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Penn State Nanofabrication Facility  
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## EDUCATION

- Ph.D. in Physics** August 2002.  
Michigan State University, East Lansing, Michigan.  
Dissertation: *CPP-Magnetoresistance in ferromagnetic/nonmagnetic multilayers.*
- M.S. in Physics** July 1996.  
Yarmouk University, Irbid, Jordan.  
Thesis: *Superparamagnetism and Spin-Glass-Type Behavior in Frozen Ferrofluids.*
- B.Sc. in Physics** University of Jordan, Amman, Jordan. June 1993.

## RESEARCH EXPERIENCE

**Nanotechnology Domain Expert and Senior Process Engineer** August 2005 – present  
Penn State National Nanofabrication Facility ([www.nanofab.psu.edu](http://www.nanofab.psu.edu))

- ❖ Daily operation of state-of-the-art Leica EBPG-5HR electron beam lithography tool and a Leo 1530 Field Emission SEM tool to create and characterize nanometer scale features.
- ❖ User support and training of new e-beam lithography users and FESEM users as well as cleanroom users in general. This includes running ebeam jobs and process flow improvement for all local untrained users of the ebeam tool.
- ❖ Operation of cleanroom equipment, when projects needed that. Equipment typically operated are metal evaporators (Lesker, Semicore, and Edwards), MA6 photolithography mask aligner, and PT720, MERIE , and M4L reactive ion etching tools.
- ❖ Ensuring sufficient supply of ebeam resists and developers and communicating with ebeam service company
- ❖ Worked on a variety of special projects that required challenging ebeam lithography process development, and on outreach to help researches with especially challenging needs in ebeam lithography.

*During this period I have fabricated complex nanostructures that became the base for two NIH and one NSF research proposals that I am included in. All proposals are submitted and are pending. The proposals are:*

1. *Metallic Surfaces and Particles in DNA* (NIH)
2. *Plasmon-Controlled Fluorescence.* (NIH)
3. *Dispersive Measurements of Quantum Coherence in Single Molecule Magnets* (NSF)

Achievements during work in the Penn State Nanofab:

- a) Improved e-beam process (i.e. resolution limit), especially using the negative-tone resist, HSQ.
- b) Developed two new processes for ultrahigh resolution (<20nm) lift off process with high aspect ratios. One process uses M(MMA/MAA)/HSQ and the second uses M(MMA/MAA)/ZEP520A.
- c) Created SQUID nano-bridge devices (through supervising an NSF REU summer student) as a collaboration with Physics Department in the University of California, Berkley. Those nano-SQUIDs will be the basis for studying the spin states of individual single molecule magnets. The REU student had a very positive experience and concluded her project successfully by fabricating 20nm nano-SQUIDs.

### Specific Remote Projects:

1. Fabricating Au nanopatterns of ~50nm width and ~50nm breaks on freestanding SiN films.  
User: Hugo Romero, University of Pennsylvania
2. Fabricating Ag and Au nanostructures on glass substrates for plasmonic studies.  
User: Joseph Lakowicz, The University of Maryland
3. Fabricating long nano-lines (50nm wide) of Au on Si/SiO<sub>2</sub> wafers  
User: Shigeru Amemiya, Pittsburgh University.
4. Metallic Nanodots on Si for Raman Studies  
User: Greg McCarty, University of North Carolina
5. Making nanotube FET transistors using Au/Pt nanodots on Si/SiO<sub>2</sub>  
User: Son Nguyen, Temple University

### **Postdoctoral Researcher**

September 2002 – present

Department of Physics, Pennsylvania State University.

- ❖ Demonstrated and studied the current-driven magnetization switching and magnetic domain wall manipulation in a variety of magnetic configurations in micro- and nanostructures of GaMnAs.
- ❖ First to exchange bias a ferromagnetic semiconductor by proximity to an antiferromagnetic layer.
- ❖ Demonstrated the use of nanolithography to engineer the Curie temperature and resistivity of ferromagnetic semiconductors.
- ❖ Played a leadership role and assisted other post-docs and graduate students in two projects that involved exchange biasing and the nanopatterning and characterization of GaMnAs.
- ❖ Worked in a Class 10 Nanofabrication Cleanroom facility focusing on electron beam nano-patterning, wet and reactive ion etching, and metal deposition to lithograph semiconductor films into sub-micron features.
- ❖ Planned, designed, and executed extensive studies on spin transport in magnetic nanostructures.
- ❖ Grew magnetic and nonmagnetic GaAs-based semiconductor films and multilayers using ultrahigh-vacuum Molecular Beam Epitaxy.

### **Graduate Research Assistant**

May 1999-August 2002

Department of Physics and Astronomy, Michigan State University.

- ❖ Worked in a class 100 Cleanroom facility to fabricate nano-pillars for current-driven switching of magnetization in magnetic multilayers.
- ❖ Developed lithographic techniques to prepare sub-micron scale samples (electron beam lithography, photo-lithography, metal evaporation, ion milling, and wet and dry etching).
- ❖ Used AFM, SEM, X-ray scattering, and SQUID magnetometry to characterize samples.
- ❖ Prepared Ferromagnetic/Nonmagnetic thin films using high-vacuum-compatible sputtering.
- ❖ Studied CPP-Magnetoresistance (CPP-GMR) of multilayers at 4.2 K using four-terminal probe and SQUID comparator, and at room temperature using nano-voltmeter systems.

### **Graduate Research Assistant**

January 1995-July 1996

Department of Physics, Yarmouk University, Irbid, Jordan.

- ❖ Prepared ferro-fluids (magnetic fluids) of Barium Ferrite fine particles.
- ❖ Used a Vibrating-Sample Magnetometer to study Superparamagnetism in spin-glasses.
- ❖ Measured susceptibility, magnetic viscosity, and hysteresis at cryogenic temperatures.

## TEACHING EXPERIENCE

### Graduate Teaching Assistant

August 1997 – May 1999.

Department of Physics and Astronomy, Michigan State University, Michigan.

Taught freshman physics labs, and worked as an instructor in discussion sessions. Used computer-based homework assignment and submittal system.

### Graduate Teaching Assistant

September 1994- June 1995.

Department of Physics, Yarmouk University, Irbid, Jordan.

Taught freshman physics labs.

### High School Science Teacher

September 1995- June 1997.

Ministry of Education, Jordan

Taught physics, general science, and mathematics.

### Departmental Services

Michigan State University

Summer 2001.

- Helped in *Science Camp*, a summer outreach program demonstrating exciting physics experiments to promote science education for middle school students.
- Mentored new graduate students.

## PROFESSIONAL MEMBERSHIP

American Physical Society and Magnetism and Condensed Matter Physics topical groups in the APS.

## PUBLICATIONS

See attached sheet.

## CONFERENCES and WORKSHOPS

See attached sheet.

## LIST OF PUBLICATIONS:

1. K. Eid, O. Maksimov, N. Samarth, Antisymmetric Magnetoresistance in ferromagnetic GaMnAs nanostructures with perpendicular anisotropy. (To be submitted to Appl. Phys. Lett.).
2. B.L. Shue, K. Eid, O. Maksimov, N. Samarth, P. Schiffer, width dependence of annealing enhancement of Curie temperature in GaMnAs nanowires. J. Appl. Phys. (In press).
3. K. Eid, B.L. Shue, O. Maksimov, M. Stone, P. Schiffer, N. Samarth, *Engineering the ferromagnetic Curie temperature by nanolithography*. Appl. Phys. Lett. **86**, 152505 (2005). *Selected for the April 18 2005 issue of the Virtual Journal of Nanoscience*.
4. K. Eid, M. Stone, O. Maksimov, K. Ku, W. Fadgen, P. Schiffer, N. Samarth, T. Shih, C. Palmstrom, *Exchange biasing GaMnAs by MnO*, J. Appl. Phys. **97**, 10D304 (2005) (**Invited**).
5. K. Eid, O. Maksimov, M. B. Stone, P. Schiffer, N. Samarth, *Exchange Bias in MnO / Ga<sub>1-x</sub>Mn<sub>x</sub>As Bilayers*, J. Superconductivity **18**, 421 (2005).
6. K. Eid, H. Kurt, W.P. Pratt, J. Bass, Changes in magnetic scattering anisotropy at ferromagnetic/superconducting interface, Phys. Rev. B **70**, 100411 (2004) (**Rapid Communications**). *Selected for publication in the Oct. 1<sup>st</sup>, 2004 issue of Virtual Journal of Applications of Superconductivity*.
7. K. Eid, M. Stone, K. Ku, P. Schiffer, N. Samarth, T. Shih, and C. Palmstrom, *Exchange-biasing of the III-V ferromagnetic semiconductor Ga<sub>1-x</sub>Mn<sub>x</sub>As*, Appl. Phys. Lett. **85**, 1556 (2004). Also cond-mat/0312259.
8. Wen-C. Chiang, C. Ritz, K. Eid, R. Loloee, W.P. Pratt, J. Bass, *Search for mean-free-path effects in CPP magnetoresistance*, Phys. Rev. B **69**, 184405 (2004).
9. K. Eid, W. P. Pratt, J. Bass, *Enhancing current-perpendicular-to-plane magnetoresistance (CPP-MR) by adding interfaces within ferromagnetic layer*, J. Appl. Phys. **93**, 3445 (2003).
10. H. Kurt, Wen-C. Chiang, C. Ritz, K. Eid, W. P. Pratt, J. Bass, *Spin-memory loss and CPP-magnetoresistance in sputtered multilayers with Au*, J. Appl. Phys. **93**, 7918 (2003).
11. H. Kurt, R. Loloee, K. Eid, W. P. Pratt, J. Bass, *Spin-memory loss at 4.2 K in sputtered Pd, Pt, and at Pd/Cu and Pt/Cu interfaces*, Appl. Phys. Lett. **81**, 4787 (2002).
12. A. Zambano, K. Eid, R. Loloee, W. P. Pratt, J. Bass, *Interfacial properties of Fe/Cr multilayers in the CPP geometry*, J. Magn. Magn. Mat. **253**, 51 (2002).
13. K. Eid, R. Fonck, M. Darwish, W. P. Pratt, J. Bass, *Current-perpendicular-to-plane magnetoresistance properties of Ru and Co/Ru interfaces*, J. Appl. Phys. **91**, 8102 (2002).
14. K. Eid, M. Tsoi, D. Portner, R. Loloee, W. P. Pratt, J. Bass, *Further evidence against mean-free-path effects in the CPP-MR*, J. Magn. Magn. Mat. **240**, 171 (2002).
15. K. Eid, D. Portner, J. Borchers, R. Loloee, M. Darwish, M. Tsoi, R. Slater, K. O'Donovan, H. Kurt, W. P. Pratt, J. Bass, *Absence of mean-free-path effects in CPP magnetoresistance of magnetic multilayers*, Phys. Rev. B **65**, 054424 (2002).
16. K. Eid, D. Portner, R. Loloee, W. P. Pratt, and J. Bass, *CPP-MR of magnetic multilayers: mean-free-path is not the culprit*, J. Magn. Magn. Mat **224** L205 (2001).

## CONFERENCES, SEMINARS, and WORKSHOPS

### INVITED TALKS AND SEMINARS:

- 49<sup>th</sup> Conference on Magnetism and Magnetic Materials, Jacksonville, Florida, Nov. 2004. Invited presentation on exchange biasing GaMnAs.
- AVS 51<sup>st</sup> International Symposium, Anaheim, California, Nov. 2004. Invited presentation on the importance of interfaces in semiconductor films and multilayers. (Presented by advisor).
- Workshop: Magnetic and magneto-transport properties in thin films and multilayers, Michigan State University, East Lansing, October 2000.
- Penn State University, Physics Department. April 2002, Seminar on CPP-GMR in macroscopic and sub-micron magnetic multilayers.
- Ohio University, Physics Department. April 2002, Seminar on CPP-GMR in macroscopic and sub-micron magnetic multilayers.

### CONFERENCE PRESENTATIONS:

- 50<sup>th</sup> Conference on Magnetism and Magnetic Materials, San Jose, California, November 2005
- TMS 47<sup>th</sup> Electronic Materials Conference, Santa Barbara, California, June 2005 (**Two presentations**).
- 48<sup>th</sup> Conference on Magnetism and Magnetic Materials, Anaheim, California, 2004.
- American Physical Society March Meeting, Austin, Texas, March 2003.
- American Physical Society March Meeting, Indianapolis, Indiana, March 2002.
- Magnetism and Magnetic Materials 64<sup>th</sup> Annual Conference, Seattle, Washington, November 2001.
- American Physical Society March Meeting, Seattle, Washington, March 2001.
- American Physical Society March Meeting, Minneapolis, Minnesota, March 2000.

### POSTERS PRESENTED AT CONFERENCES:

- 16<sup>th</sup> International Conference on Electronic Properties of Two Dimensional Systems, Albuquerque, New Mexico, July 2005.
- Workshop: Magnetic and magneto-transport properties in thin films and multilayers, Michigan State University, East Lansing, October 1999.
- Workshop: Magnetic and magneto-transport properties in thin films and multilayers, Michigan State University, East Lansing, October 2001.
- American Vacuum Society Meeting: Magnetism and transport properties of thin films, University of Toledo, Toledo, Ohio, June 2002 (poster).
- Center for Sensor Materials Annual Symposium, Michigan State University, East Lansing, Michigan, **Feb. 2000, Feb. 2001, Feb. 2002** (posters).
- DARPA Spins Review Conference, Viability of Spintronics for Devices and Progress in the Field, Santa Monica, California, October 2003.
- 3<sup>rd</sup> International Conference on the Physics and Applications of Spin-Related Phenomena in Semiconductors, Santa Barbara, California, July 2004.