Researchers take magnetic waves for a spin

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Researchers at New York University have developed a method for creating and directing fast moving waves in magnetic fields that have the potential to enhance communication and information processing in computer chips and other consumer products.

Their method, reported in the most recent issue of the journal *Nanotechnology*, employs "spin waves," which are waves that move in magnetic materials. Physically, these spin waves are much like water waves—like those that propagate on the surface of an ocean. However, with a purpose akin to that of electromagnetic waves (i.e., light and radio waves), spin waves can efficiently transfer energy and information from place to place.

"Spin waves hold tremendous promise in improving the functionality of a range of technologies," says Andrew Kent, a professor in NYU's Department of Physics and one of the paper's co-authors. "Our results mark another vital step in harnessing a resource that is faster and more energy efficient that what we rely on today."

Currently, electromagnetic waves in antennas can be converted into spin waves. However, the resulting spin waves have a long wavelength and propagate slowly. In contrast, short-wavelength spin waves can move over greater distances, more quickly, and with less energy, and thus present the possibility of improving a range of communications and electronic devices.

Yet, scientists have had difficulty in creating such spin waves. To overcome this obstacle, the NYU researchers developed "spin torque nano-oscillators" (STNO)—nanoscale devices that can convert a direct current into spin waves. They showed that these oscillators can be arranged in arrays to direct the spin wave energy, much the way antennas are used to direct electromagnetic waves.

Crucially, they developed a method that allows the spin waves to navigate in specific patterns and directions throughout a magnetic material. Their idea relies on the interference of waves and controlling the interference to produce specific wave propagation patterns.

Provided by New York University