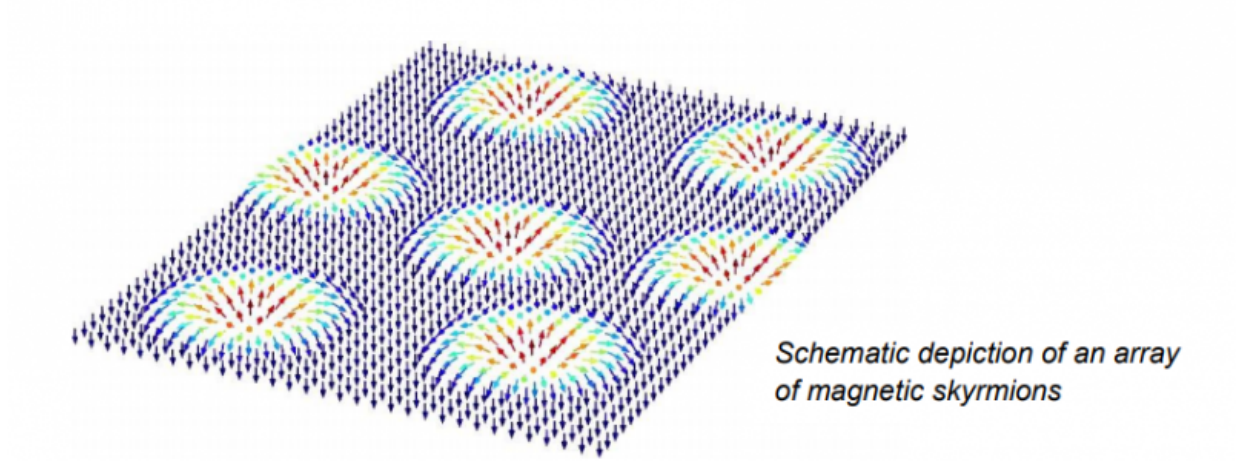
Researchers make a breakthrough toward the next generation of memory devices

August 22 2017



Credit: Agency for Science, Technology and Research (A*STAR), Singapore

A*STAR and NTU researchers have created a thin film material that allows them to control the size and density of magnetic skyrmions. In addition, they have also achieved electrical detection of these skyrmions. The fabrication process for these films is compatible with current industrial methods. This discovery is a breakthrough and is a key step towards the creation of a skyrmion-based memory device, which is one of the promising contenders for the next generation of memory technologies.

The discovery has been recently published in *Nature Materials*.

Skyrmions are small particle-like magnetic structures about 400 times smaller than a red blood cell. They can be created in magnetic materials, and their stability at small sizes makes them ideal candidates for memory devices. Since the discovery of room temperature skyrmions in 2015, there has been a global race to create a skyrmion memory device because such a device could potentially hold more information, while using less power.

The need for more memory

Increasingly large amounts of data are created daily in our rapidly digitalised world. Moreover, cutting-edge technologies such as the Internet of Things (IOT), edge computing, and Artificial Intelligence (AI) require immediate processing of this data for effective performance. This requires the development of memory devices with increasingly higher capacities.

The capacity of current memory and computing devices has been doubling every two years. This increase in memory density has been achieved by shrinking the size of Schematic depiction of an array of magnetic skyrmions individual memory bits. Think of each memory device as a Go board, and each memory bit as a game piece. The number of game pieces that can be placed on each board is limited by their size. To increase the number of pieces that can be fit into the same board, the size of the pieces needs to be smaller. By shrinking a game piece to half its size, four times as many game pieces can fit onto the board.

However, current technology is reaching its limits of miniaturizing memory bits. Scaling it down further using current methods would cause the memory devices to be more prone to temperature fluctuations – which affects how well a device retains data. "This discovery is a crucial step towards the development of a skyrmion-based memory device. It could place Singapore at the forefront of next-generation memory

technology and storage solutions," said Dr Anjan Soumyanarayanan, lead author of the paper and one of the A*STAR researchers behind the discovery.

More information: Anjan Soumyanarayanan et al, Tunable room-temperature magnetic skyrmions in Ir/Fe/Co/Pt multilayers, *Nature Materials* (2017). DOI: 10.1038/nmat4934

Provided by Agency for Science, Technology and Research (A*STAR), Singapore