Paul M. Thibado, Curriculum Vitae

CONTACT INFORMATION
825 West Dickson Street, Department of Physics
University of Arkansas, Fayetteville, AR 72701
(479) 575-7932 (TEL), (479) 575-4580 (FAX),
thibado@uark.edu www.uark.edu/misc/mbestm

EDUCATION

University of Pennsylvania — Philadelphia, PA
Ph.D. Experimental Condensed-Matter Physics, 1994
Supervisors: Prof. D.A. Bonnell and E. Ward Plummer

San Diego State University — San Diego, CA
B.S. Physics, 1990, B.S. Mathematics, 1990

EXPERIENCE

University of Arkansas — Fayetteville, AR
Full Professor of Physics, 1996 - Present

Naval Research Laboratory — Washington, DC
National Research Council Post-Doctoral Fellow, 1994 - 1996
Supervisor: Dr. L. J. Whitman

SIGNIFICANT RESEARCH ACTIVITIES - EXPERIMENTAL SURFACE PHYSICS

- Discovered freestanding graphene ripples exhibit collective behavior identical to spins of 2D Ising system via four universal critical exponents
- First to obtain atomic-resolution STM images of freestanding graphene
- First to measure time-dependent fluctuations of freestanding graphene ripples
- Designed and built unique, two-tip, low-temperature (4 Kelvin), ultra-high vacuum (10^{-10} Torr) scanning tunneling microscope (modified Omicron LT-STM)
- Discovered Ar contamination in GaN leads to new surface reconstructions during MBE
- Designed and built two large-scale MBE-STM research labs at University of Arkansas
- Measured spin-injection probability from a ferromagnetic metal STM tip into p-type semiconductor with near-atomic scale resolution; quantified the spin-relaxation time via the polarization of the recombination luminescence
- Discovered spontaneous formation of two-dimensional (2D) islands on GaAs(001)-(2x4) surface (i.e., no material deposition)
- Measured two coupling energies and four universal critical exponents for the spontaneously–formed, two-dimensional (2D) GaAs islands
- Resolved the correct atomic structural model for the well-ordered GaAs(001)-(2x4) surface reconstruction, ending a decade-long controversy
- Discovered new imaging mechanism for scanning tunneling microscopy (STM); found that top-layer electronic orbitals contract at lower biases to expose subsurface atomic features, dubbed "electronic sample sharpening"
- Developed atomic-structural models for numerous III-Sb(001) surface reconstructions
- Determined how surface reconstructions and growth kinetics impact interfacial abruptness for short-period GaSb/InAs superlattices
- Developed new growth procedure for GaSb/InAs superlattices to produce smoother interfaces
- Discovered Fe nucleation and growth on GaAs is dominated by the substrate surface reconstruction

- Developed new STM tip fabrication method; resulting paper selected as “Best Shop Note” by AVS for 2012
- Discovered method to move top layer of graphite to produce graphene; paper named “Editors’ Selection” by PRB

GRANTS FUNDED - RESEARCH (TOTAL $4,300,000)

- Sole PI on DoD-ONR grant, $700,000/3yr (10-14): "Role of Edges and Defects on Electrical Properties of Graphene Nanostructures: An Atomic-Scale Real-Space Investigation"
- Sole PI on NSF-EPM grant, $300,000/3yr (09-13): "Atomic-Scale Tracking of Dopant Atoms"
- Sole PI on NSF-EM grant, $370,000/3yr (04-08): "Performance Characteristics of a Spin-Polarized Field Effect Transistor"
- Sole PI on NSF-MRI grant, $720,000/3yr (02-05): "Development of a Spin-polarized Field Effect Transistor"
- PI on NSF-FRG grant, $600,000/3yr (01-04): "Origin of the Spin-Relaxation Lifetime on a Nanometer-scale for Metal-Semiconductor Interfaces"
- Founding Co-PI on NSF MRSEC grant, $5,300,000/5yr: my funding is $100,000/2.5yr, "The Center for Semiconductor Physics in Nanostructures"
- Sole PI on NSF-Career grant, $400,000/4yr (97-01): "Atom Diffusion Studies During III-V Epitaxy: A Combined MBE-STM Investigation"
- Sole PI on ONR grant, $720,000/3yr (97-00): "Origins of Interfacial Disorder in Ferromagnetic-Metal-semiconductor Heterojunctions and Its Role in the Electron Spin-Injection Process"
- Sole PI on Arkansas State grant, $ 120,000/1yr (98-00): "Atomic Control of Structure"
- Sole PI on Research Corporation grant, $70,000/1yr (98): "Origins and Role of Interface Roughness in InAs/InP High Electron Mobility Quantum Wells"
- Participating-PI on NSF grant, my funding is $160,000/2yr: "Ultrafast Electronic-Photonic Materials and Devices"
- Participating-PI on NSF REU grant, my funding is $40,000/6yr: "Modern Optics and Optical Materials"

TEACHING ACTIVITIES

Initiated and led innovative research and development of student-operated remote control units (“clickers”) in large-lecture settings, creating low-cost, user-friendly, and highly reliable student accountability breakthroughs on the University of Arkansas campus and ultimately, at universities nationwide and around the world.

- Implemented the use of interactive web-based homework collection in our algebra-based physics course with an enrollment of 200 students. Students log on with a unique password, which is linked to each student's ID number. These answers total 20% of the students' course grade. This requires students to practice what was learned during the lecture.
- Received 4.5/5.0 "overall instructor" on Experiment and Data Analysis evaluations
- Received 4.6/5.0 for "overall best instructor" on Grad. Math Methods evaluations
- Received 4.8/5.0 for "overall best instructor" on Grad. Optical Properties evaluations

- Received 4.5/5.0 for "overall best instructor" on Fresh. College Physics evaluations
- Received 4.7/5.0 for "overall best instructor" on Junior Analytical Mech. evaluations
- Received 4.3/5.0 for "overall best instructor" on Soph. Univ. Physics III evaluations
- Initiated and supervised complete revision of of College Physics I & II lab manuals

Hub vs. Star Research Management:

Devised and implemented new "Hub" method of work organization in the lab, in which every graduate student participates in every research project from inception to completion. This team-based, Hub workflow is superior to single-student, discrete projects – known as the "Star" method - because it provides peer training for each student, it enables faculty to manage more graduate students (key initiative of the University), and it significantly improves publication productivity and quality (another key goal of the University) through multi-edits.

COURSES TAUGHT

- University Physics III Modern Physics: Enrollment ~30 undergraduates
- College Physics I, Algebra-Based Mechanics: Enrollment ~200 undergraduates
- College Physics II Algebra-Based Electricity & Magnetism: Enrollment ~150
- Research Techniques I: Condensed Matter Physics: Enrollment ~10 graduates
- Mathematical Methods for EM: Enrollment ~15 graduate students
- Introduction to Research: Enrollment ~10 graduate students
- Analytical Mechanics: Enrollment ~15 undergraduate students
- Optical Properties of Solids: Enrollment ~5 graduate students
- Mathematical Methods for Physicists (new course) Enrollment: ~20 graduates
- Experimental and Data Analysis: Enrollment ~10 graduate students

Unsolicited Student Comments:

"Thank you, i really enjoyed learning about these experiments and actually doing the experiment and then doing the data analysis part."

"thanks very much for the whole semester's guidance and help, I really leant a lot from this class."

"Great class! Learned a lot! Instructer was fair."

"I really enjoyed taking this class . Dr.Thibado is an excellent 'proctor' , he has carefully re-designed this course and helps students to get the maximum benefit out of it."

"Overall a good course that introduces us to some of the great experiments of modern physics/quantum mechanics. The experiments could be reduced, so that student has more time to understand both the theory, and the reasoning behind the procedures. The instructor seemed to have a good grasp of how to handle the equipment and the physics behind the experiments, which made this class a worthwhile experience."

GRANTS FUNDED - TEACHING (TOTAL $4,801)

- PI on University of Arkansas, 2001 Charles and Nadine Baum Teaching Grant; $1400
- PI on University of Arkansas, 2001 Fulbright College Teaching Innovation Grant; $1000
- PI on University of Arkansas, 2000 Charles and Nadine Baum Teaching Grant; $1401
- PI on University of Arkansas, 2000 Fulbright College Teaching Innovation Grant; $1000

These grants helped expand clicker use to other departments and classrooms.

GRADUATE STUDENTS SUPERVISED

- Kevin Schoelz Doctoral candidate, estimated 2015
- Matt Ackerman Doctoral candidate, Completed 2014
- Steven Barber Doctoral candidate, Completed 2014
- Dejun Qi Doctoral candidate, Completed 2014
- Matt Ackerman Master candidate, Completed 2013
- Kevin Schoelz Master candidate, Completed 2013
- Gobind Basnet Master candidate, Completed 2013
- Steven Barber Master candidate, Completed 2012
- Dejun Qi Master candidate, Completed 2010
- Muhammad Javed Master candidate, Completed 2009
- Fashbir Fashbir Master candidate, Completed 2007
- Zhao Ding, Doctorate Completed 2002
- Zhao Ding, Masters Completed 2000
- Daniel Bullock, Doctorate Completed 2001
- Daniel Bullock, Masters Completed 1999
- Christi Emery, Masters Completed 2001
- Tim Clingan, Masters Completed 2001
- Muhammad Anser, Masters Completed 2000
- Numerous other graduate students were supervised but did not complete a degree.

POST-DOCTORATE SCHOLARS DIRECTED

- Dr. Matt Ackerman
- Dr. Peng Xu
- Dr. Jianfeng (Jeff) Xu
- Dr. Zhao Ding
- Dr. Daniel Bullock
- Dr. Vincent LaBella
- Dr. Jay Smathers
- Dr. Haeyeon Yang

UNIVERSITY/DEPARTMENTAL SERVICES

- Physics graduate student advisor
- Chair, physics graduate admissions committee
- Chair, physics research services committee, overseeing electronics shop, machine shop, and computer lab
- Chair of website modernization committee
- Member of departmental by-laws renovation committee

- Initiated clicker use technology at the University
- Developed community outreach for elementary-school-age girls (via Girl Scout troops), with the goal of expanding their interest in physics
- Member of numerous search committees for departmental personnel hires including tenure-track faculty, electronics technician, and machinist
- Member of campus-wide toxic substance committee
- Member of the Export Control committee under Director Rosemary Ruff
- Radiation Safety Officer for Physics under Director Julia Tchakhalian

INBRE:
Serve as member of INBRE conference organizing committee. In addition, my group annually prepares and presents 4-7 posters for INBRE, the largest contribution from the physics department, along with providing significant INBRE site preparation

Graduate Recruiting – Chair of graduate recruit for ~10 years. Made major changes to recruiting to simplify, speed up, and save money. Now, we collect all the applicant materials in the department (not at the graduate school), no fee is required by the applicants, we sort through them, and make offers (contingent upon admission by the graduate school). Once a student accepts our offer we forward their application to the graduate school for processing (department pays this fee). We can now make offers in as fast as in one day. In the past, the graduate school would process the applications first and delay us sometimes by months due to incomplete file (often too late to make an offer). The graduate school now only processes the applications of those that have accepted our offer and not the ~100 that applied. Respond to ~1,000 e-mails, review ~100 applications, and make ~20 offers to get 10 new students (department only pays 10 applicant fees).

PROFESSIONAL ACTIVITIES AND SERVICES

- Panelist for NSF-MRI & IMR 2004 through 2012 programs
- Panelist for NSF-Career 2001, 2004, 2008 & 2011 programs
- Reviewer for NSF-MRSEC program
- Panelist for NSF-NIRT program
- Reviewed a large proposal ($1,175,000 Euros) for the Science Foundation of Ireland.
- Reviewed tenure package for Asst. Prof. Pearson at the University of Michigan - Flint
- Reviewed promotion package for Assc. Prof. Pearson at the Univ. of Michigan - Flint
- Reviewed tenure package for Asst. Prof. LaBella at the SUNY – Albany
- Member of a Committee for the 2006 14th International MBE conf. Tokyo, Japan
- Organizer for 2002 Arkansas Distance Education Conference held in Fayetteville, AR
- Member of the Sorting Comm. 1999 Electronic Materials Conf. Santa Barbara, CA
- Member, American Physical, American Vacuum, Materials Research Societies
- Refereed numerous journal articles for Phys. Rev. Lett., Phys. J. Crystal Growth, and J. Vac. Sci. Technol. Rev. B, Appl. Phys. Letts., etc.

HONORS AND AWARDS

- Post-doc, Dr. Vince LaBella, Elected APS Fellow (clicker development), 2014
- Invited presentation APS March Meeting, Denver, 2014
- Awarded Master Researcher Award by Fulbright College, 2014
- Five patents awarded by USPTO
- Physics World wrote two page article on our spintronics research results
- Science News article described our spintronics research results
- Invited to write review article for the Surface Science Reports
- Invited to write review article for the International Journal of Modern Physics B
- Post-doc, Dr. Vince LaBella, won the NSF Career in 2004 at SUNY-Albany
- STM image was featured on the Omicron calendar
- Four post-docs have won tenure-track faculty positions
- Two Ph.D. awardees have won tenure-track faculty positions
- Invited to write four review articles
- Science News article described our research results on GaAs
- Data used in Encyclopedia of Applied Physics, Vol. 22. 1998, the 1996 American Physical Society calendar, l 996 Compound Semiconductor, and the 1995 American Vacuum Society Conference program cover
- From January 1, 2003 until July 31, 2003 I was on an office campus duty assignment (OCDA) in France.
- From May 2009 until July 31, 2010 I was on an office campus duty assignment (OCDA) in France.
- Anonymous Referee Comments:

"the paper is clearly written and well organized, I would recommend this manuscript to be published in Carbon and I believe it can cause many interests from graphene community."

"This is the best paper you have ever sent me for review."

"I have personally selected your paper to be prioritized for author proof creation, which means you will receive your author proof within 2 working days* and your final paper will be available online faster."

"The manuscript is very well written, logically structured and a pleasure to read. The results are technically sound and they should be of interest for the basic and applied research on graphene and more in general on nanostructures. It can open substantial opportunities to the understanding of thermal and electrical properties of graphene, making an essential step to further developments. It clarifies the not trivial question of why high tunneling currents are required for investigate graphene's electronic properties. Moreover the joined approach between first-principles theory and experiments represents a strong demonstration of the essential usefulness of both simulation and experiment in the investigation of nanostructures. I am in favor of publishing the manuscript in Physical Review Letters"

"This is an excellent paper that sheds light on the deep electronic modifications that occur on the surface of graphene compared to its 3D counterpart, graphite. The experimental observations and the theoretical interpretation of the data are definitely convincing and indeed project new meaning in the lively discussion not only of STM imaging of graphene, but more deeply, into its intrinsic electronic and thermal properties.

I support the comments made by Ref. B and the modifications that the authors have included in this revised version. I believe this paper can be published in PRL without further review."