

# IEEE Magnetics Society

## Santa Clara Valley Chapter

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The objective of the Santa Clara Valley Chapter of the IEEE Magnetics Society is to sponsor local seminars and publicize conferences, workshops and other information of interest to the Society's local members and technical people in the area of applied magnetics.

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**Web Site:** <http://www.ewh.ieee.org/r6/scv/mag/>

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### 2006 Meetings

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|-----------|---|
| 1/17/06   | Beyond the Limits of Magnetic Recording<br>Dr. Mason Williams *, HGST (ret.)              |
| 3/22/06   | Magnetic Memory Devices: Minimum Feature Sizes<br>Dr. Steven Hetzler, IBM                 |
| 4/18/06   | Massive Information: Exploitation and Security<br>Prof. Ronald Indeck *, Washington Univ. |
| 6/20/06   | Trends and Opportunities in Data Storage<br>Tom Coughlin, Coughlin Associates             |
| 9/19/06   | Spin Electronics<br>Prof. Michael Coey, *, Univ. of Dublin                                |
| 10/17/06  | Recollections of the Early History of Video Tape Recording<br>Fred Pfof, Consultant       |
| 11/ 14/06 | The Technology of Magnetic Hard Disk Drive Storage<br>Dr. Ed Grochowski, IDEMA            |

## 2006 Meetings Abstracts (Incomplete)

**TUESDAY, JUNE 20, 2006**

### **Trends and Opportunities for Data Storage**

**Tom Coughlin, President, Coughlin Associates**

A terabyte in your pocket, a petabyte in your home—within the next decade we might see these levels of personal storage requirements. Already a terabyte hard disk drive can be seen on the near horizon. New applications will drive storage capacity, performance, and unit growth for all types of storage devices. Growing storage demand for consumer applications will join with industrial storage system demand to create an unprecedented demand for storage. Within 5 years personal content (created by non-commercial sources) will equal and even exceed commercial content in many homes. Supplying storage to support the creation and delivery of commercial as well as personal and quasi-commercial digital content, including non-traditional delivery to support new markets such as IPTV and mobile phones will become an important factor ensuring storage growth. This talk will explore these and other developing trends in data storage products and applications.

The implications and growing uses of disk drives as well as form factor projections will be shown. Disk drives will compete and cooperate with existing and new storage technologies for many of these fast developing markets. To compete and work successfully with alternative digital storage technologies in developing applications hard disk drives will need to continue technological and architectural developments. These changes will require courage, vision and commitment to the great value that storage technologies provide to humanity. Capital spending to support the growth of disk drive units and the introduction of new technology to support growing storage requirements will also be estimated.



Tom Coughlin, President, Coughlin Associates has been working for over 25 years in the data storage industry at companies such as Ampex, Polaroid, Seagate, Maxtor, Micropolis, Syquest, and 3M. He has over 50 publications and six patents to his credit. Tom is active with IDEMA, the local IEEE section (where he is Vice-Chairman) including the IEEE Magnetics Society and the IEEE Consumer Electronics Society (where he is Chairman). He is also active with other professional organizations. He is the founder and organizer of the Annual Storage Visions Conference, a partner to the annual Consumer Electronics Show. Coughlin Associates provides market and technology analysis as well as Data Storage Technical Consulting services. For more information go to [www.tomcoughlin.com](http://www.tomcoughlin.com)

**TUESDAY, SEPTEMBER 19, 2006**

## **Spin Electronics**

**Professor Michael Coey**  
**2006 IEEE Magnetics Society Distinguished Lecturer**  
**School of Physics, Trinity College Dublin**

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<sub>2</sub>:Mn, and the emerging class of d0 ferromagnets such as HfO<sub>2</sub> or CaB<sub>6</sub> 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.



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 aspects of the understanding, development, and 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. Contact: J. M. D. Coey, School of Physics, Trinity College, Dublin 2, Ireland. Tel: +353 1 6081470; Fax: +353 1 6772941; email: [jcoey@tcd.ie](mailto:jcoey@tcd.ie)

**TUESDAY, NOV 14 , 2006**

## **The Technology of Magnetic Hard Disk Drive Storage**

### **Ed Grochowski, Executive Director, IDEMA**

Today's hard disk drive has evolved through miniaturization into a small storage device with up to 750 Gigabytes of storage, with the promise of a one terabyte product appearing in the very near future. This storage device, based on reduced form factors and large capacity, is well suited for today's storage applications, from large server units to mobile and consumer based products. The technology which made this storage device possible includes advanced read/write heads which now include PMR, thin film media, PRML data channels and many other features which have added to the usefulness of HDD's while significantly reducing price per gigabyte. An analysis of this technology will be given as well as projections of where newer advances could extend the applications of magnetic storage products to the future. A comparison of HDD storage to alternative non-volatile technologies including Flash memories and MRAM devices will be discussed. A major part of the presentation will include trend charts, with technical rationale, to assist in the projecting the future.



Ed Grochowski began his career with IBM's microelectronic silicon activity in New York and later joined the IBM Almaden Research Center in California where his interests included hard disk drive and component technology, and their evolutionary trends. Dr. Grochowski holds nine patents and has authored and presented numerous articles on magnetic disk drives and component technology, including a website of storage trend charts. These charts are regarded as industry road maps and are widely quoted as references. He earned a Ph.D. from New York University (1971) in Chemical/Materials Engineering. Ed currently is the Executive Director of IDEMA USA (International Disk Drive Equipment and Materials Association), a non-profit hard disk drive organization serving the storage industry. He chairs the conferences and technical committee for DISKCON USA and DISKCON Asia Pacific, as well as the IDEMA Symposium series, and coordinates the 4K byte long sector standards committee for IDEMA.

Ed is also a member of the IEEE and is a well known speaker on hard disk drive trends and technology. After 41 years with IBM, Dr. Grochowski retired and next joined Hitachi GST. Besides his IDEMA responsibilities, he is presently active as a storage industry consultant. His prior and present clients include IDC (International Data Corp.) and TrendFocus.

Contact: Dr. Edward Grochowski, [Ed.Grochowski@idema.org](mailto:Ed.Grochowski@idema.org)