

**DSN-I Seminar Series***Professor James A. Bain***HEAT ASSISTED MAGNETIC RECORDING:  
A HIGH VOLUME APPLICATION FOR PLASMONIC  
NANOTECHNOLOGY**

September 5, 2014  
Hamburg Hall Room 1216  
3:30 p.m. - 5:00 p.m.

**► Abstract**

In this talk, I will review Heat Assisted Magnetic Recording (HAMR) and why it is needed to allow hard disk drive (HDD) technology to continue to advance. I will spend a few minutes discussing the prospects of HDD's in the face of solid state drives (SSD's) and justify the assertion the HDD's and SSD's will coexist for the foreseeable future. One critical technology for HAMR's success is the development of efficient optical near field transducers (NFT's) for localizing optical energy during the recording process. Metallic nanostructures are used because they can localize optical fields at dimensions far below the optical wavelength using surface plasmon polaritons (or plasmons). Engineering these systems involves developing efficient plasmonic designs and finding ways to dissipate waste heat at the nanoscale. The CMU HAMR team within the Data Storage Systems Center (DSSC) has made a number of recent advances in this area and some of these will be reviewed. Specifically, I will discuss how the plasmonic modes of an NFT and the coupling to the medium can be modeled as an optical transmission line terminated by a mismatched load. Additionally, I will describe recent design innovations for the direct coupling of lasers to NFT's through evanescent optical fields to get more efficient excitation and the development of better nanoscale heat sinking of the NFT's through the use of AlN dielectrics. Fabrication of plasmonic nanostructures within the CMU nanofab and their characterization is an ongoing part of this work and will be featured. I will attempt to demonstrate that NFT's for HAMR is a near-term potentially high-volume application of engineered plasmonic devices with a high likelihood of commercialization.

**► Speaker Bio**

Professor James A. Bain received his B.S. (1988) in Materials Science and Engineering from the University of Pennsylvania and his M.S. (1991) and Ph.D. (1993), also in Materials Science and Engineering, from Stanford University. He is a professor in the Electrical and Computer Engineering (ECE) Department of Carnegie Mellon University. He also holds a courtesy appointment in the Department of Materials Science and Engineering and is associate director of the Data Storage Systems Center (DSSC). These departments and the DSSC are part of the College of Engineering at CMU. Prof. Bain has co-authored more than 225 papers in the field of magnetic, optical, electrical, thermal, and mechanical devices and materials for information storage. He currently has active research programs in heat assisted magnetic recording, and resistive switches for memory and reconfigurable electronics. He is a member of the Materials Research Society and the IEEE. Magnetics, IEEE Electron Devices and IEEE Photonics Societies.