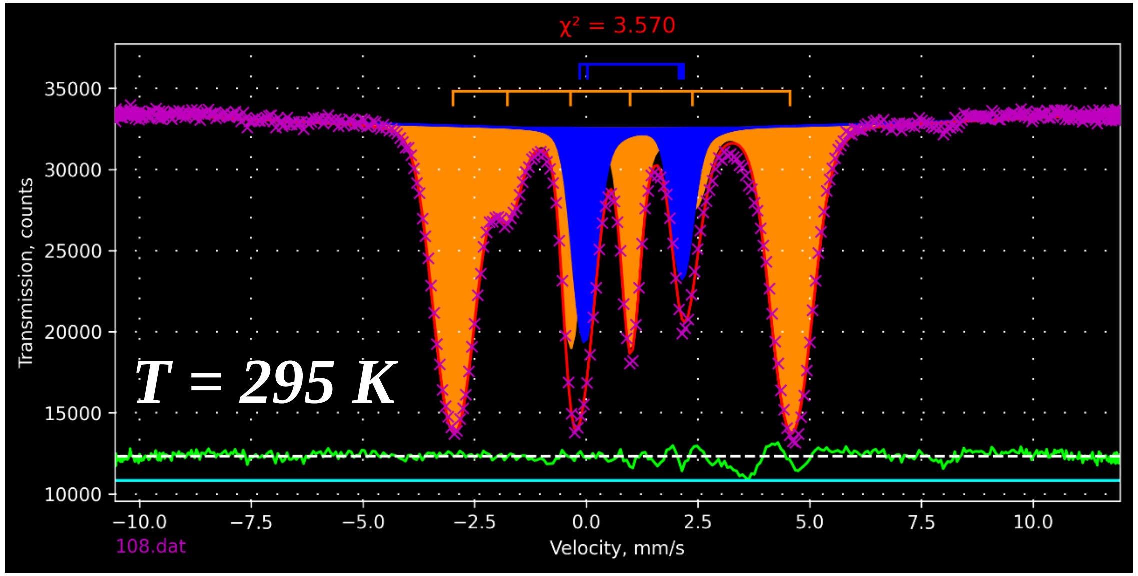
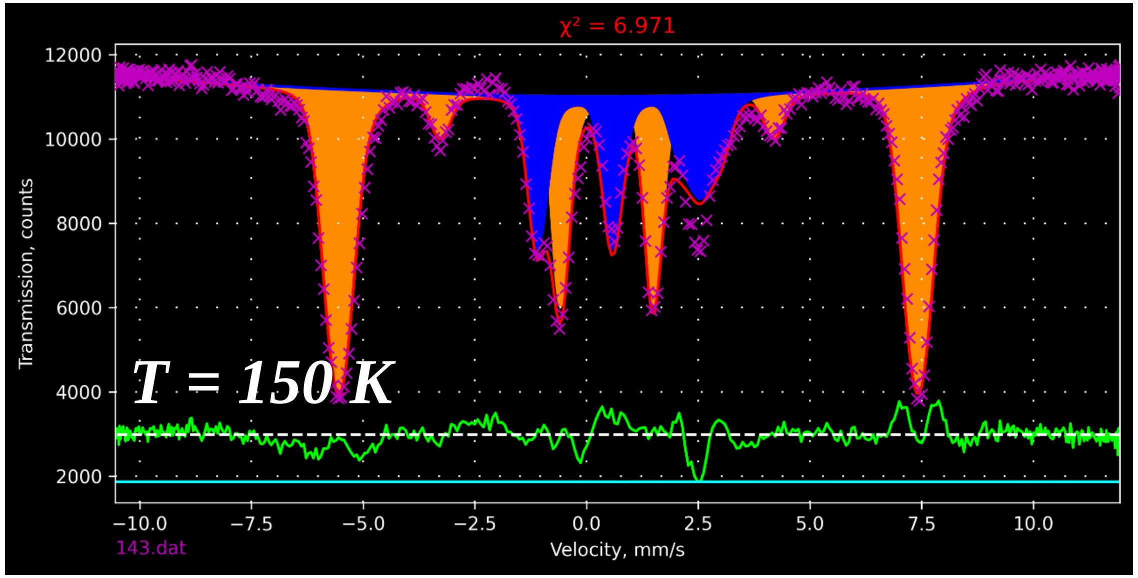


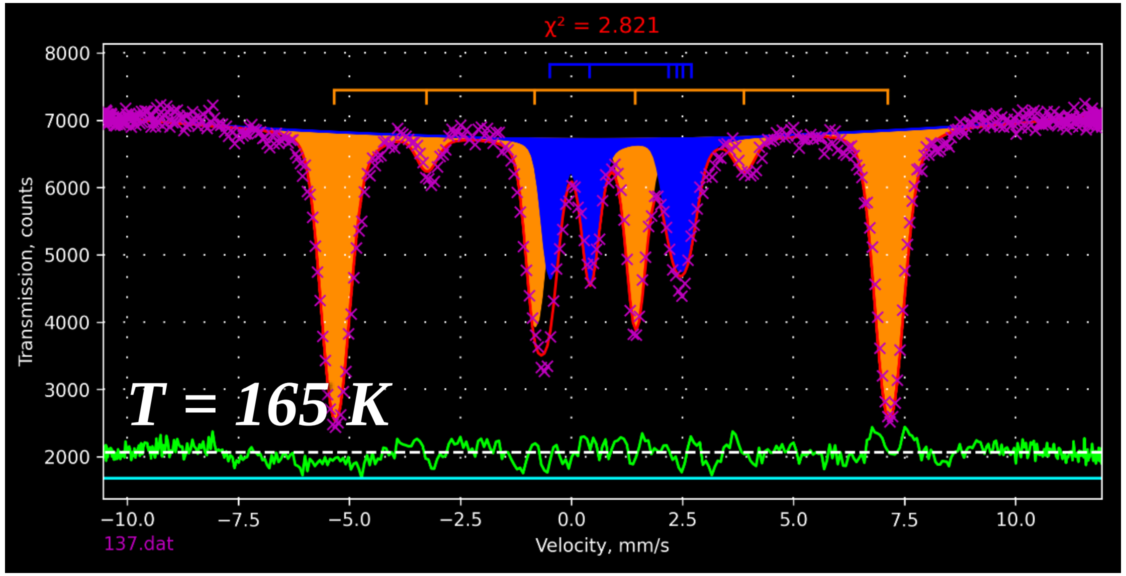
Figure 2 | The 168 displacement amplitudes of the low-temperature *Cc* magnetite structure. Main panel: centric and acentric mode amplitudes, *q*,

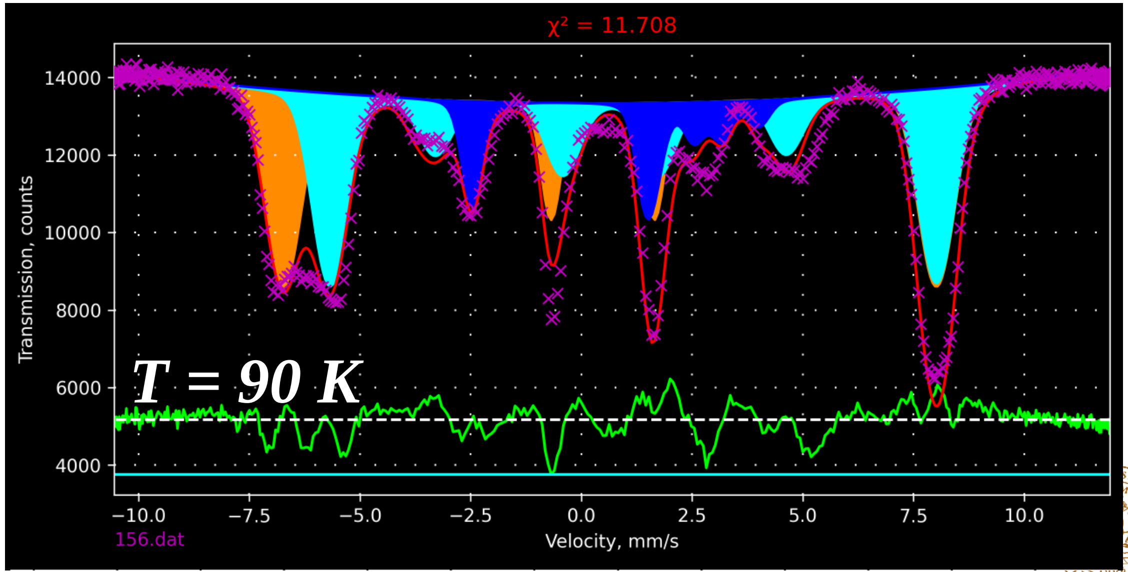
Thank you for your attention!

Temperature evolution of Fe_4O_5 Mössbauer spectra

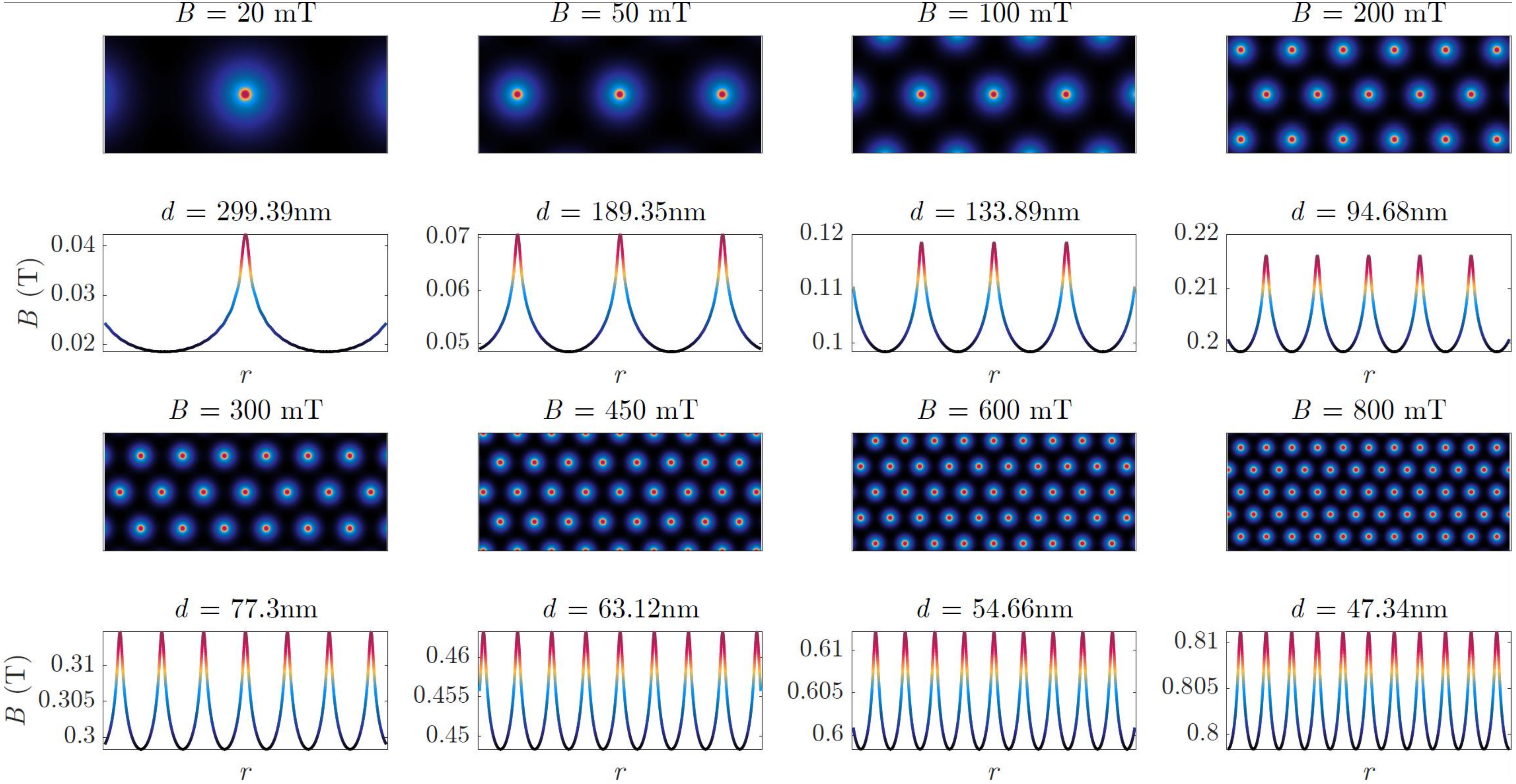








Vortex lattice (VL) in YBCO



$\lambda \approx 150$ nm

$\xi \approx 3$ nm

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Ground state of stoichiometric FeO

American Mineralogist, Volume 87, pages 347–349, 2002

Monoclinic nearly stoichiometric wüstite at low temperatures

HELMER FJELLVÅG,[1] BJØRN C. HAUBACK,[2] TOM VOGT,[3] AND SVEIN STØLEN[1,*]

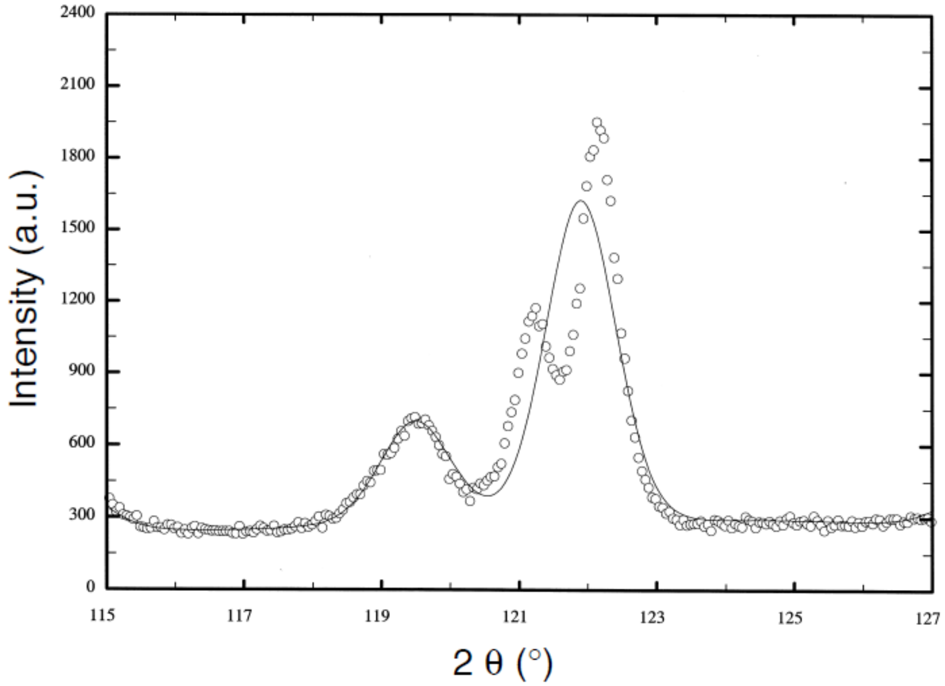


FIGURE 1. Observed and calculated powder neutron diffraction intensities for rhombohedral $Fe_{0.99}O$ ($R\overline{3}$) (λ = 1.8857 Å).

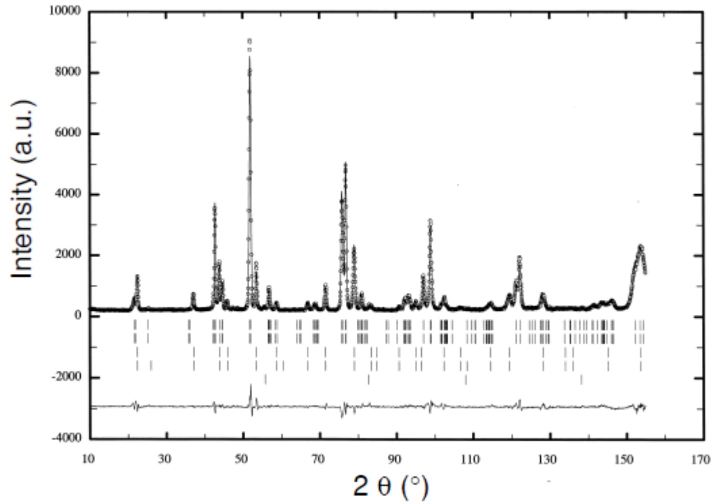
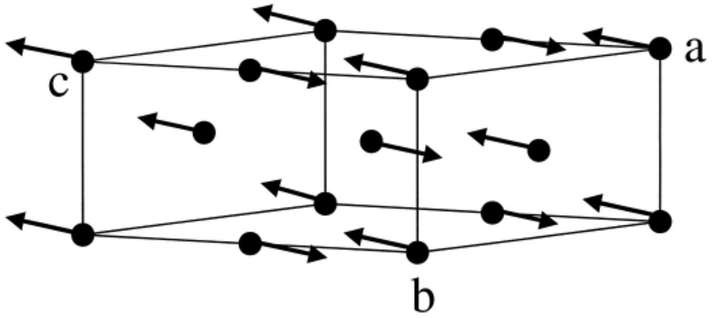
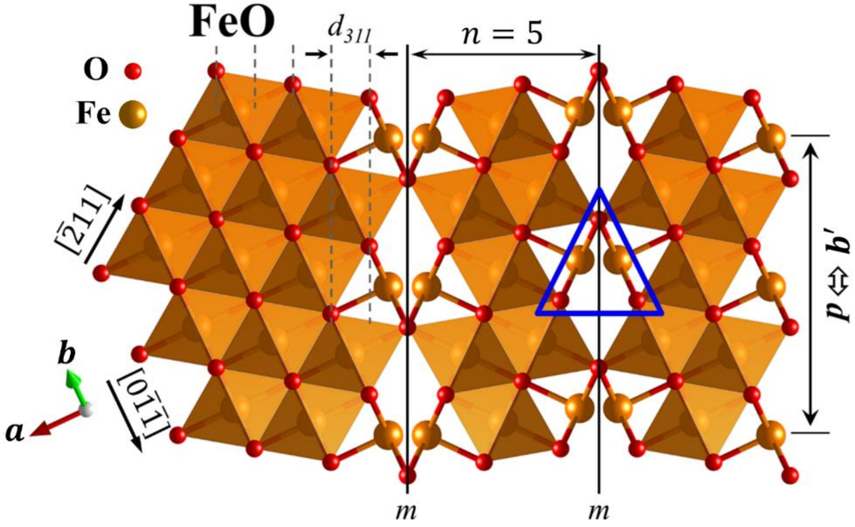
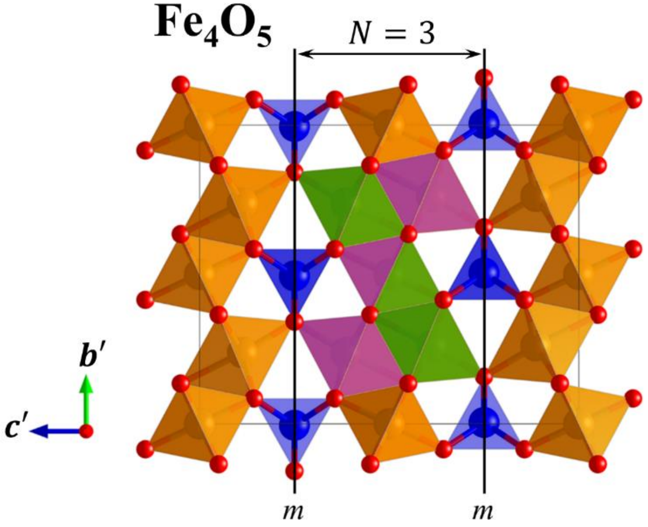


FIGURE 3. Magnetic structure of monoclinic $Fe_{0.99}O$ at 10 K in the magnetic unit cell a (magn) = a_m, b (magn) = b_m, and c (magn) = $2c_m$.

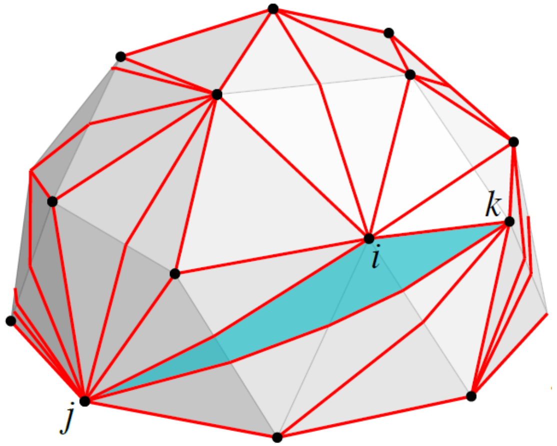


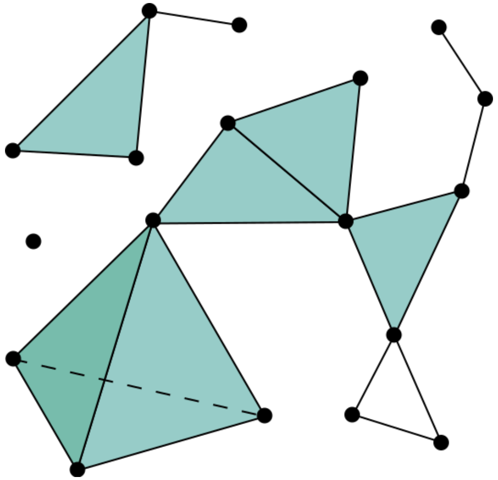
Algebraic approach to crystallography of modular structures



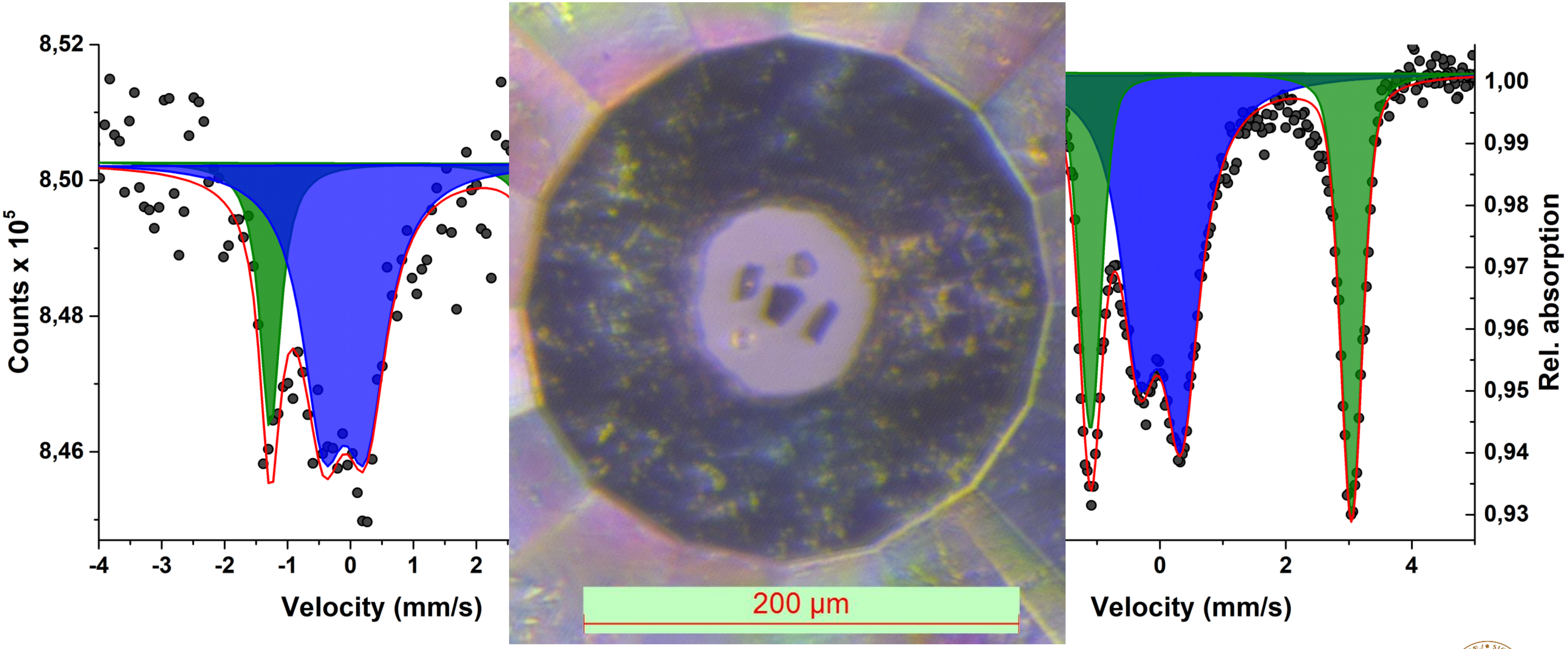


ABSTRACT SIMPLICIAL COMPLEX





MS acquisition in a diamond anvil cell (DAC)



High-pressure phase transitions of Fe_4O_5