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SUMMARY

Experimental physicist establishes and manages research programs at a top 10 condensed matter physics research institution. Successes impact multiple fields and industries, and include discoveries of new physical phenomena, development of next-generation technologies, and solving enigmatic problems in cutting-edge material systems. Technological limitations are routinely overcome by developing new devices and fabrication techniques, implementing extensive automation, and inventing novel measurement systems replicated by internationally acclaimed laboratories. The main objective is to continue expanding the boundaries of technology by utilizing a deep knowledge of solid state and materials science, broad hands-on engineering and trade skills, and team leadership abilities.

Ph.D. in Physics, University of Maryland at College Park, 2003 • M.Sc. in Physics, University of Maryland at College Park, 1997 • B.S. in Physics, University of Texas at Austin, 1993

RESEARCH PRODUCTS

Click for details: [Research](#)

- 10 authored proposals, 5 awarded grants
- Co-PI of three research programs, managing two
- 32 collaborations with national and international universities and laboratories
- 37 contributed and invited talks
- Invention of numerous optical measurement systems and components
- Since 2009 – 9 first-author, 2 last-author publications
- 22 publications: Nano Letters, PRL, Nature Nano., PRB, Rev. Sci. Instrum., J. Phys. Condes. Matter
- Discoveries of new physical phenomena
- Mentor 8 undergraduate students, 1 graduate student, and 4 research associates

INVENTED & ENGINEERED MEASUREMENT SYSTEMS, INSTRUMENTATION, AND COMPONENTS

- Invented novel heterodyne Kerr and Faraday measurement systems at THz and MIR frequencies
- Implemented double-modulation gating techniques into continuous scan FTIR spectroscopy and polarization-modulated laser sources in Kerr/Faraday/cyclotron resonance systems
- Designed and built Voigt and Faraday geometry magneto-optical broadband reflection and transmission spectroscopy measurement system (step-scan and continuous scan variants)
- Designed and built THz measurement platforms to characterize and facilitate research of carbon nanotube and graphene hot-bolometer THz detectors
- Designed and implemented full automation of optical and magneto-optical measurement systems for unattended data acquisition that incorporate spectrometers, lasers, magnet system, multiple actuators and rotation stages, cryostats, and wide-ranging temperature control
- Designed and built reflection/transmission spectroscopy system with *in situ* laser photodoping
- Designed and built broadband FIR measurement system to 2 mm wavelength with step-scan FTIR spectrometer (custom hardware and software), high power Hg vapor lamp, and He-3 bolometer detector system
- Designed and built magneto-microwave reflection and transmission waveguide system operating at 100 GHz utilizing a 14T magnet and Gunn diode
- Invented differential photocurrent measurement system utilizing novel THz-laser circular-polarization modulation
- Implemented concurrent dc transport, dynamic capacitance, high-voltage gates, and magneto-optics
- Designed and built FIR/THz CW molecular laser cavity with dielectric waveguide, 1000-50 um at 50mW; gas recapture/reuse system; fabricate output coupler; novel Fabry-Perot resonator from Si slab to characterize lasing frequency; phase-lock feedback stabilization of dual laser system with computer control
- Developed a simulation platform to qualify photomultiplier tube performance in NOx air analyzers

- Designed and built a traveling wave electro-optical modulator
- Designed and built cold shield and sample mounting schemes in Oxford magnet system (thermal, mechanical, and optical analyses)
- Designed and built laboratory helium recovery system encompassing five laboratory spaces; consultant for multi-lab helium recovery system at IREAP
- Implemented low-budget helium exhaust flow meters made from automotive mass-air-flow sensors
- Designed and built He-3 gas handling systems (sealed pump and storage tanks) for 150mK bolometer and He-3 bolometer cryostat heater electronics, external tank, and thermometry
- Designed and built He-4 dip probe for dc-resistivity/ac magnetic susceptibility/thermometer calibration
- Developed novel conformal gate dielectrics with translucent metal gates, ion implanted Si substrates back-gates, and solid electrolytic gates for use in the optical studies of bulk crystals and films over cm-size surfaces
- Designed 4-ton recirculating coolant chiller system and portable UHV pump station
- Develop software for MIDI performance controller; Designed and built MIDI kick-board controller

PROFESSIONAL/ACADEMIC EXPERIENCE HIGHLIGHTS

Associate Research Scientist, Physics Department, Prof. H. D. Drew, U. of Maryland, 2017 – Present

- Established and managed two research programs to study Weyl and 3D-Dirac semimetals
- Discovered dynamic chiral pumping in Weyl material TaAs at THz frequencies
- Mentored undergraduates and research associates

Assistant Research Scientist, Physics Department, Prof. H. D. Drew, U. of Maryland, 2011 – 2017

- Co-PI of three awarded grants in basic research from DoE (2013 & 2016) and NSF (2016);
- Performed first broadband spectroscopic characterization of 3D-Dirac semimetal Na₃Bi
- Discovered optically active plasmaron mode in a 3D Dirac material
- Studied surface states of 3D Dirac system Cd₃As₂ using novel gate-modulated FTIR spectroscopy
- Developed analytical methods to spatially and spectroscopically resolve multiple charge carrier contributions to the conductivity in semiconductors using gate-modulated magneto-optical techniques
- Measured THz Faraday/Kerr angle 100 times more sensitively than any reported measurement scheme
- First to isolate and optically characterize surface states in 3D topological insulators
- Discovered shift of the surface Dirac cone in capped 3D topological insulator, and first to characterize potential fluctuation near the Dirac point and bulk conduction band edge
- Investigated graphene plasmonic devices as THz and MIR detectors and emitters
- Supervised machine shop, chemistry room, fabrication facility, helium recovery system, four lab areas
- Mentored undergraduate and graduate students and advised research associates

Postdoctoral Research Associate, Physics Department, Prof. H. D. Drew, U. of Maryland, 2007 – 2011

- Magneto-optical studies of high-T_c superconductors, topological insulators/semiconductors, and graphene cryogenically maintained in high magnetic fields in the Far- and Mid-IR spectral regions
- Discovered current-vertex correction effects in high-T_c cuprate superconductors cause the anomalous Hall effect
- Performed polarization-sensitive photocurrent measurements in GaAs (110) quantum well stacks, measured to Johnson-noise limit, to test for confinement-induced orbital Berry phase contributions
- Measured optical constants of thin films, bulk crystals, heterostructures, and composite materials consisting of metals, semimetals, insulators, and semiconductors using FTIR spectroscopy
- Instructed, supervised, and mentored graduate and undergraduate students

Scientist/Consultant, Metallurgy Division of NIST (Dr. William F. Egelhoff), Gaithersburg, MD, 2009

- Investigated feasibility of utilizing anti-ferromagnetic resonance to remotely quantify the oxidation of ferrous material (rebar) embedded in re-enforced concrete structures using high frequency microwaves

Lecturer, Physics Department, U. of Maryland, 2009

- Phys 142, Phys 270 survey courses for scientists & engineers, over 100 students

Professional Jazz Pianist, 2004 – 2007

Graduate Research Assistant, *Physics Department, Prof. H. D. Drew, U. of Maryland*, 1998 – 2003

- Explored the metal-insulator transition in high-Tc superconductors utilizing several experiments: broadband FTIR spectroscopy, a 100GHz waveguide system, and dc- resistivity and ac- magnetic susceptibility measurements

Consultant, *Infinitem Technology, Hyattsville, MD*, 1997-1998

- Programed a performance based MIDI control software package in Visual Basic and Visual C++

Graduate Research Assistant, *Physics Department, Prof. R. A. Webb, U. of Maryland*, 1996 –1997

- Fabricated and studied novel single electron ‘Coulomb blockade’ transistors
- Designed and built small devices (<50nm linewidths) utilizing e-beam and UV multi-layer lithography and various clean-room equipment

Teaching Assistant, *U. of Maryland*, 1994 –1996, 1997 –1998

Scientist/Engineer, *Dasibi, R&D Division, Austin, TX*, 1993 – 1994

- Optimized photomultiplier detector performance in production air quality analyzers;
- Derived and tested equations reducing an extensive calibration algorithm to a two point calibration

Research Assistant, *Prof. Mark Raizen, University of Texas at Austin*, 1992 – 1993

Research Assistant, *U. of Texas, Applied Research Laboratories*, 1991 – 1992

- Located submarines from sonar data utilizing DSP techniques in C & Fortran on Vax/VMS & UNIX

SELECTED PUBLICATIONS

Click for full [Bibliography](#)

1. A. L. Levy, A. B. Sushkov, Fengguang Liu, Bing Shen, Ni Ni, H. D. Drew, and G. S. Jenkins, *Observation of dynamic chiral pumping in Weyl material TaAs*, manuscript in preparation (2018).
2. G. S. Jenkins, C. Lane, B. Barbiellini, A. B. Sushkov, R. L. Carey, F. Liu, J. W. Krizan, S. K. Kushwaha, Q. Gibson, T.-R. Chang, H.-T. Jeng, H. Lin, R. J. Cava, A. Bansil, and H. D. Drew, *Three-dimensional Dirac cone carrier dynamics in Na₃Bi and Cd₃As₂*, Phys. Rev. B 94, 085121. (2017) ([link](#))
3. G. S. Jenkins, D. C. Schmadel, A. B. Sushkov, H. D. Drew, M. Bichler, G. Koblmueeller, M. Brahlek, N. Bansal, and S. Oh, *Dirac cone shift of a passivated topological Bi₂Se₃ interface state*,” Phys. Rev. B 87, 155126 (2013). ([link](#))
4. Jun Yan, M.-H. Kim, J. A. Elle, A. B. Sushkov, G. S. Jenkins, H. M. Milchberg, M. S. Fuhrer, and H. D. Drew, *Dual-gated bilayer graphene hot-electron bolometer*, Nature Nanotechnology 7, 472–478 (2012) ([link](#)).
5. G. S. Jenkins, D. C. Schmadel, and H. D. Drew, *Simultaneous measurement of circular dichroism and Faraday rotation at terahertz frequencies utilizing electric field sensitive detection via polarization modulation*, Rev. Sci. Instrum. **81**, 083903 (2010) ([link](#)).

SUMMARY OF SKILLS

Click for [Example: He recovery](#)

Engineering skills: optics, lasers, cryogen (cryostats, He-3 and He-4 systems), refrigeration, vacuum, physical modeling (thermal, mechanical, electrodynamic), electronics (filters, amplifiers, active feedback), automation, systems integration

General trade skills: machining/drafting (hundreds of drawings), hot works (TIG/MIG/Gas welding, brazing, soldering), electrical, gas/coolant handling, polishing/grinding and coating optics

Device fabrication & diagnostics: class 1000 clean rooms; e-beam and UV lithography; PLD; metal film and organics deposition; ion implantation; etching; annealing; dicing; grinding/polishing; wire bonding; spin coating; profilometers; probe stations; glove boxes; e-beam and optical microscopes; SEMs; ellipsometry; FTIR/grating spectroscopy; magnetic susceptibility; XRD

Computing/Software: Windows, Linux, Vax/VMS, Unix; Program in Labview, C++, Fortran, Visual Basic and C++, asm, html, G code, Arduino scripts; Mathematica, MatLab, MathCad, Origin/SigmaPlot; Optical spectra modeling (RefFit); Ion implantation/particle-matter interaction (SRIM/TRIM); band structure modeling & optical response (VASP); electrodynamic FEA modeling (HFSS)