High Density Magnetic Recording: from Heat Assisted Magnetic Recording (HAMR) to Ultrafast Spin Dynamics in Novel Materials

by Dr. Ganping Ju

Date: 23rd October 2007 (Tuesday)
Time: 4:00pm to 5:00pm
Venue: LT 4

Abstract

The tremendous increase in magnetic areal density has been largely responsible for the proliferation of hard disk drive recording into new applications and markets. The superparamagnetic limit imposes a signal-to-noise ratio, thermal stability, and writability tradeoff that limits the ability to continue to scale traditional magnetic recording technology to higher storage densities. Heat Assisted Magnetic Recording (HAMR) offers a new degree of freedom with elevated writing temperature that holds the promise of extending the areal density of magnetic data storage. By temporarily heating the media during the recording process, the media coercivity can be lowered below the available applied magnetic write field, allowing higher media anisotropy and therefore smaller thermally stable grains. The heated region is then rapidly cooled in the presence of the applied head field where transition is recorded. With a tightly focused laser beam heating the media, the write process is similar to magneto-optical recording, but in a HAMR system the readout is performed with a magneto-resistive element. A detailed illustration of the challenges and implementation of HAMR will be presented [1].

On the other hand, the understanding of magnetization dynamics on sub-ns timescale becomes increasingly important for the high data-rate application. Over the last decade, the ultrafast spin/magnetization dynamics has recently attracted strong scientific interest. We will discuss the dynamics effect in the advanced recording systems. As an example, we will present a scientific study of ultrafast magnetization generation by optically induced antiferromagnetic-ferromagnetic phase transformation in chemically ordered FeRh films [2]. We demonstrate that ferromagnetism can be induced on the sub-ps timescale by driving the transformation with femtosecond optical pulses. The understanding of the underlying Physics and potential application will be also discussed.

Overall, we would like to share with you that the ever-increasing data storage capability is driven not only by great engineering accomplishment but also with scientific innovation and understandings.

Dr. Ganping Ju Speaker

Dr. Ganping Ju is currently the manager of the Advanced Magnetic Media group in Seagate Research, Pittsburgh. He received his Bachelor’s degree in Physics from Peking University (China) in 1994, and received his Ph.D degree in Physics from Brown University in 1999. He joined Seagate Research as Research Staff Member in the Recording Media Research department in 1999, and become a manager in 2003. He has also received two Outstanding Innovation and Technical Contribution Awards from Seagate Technology. His primary research interest include: advanced characterization of the magnetic properties and recording Physics in novel recording media, high frequency and ultrafast switching dynamics in magnetic thin film and storage devices. He has authored over 40 scientific publications. He has given over 30 conference presentations, including 15 invited presentations in international conferences and university seminars. He is currently a member of IEEE and APS. He is also serving as Technical Committee Member and Pittsburgh Chapter Chair of IEEE Magnetic Society.

All are Welcome!