Topological defects could be key to future nano-electronics

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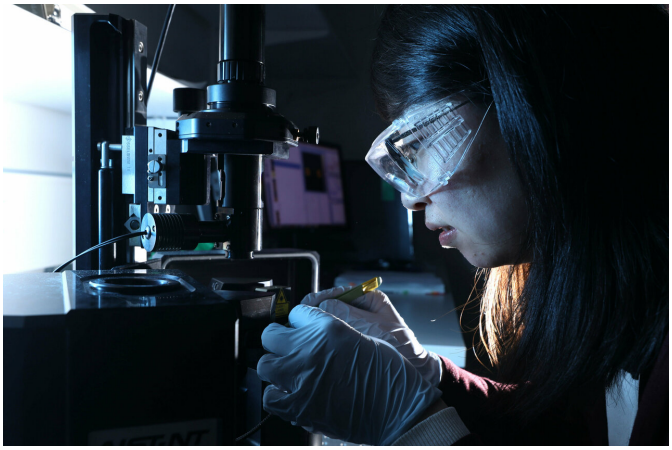
The invited review author professor Jan Seidel (UNSW). Credit: FLEET

The reason that a magnet sticks to the fridge is that electronic spins or magnetic moments in the magnetic material spontaneously align or order in one direction, which enables it to exert an attractive force to the steel door. Magnets are one type of material with such built-in order. A topological defect in such a material occurs as a discontinuity in this order, i.e., a boundary region where the order does not seamlessly transition from one area to another. These topological structures form naturally or can be highly engineered in advanced functional materials.

An article published this week in *Nature Materials* by FLEET Professor Jan Seidel outlines emerging research into different types of defective order, i.e., topological structures in materials, and their highly interesting potential applications in nanotechnology and nanoelectronics.

Although known for a long time, domain walls, a type of topological structure, have only been intensively studied in detail over recent years. It is only with recent developments in high-resolution electron microscopy (HREM) and scanning probe microscopy (SPM) that researchers have shown that domain walls can significantly affect macroscopic materials properties, and even more interestingly, that they can exhibit intrinsic properties of their own. Research in this field pioneered in part by Seidel has grown extensively in the last few years, and now has entire conferences dedicated to it, such as the annual International Workshop on Topological Structures in Ferroic Materials (TOPO), for which the first meeting was held in 2015 in Sydney.



FLEET PhD student Fan Ji in Prof Seidel's group, using SPM to study materials Credit: FLEET

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