총회 특별 초청강연 (IEEE DL)

Spin Electronics

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Conventional electronics has ignored the spin on the electron. Besides its fundamental unit charge, the electron has a magnetic moment due to its quantum of angular momentum. Things began to change in 1988, with the discovery of giant magnetoresistance in metallic thin film stacks. This led to the development of spin valves and magnetic tunnel junctions, which allowed magnetic recording to ride the tiger of 100% year-on year growth of recording density for the past ten years. Tunnel junctions are the active elements for most schemes for nonvolatile magnetic random-access memory, which will be briefly surveyed.

These devices, which underpin the multi-billion dollar magnetic recording industry, are nothing more than sophisticated magnetoresistors, the simplest two-terminal electronic device. If we are to see a second generation of spin electronics, it will be necessary to develop more complex devices such as a three-terminal spin transistor with gain. Here magnetic semiconductors are required, or at least the ability to manipulate spin-polarized currents in normal semiconductors. The puzzling new family of dilute magnetic oxides, such as ZnO:Co or SnO_2:Mn, and the emerging class of d^0 ferromagnets such as HfO_2 or CaB_6 may produce a new paradigm for magnetism in solids, and support entirely new device concepts. A major challenge is to separate spin and charge currents in solids, and transmit information magnetically, without dissipation.

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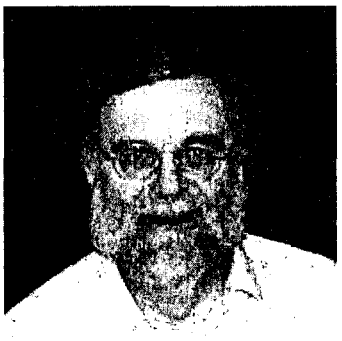
저자약력:



Michael Coey received a BA degree in physics from Cambridge University in 1966, and a PhD from the University of Manitoba in 1971. He worked as a researcher in the Centre National de la Recherche Scientifique in the 1970s, before moving to Trinity College Dublin, where he has been Professor of Experimental Physics since 1986.

Michael Coey has broad interests in magnetism, spanning materials hard and soft, crystalline and amorphous, metallic, semiconducting and insulating as well as magnetic phenomena and devices. He coordinated the 'Concerted European Action on Magnets' (1984-94), a pioneering group of academic and industrial researchers devoted to all aspect of the understanding, development an application of rare-earth iron permanent magnets. More recently, he led the Oxide Spin Electronics Network, OXSEN 1996-2000. Currently he is Deputy Director of Ireland' s nanoscience centre CRANN. He serves as Divisional Associate Editor of *Physical Review Letters* and on the editorial board of the *Journal of Magnetism* and *Magnetic Materials.*

His main research interests at present are in spin electronics, including magnetic semiconductors, as well as magnetotransport and magnetoelectrochemistry. He has published more than 500 papers, and is co-author of books on Magnetic Glasses and Permanent Magnetism. Michael Coey is the recipient of the Charles Chree medal of the Institute of Physics, and the gold medal of the Royal Irish Academy. He is a fellow of the Royal Society, and a Foreign Associate of the National Academy of Science.

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