Designing switchable electric and magnetic order for low-energy computing

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Scientists at the University of Liverpool have developed a new material that combines both electrical and magnetic order at room temperature, using a design approach which may enable the development of low-energy computer memory technologies.

Researchers from the University's School of Physical Sciences achieved this scientific advance by designed control of the distribution of the atoms within the solid state.

This new material has implications for information storage and processing applications.

Information can be stored in computers in two distinct ways - one relies on the order of atomic-scale magnets in a solid material, the other of atomic-scale electrical charges.

Both storing and manipulating this information costs energy, and with the rapid growth of the internet and internet-enabled devices, there is a strong need for lower-energy approaches to this.

In the first case, writing the information is energy-intensive whilst in the latter it is reading that is energy-intensive.

Liverpool Materials Chemist, Professor Matthew Rosseinsky, said: "Materials with both electrical and magnetic order at room temperature have been hard to engineer because these two properties often have competing requirements.

"We report a new design approach that promises to allow the synthesis and tuning of families of these materials, which are important in the development of low-energy computer memory technologies."

To make a single material that has these two distinct properties - magnetisation and electrical polarisation - is difficult because the electronic requirements for obtaining them in a material are typically contradictory: materials characteristics, such as the crystal structure or the atomic composition, which favour polarisation often disfavour magnetisation. The new design approach overcomes these difficulties.

The research was published in *Nature*.

More information: Designing switchable polarization and magnetization at room temperature in an oxide, DOI: 10.1038/nature14881

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