Half-a-loaf method can improve magnetic memories

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Chinese scientists have shown that magnetic memory, logic and sensor cells can be made faster and more energy efficient by using an electric, not magnetic, field to flip the magnetization of the sensing layer only about halfway, rather than completely to the opposite direction. They describe the new cell design in the *Journal of Applied Physics*.

Magnetic random access memory (or MRAM) cells have long been investigated as possible replacements for parts of hard disk drives, flash memory and even computing circuits. Previous designs, however, have proven to be too power-hungry or expensive to be competitive.

"Our new cell design offers a great possibility for data storage elements and logic gates that are fast and non-volatile with ultra-low power consumption," said Dr. Ce-Wen Nan of Tsinghua University in Beijing, China. The new cell is also simpler to make than existing components. Only two layers are needed, compared with three or more for traditional magnetic memories.

The design by Nan's group is a simple thin-layer sandwich of two different materials, each of which has very different magnetic and electrical properties.

Applying a voltage to the ferroelectric layer switches its polarization in a way that starts to change the magnetic orientation of the adjacent ferromagnetic layer. This partial change alters the electrical resistance of the entire stack enough to indicate whether the cell is storing a "0" or a

"1" data bit. Future research is aimed at understanding and optimizing the materials to increase the resistance change, which will enhance its commercial prospects.

More information: The article, "A simple bi-layered magnetoelectric random access memory cell based on electric-field controllable domain structure" by Ce-Wen Nan will appear in the *Journal of Applied Physics*. jap.aip.org/resource/1/japiau/v108/i4/p043909_s1

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