nature materials

SUPPLEMENTARY INFORMATION

https://doi.org/10.1038/s41563-017-0010-4

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Atomic scale imaging of magnetic circular dichroism by achromatic electron microscopy

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Supplementary Information for

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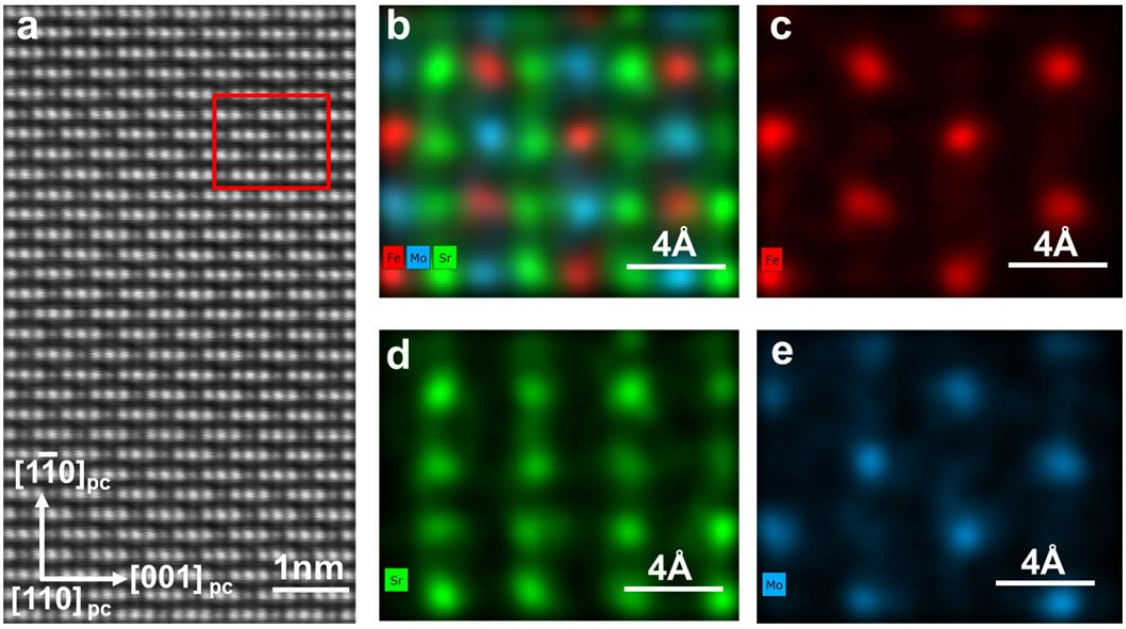

Figure S1 | Atomic scale crystal structure and chemical composition of ordered Sr_2FeMoO_6 (SFMO). **a,** HAADF STEM image of SFMO viewed along $[110]_{pc}$. The contrast is sensitive to the composition of each atomic column. **b,** Atomic scale energy dispersive X-ray (EDX) map of the region of SFMO marked in (**a**). **c-e,** Individual atomic scale EDX maps of Fe, Sr and Mo, respectively, showing chemical order and confirming the quality of the specimen.

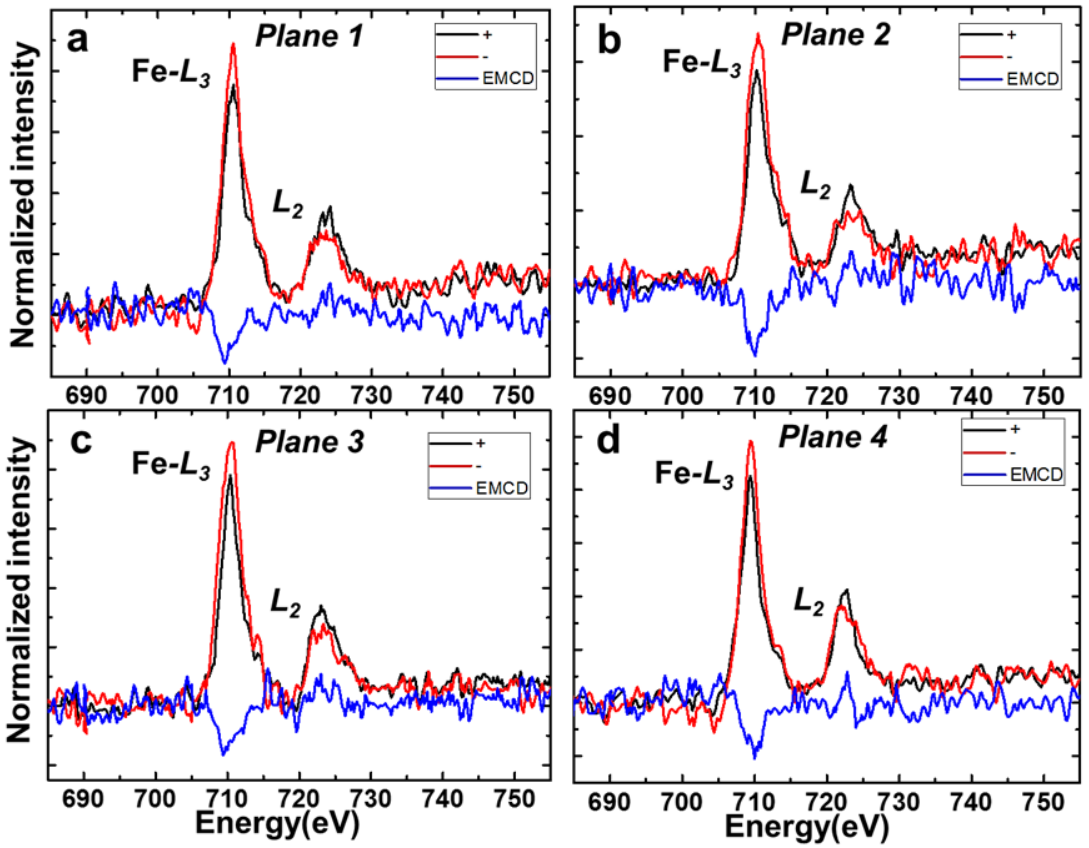

Figure S2 | Experimental atomic scale electron energy-loss magnetic chiral dichroism (EMCD) signals for Fe recorded in a three beam condition. a-d, EMCD results from different atomic planes extracted from Figures 3a and 3b. The black and red lines represent electron energy-loss spectra corresponding to the "+" and "-" positions, respectively. The blue lines are EMCD signals.

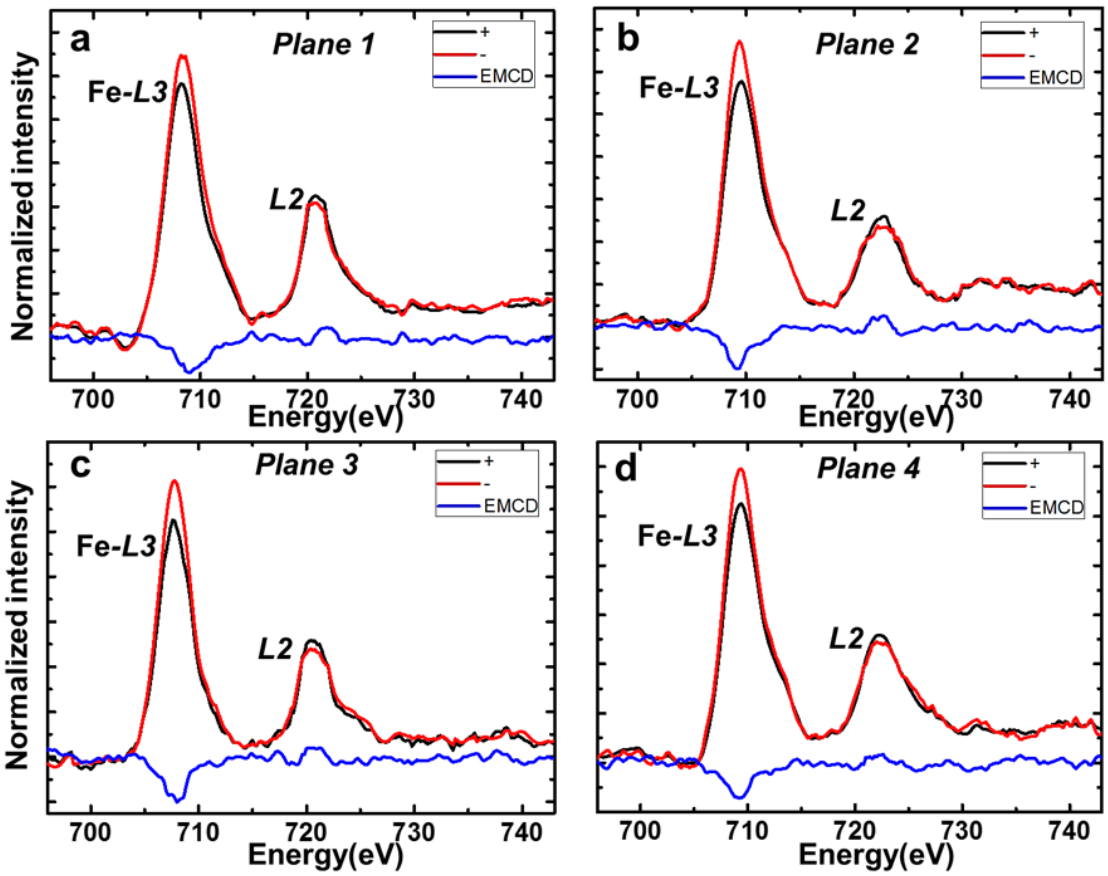

Figure S3 | Experimental atomic scale electron energy-loss magnetic chiral dichroism (EMCD) signals for Fe recorded in a three beam condition and processed using principal component analysis with Cornell Spectrum Imager software. a-d, EMCD results from different atomic planes extracted from the processed data shown in Figures 3c and 3d. The black and red lines show electron energy-loss spectra corresponding to the "+" and "-" positions, respectively. The blue lines are EMCD signals. The EMCD spectra are the same as those shown in Fig. 3f.

Table S1 | Statistical analysis of measurements of orbital to spin magnetic moment ratio (m_L/m_S) from atomic scale EMCD experiments.

Number of EMCD spectra per plane	m_L/m_S at plane 1	m_L/m_S at plane 2	m_L/m_S at plane 3	m_L/m_S at plane 4
1	0.086	0.088	0.08	0.081
2	0.061	0.062	0.04	0.061
3	0.051	0.043	0.057	0.043
4	0.039	0.039	0.046	0.031
5	0.043	0.044	0.041	0.054
6	0.081	0.082	0.081	0.079
Average Value	**0.056**	**0.053**	**0.051**	**0.058**
Standard Deviation	**0.019**	**0.021**	**0.020**	**0.019**
Total	**0.056 ±0.019**	**0.053 ±0.021**	**0.051 ±0.020**	**0.058 ±0.019**