
TECHNICAL SKILLS

Materials Investigated:

III-V/high- κ /metal gate ◊ Graphene ◊ Phase Change Materials (Metal-Insulator Transition) ◊ Surface adsorbates

Surface and Material characterization:

Low Energy Electron Diffraction ◊ Residual Gas Analysis ◊ Auger Electron Spectroscopy ◊ Ultraviolet Photoemission spectroscopy ◊ time-resolved EUV photoemission spectroscopy (using TOF & angle-resolved hemispherical analyzer) ◊ X-Ray Photoemission Spectroscopy ◊ C-V/ I-V Electrical Probe ◊ atomically-clean surface preparation techniques (Ar-Ion Sputtering, gas dosing, Activated Hydrogen, wet chemistry, Buffered Oxide Etching)

Ultra-high Vacuum, experimental design: High and Ultra-high vacuum technology ◊ precision machining and drafting design ◊ electronics design and construction

High Power Laser Systems experience: optical layout design ◊ nonlinear optics/ high-power ultrafast lasers (Ti:Sapphire Amplifier/oscillator) ◊ high harmonic generation for EUV and Soft-XRays (down to 13nm)

Languages and Software: MatLab ◊ Origin ◊ Mathematica ◊ Igor ◊ Labview ◊ Java ◊ C++ ◊ Blender ◊ SketchUp

EDUCATION

Doctor of Philosophy, Physics Expect. Feb 2015
Concentration: Ultrafast condensed matter physics
University of Colorado Boulder, Boulder, CO

Masters of Science, Physics Dec 2011
University of Colorado Boulder, Boulder, CO

Bachelor of Science, Physics [With Honors & Cum Laude] May 2007
Concentration: Precision Spectroscopy Atomic Physics
University of Arizona, Tucson, AZ
Minors: Mathematics, Astronomy, Spanish

LEADERSHIP

Student Leadership Council- President August 2012 – August 2014
NSF EUV Engineering Research Center

Industrial Outreach Coordinator May 2010 – August 2012
NSF EUV Engineering Research Center

EXPERIENCE

GRADUATE RESEARCH ASSISTANT May 2009 –Present

Kapteyn/Murnane Group, JILA / NIST / University of Colorado

- Entirely built and implemented femtosecond time-resolved and angle-resolved photoemission spectroscopy experiment for studies of phase change materials and surface catalysis using optimized generation of EUV-Soft X-Ray light
- Investigated metal-insulator phase change materials, relating time-scales of electron dynamics to underlying driving mechanisms of transition
- Current work studying electron dynamics of surface adsorbates on metal surfaces, graphene, and attosecond electron interferometry

RESEARCH INTERN

May 2014- Sept 2014

High κ / Metal gate Division, IBM TJ Watson Research Center, Yorktown Heights, NY

- Used EUV photoemission spectroscopy to investigate band bending and interfacial defects of III-V semiconductor/ high- κ / metal gate stack as a function of each step in the deposition process and thermal annealing
- Correlated results with C-V electrical characterizations and X-Ray Photoemission spectroscopy

RESEARCH ASSISTANT

April 2008 – August 2008

Laser Damage and Ablation Group, National Ignition Facility, Lawrence Livermore National Lab

- Studied laser damage site morphology and applied computer learning algorithms (in Matlab) to predictively identify catastrophic laser damage growth on the final upconversion optics in the National Ignition Facility

RESEARCH ASSISTANT

Jan 2006 - Dec 2007

Precision Measurement AMO Group, Dr. Alex Cronin, Dept of Physics, University of Arizona

- Developed “Cover Slip Cavity” Extended Cavity Diode Laser (670nm) for use in atomic spectroscopy
- Implemented atomic vapor Saturated Absorption Spectroscopy setup for use in graduate level Atomic/Molecular/Optical Physics lab course

NSF REU RESEARCHER

May 2006- August 2006

Laboratory for Elementary Particle Physics, Dr. Georg Hoffstaetter, Cornell University

- Performed benchmark comparison of Coherent Synchrotron Radiation Modeling of accelerated electron bunches using two simulation codes for the proposed Energy Recovery Linear accelerator

PUBLICATIONS

- “Controlling the electronic structure of graphene using surface-adsorbate interactions” P. Matyba, **A. Carr**, C. Chen, D. Miller, G. Peng, S. Mathias, M. Mavrikakis, D. Dessau, M. Keller, H. Kapteyn, and M. Murnane, *Nanoletters*, Sub. Feb 2014
- “Time- and angle-resolved photoemission spectroscopy with optimized high-harmonic pulses using frequency-doubled Ti:Sapphire lasers” S Eich, A. Strange, **A.V. Carr**, J. Urbancic, T. Popmintchev, M. Wiesenmayer, K. Jansen, A. Ruffing, S. Jakobs, T. Rohwer, S. Hellman, C. Chen, P. Matyba, L. Kipp, K. Rossnagel, M. Bauer, M. Murnane, H. Kapteyn, S. Mathias, M. Aeschlimann *Journal of Electron Spectroscopy and Related Phenomena*, **195**, 231-236 (2014)
- “Tracking the relaxation pathway of photo-excited electrons in 1T-TiSe₂” G. Rohde, T. Rowher, C. Sohrt, A. Strange, S. Hellman, L. Yang, K. Hanff, **A. Carr**, M. Murnane, H. Kapteyn, L. Kipp, K. Rossnagel, M. Bauer *Eur. Phys. J. Special Topics*, **222**, 997-1004 (2013)
- “Time domain classification of charge-density-wave insulators” S. Hellmann, T. Rohwer, M. Kaliane, K. Hanff, C. Sohrt, A. Strange, **A. Carr**, M. Murnane, H.C. Kapteyn, L. Kipp, M. Bauer, K. Rossnagel *Nature Communications*, **3**, 1069 (2012)
- “Collapse of long-range charge order tracked by time-resolved photoemission at high momenta” T. Rowher, S. Hellmann, M. Wiesenmayer, C. Sohrt, Ankatrin Strange, B. Slomski, **A. Carr**, Y. Liu, L. Miaje Avila, M. Lallane, S. Mathias, L. Kipp, K. Rossnagel, M. Bauer *Nature* **471**, 490–493 (2011)
- “Defect classification using machine learning” **A. Carr**, L. Kegelmeyer, Z. Liao, G. Abdulla, D. Cross, W.P. Kegelmeyer, F. Ravizza, C. W. Carr *Proc. SPIE 7132, Laser-Induced Damage in Optical Materials: 2008*, 71321H (December 30, 2008)
- “Laser damage growth in fused silica with simultaneous 351nm and 1053nm irradiation” M. Norton, **A. Carr**, W. Carr, E. Donohue, M. Feit, W. Hollingsworth, Z. Liao, R. Negres, ; A. Rubenchik, ; P. J. Wegner *Proc. SPIE 7132, Laser-Induced Damage in Optical Materials: 2008*, 71321H (December 30, 2008)
- “Cover Slip External Cavity Diode Laser” **A. Carr**, Y. Sechrest, S. Waitukaitis, J. Perreault, V. Lonij, A. Cronin. *Review of Scientific Instruments*, **78**, 10 (2007)
- “Studies of Hyperfine Structure of Lithium vapor using Saturated Absorption Spectroscopy”, **A. Carr**, Honors Thesis, University of Arizona (2007)

TEACHING EXPERIENCE

University of Colorado, Boulder, CO

- Teaching Assistant: Physics 2150- Experimental Physics

Spring 2009

- Teaching Assistant: Physics 1120- Calculus based Intro Physics Fall 2008
University of Arizona, Tucson, AZ
- Teaching Assistant: Experimental AMO Physics for Graduates Fall 2007