



VCU

VIRGINIA COMMONWEALTH UNIVERSITY

“Voltage-Controlled High Density Memory Devices” VCU #16-018

Applications

- Energy efficient computing
- Nanomagnetic memory

Advantages

- Voltage controlled (doesn't require a bias magnetic field)
- Small and stable device
- Improved strategy for skyrmion switching
- Non-volatile and energy efficient
- Additionally, a strategy for reducing the write current for switching magnetization in PMA materials

Inventors

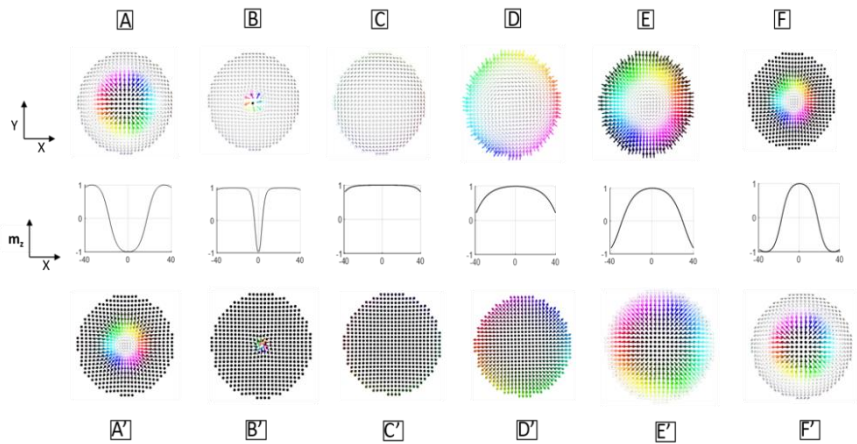
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Technology Summary

This invention is a new switching strategy for computing memory which only uses a voltage and doesn't require a bias magnetic field. Existing processes use magnetic field or spin current for reversal which consumes a lot of energy. This invention uses voltage controlled magnetic anisotropy for core reversal of a magnetic skyrmion, skyrmion mediated ferromagnetic state reversal and switching between skyrmion and ferromagnet states without requiring any bias magnetic field or spin current. This strategy for switching of a fixed skyrmion leads to smaller and more stable devices for high density memory applications. This invention can create new avenues towards implementing energy efficient nanomagnetic memory and computing. The figure to the right displays the spin state configuration with varying voltage, where A shows skyrmion with core pointing down changing until F with core pointing up [1].



(c)

Finally, another important invention is the ability to control the switching pathway between the ferromagnetic “up” and “down” states in perpendicular MTJs to lower the write current needed to switch between these states. This paper is under preparation for publication [2].

Technology Status

Patent pending: U.S. and foreign rights available.

A publication describing a portion of this technology can be found at the following link:

[1]Scientific Reports, 6, 31272 (2016); <http://www.nature.com/articles/srep31272>

[2] To be published.

This technology is available for licensing to industry for further development and commercialization.