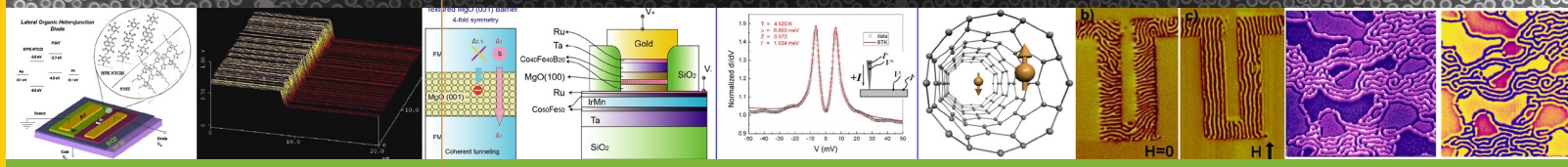
JHU

# New Magnetoelectronic Materials, Phenomena and Devices for Next Generation Technologies



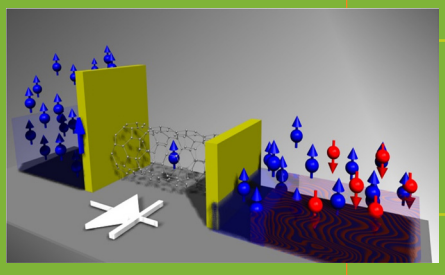

Johns Hopkins University

MAGNETOELECTRONICS

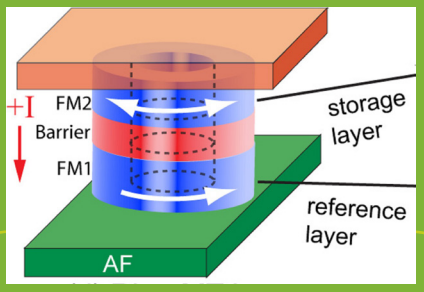
**Magnetoelectronics has provided some of the most exciting areas for the exploration of new physical phenomena and new technologically important devices such as spin-valve GMR read-heads, and magnetic random access memory.**

The MRSEC at the Johns Hopkins University (JHU) is composed of scientists at JHU, Brown University, Carnegie Mellon University, and the National Institute of Standards and Technology. Research areas include: perpendicular spin transport in MgO-based magnetic tunnel junctions (MTJs), magnetic nanorings and other novel device architectures, organic magnetoelectronic materials, and explorations of magnetoelectronic effects in lateral structures. The research effort encompasses synthesis and processing, characterization of nanostructures, measurements of properties, theoretical modeling, and prototype device fabrication and applications.

## HIGHLIGHTS . . .



We have created a new type of spin diode with electrically controlled functionality using carbon nanotubes.

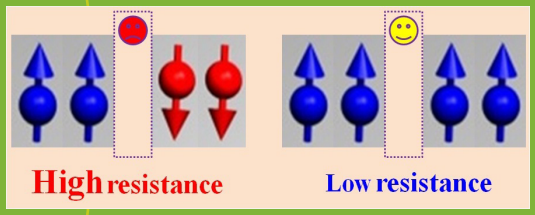



We have fabricated nanoring magnetic tunnel junctions with properties unattainable in disc-shaped MTJs.

DIRECTOR: Chia-Ling Chien
http://mrsec.jhu.edu/

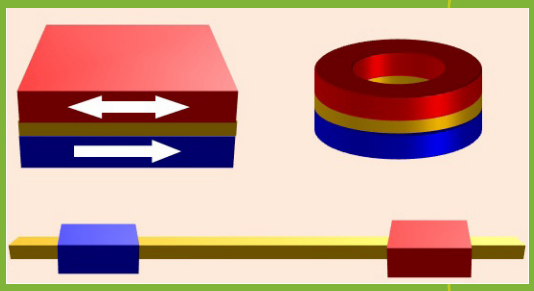
## RESEARCH FUNDAMENTALS . . .

Spin is involved in charge transport, exhibiting intriguing physical phenomena such as giant magnetoresistance (GMR) and tunneling magnetoresistance (TMR).




**"The rapid progress of magnetoelectronics has enabled computers and devices such as iPods to alter our lives."**

Chia-Ling Chien,
Director



The JHU-MRSEC employs state-of-the-art techniques to fabricate and characterize inorganic and organic magnetoelectronic materials and devices such as perpendicular MTJs, nanorings, and lateral structures.

## MRSEC OFFERS DIVERSE EDUCATION AND PARTNERSHIPS...

- **Research Experience for Undergraduates (REU):** We provide a wide range of research opportunities for undergraduates.
- **High School Student Summer Internships:** High school students participate in our research programs through paid summer internships.
- **High School Teacher Summer Internships:** We run internships for high school teachers to enhance their scientific knowledge and provide them with new educational materials.
- **Research Experience for Teachers (RET):** High school teachers spend two consecutive summers in our RET program conducting research and doing curriculum development.
- **Partnership in Research and Education in Materials (PREM):** We partner with Howard University and Prince George's Community College to provide research and training opportunities for members of underrepresented groups.

OUTREACH

**More information about the workshops, internships, partnerships, and educational opportunities are available at: http://mrsec.jhu.edu/outreach/**