Geoffrey Z. Iwata

CONTACT INFORMATION

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EDUCATION

University of California at Berkeley, Berkeley, California USA

B.A., Physics with Honors, May 2012

- Senior thesis Topic: *Electro-Optical Kerr Effect in Zero-Birefringent PMMA*
- Advisor: Professor Dmitry Budker
- Research Focus: Nonlinear magneto-optics, laser stabilization feedback control, electro-optical effects in solids.

Columbia University, New York, New York USA (*Dean's Fellow*)

M.A., Physics, May 2014

M.Phil., Physics, May 2015

Ph.D. Candidate, Physics, Expected 2017

- Advisor: Professor Tanya Zelevinsky
- Research Focus: Buffer-gas and laser cooling of BaH molecules. Sr_2 lattice clocks. Ultra-cold molecular physics and dipolar quantum interactions.

RESEARCH EXPERIENCE

Berkeley Undergraduate Research Apprenticeship Program, UC Berkeley

Micro-DAVLL Project *Summer 2009 to Summer 2010*

- Completed a design for a small sized Dichroic Atomic Vapor Laser Lock system using Comsol Multiphysics and Solidworks softwares
- Implemented design and characterized performance for various applications, involving building various complex electronic components. Much of this work was independent, allowing for self-study and thorough understanding
- Project culminated in a co-first authorship of a paper

Neutron Electric Dipole Moment (NEDM) Collaboration *Fall 2010 to Spring 2011*

- Responsibility to work with graduate student on developing Liquid Helium Temperature Kerr Monitor for NEDM Collaboration between UC Berkeley and Oak Ridge National Laboratory
- Developed working polarimeter to measure laser ellipticity. Involved working with active optical elements and writing Python control scripts for lock-in detection and analysis
- Machined and explored different geometries for small PMMA windows to minimize systematic birefringent effects
- Extensive experience with cryostat and associated equipment

Jagiellonian University Student Exchange, Krakow, Poland

Exploring Resonances in Amplitude Modulated Nonlinear Magneto-optical Rotation (AMOR) *Summer 2011*

- Worked at Jagiellonian University (JU) on exploring methods to obtain rotation resonances in the non-linear Faraday Effect
- Developed competence with building and modifying efficient data acquisition programs using NI LabView
- Collaborated with Polish graduate student at JU to create productive and efficient research environment

Summer Undergraduate Research Fellowship (SURF) and Senior Thesis, UC Berkeley

Temperature dependent electro-optical Kerr Effect in zero-birefringent PMMA *Summer 2011 to Present*

- Exploring cryogenic temperature dependence of optical properties of recently developed variations on PMMA acrylic that exhibit no change in birefringence under physical stress
- Extensive experience with Photoelastic Modulator Polarimetry techniques
- Built experimental apparatus for high voltage electrodes and cryostat mount from scratch
- Extension of previous research listed above, but specific to own interest in electro-optical effects
- Designed and implemented data acquisition techniques for light ellipticity

Zelevinsky Ultracold Molecule Group, Columbia University

Ultracold $^{88}Sr_2$ Research *Spring 2013 to Summer 2014*

- Ultracold molecule photoassociation, probing, and recovery experiment with goals to constrain non-Newtonian gravity at nanometer range scales
- Aided with demonstration and characterization of Raman Transitions between vibrational ground state levels
- Discovery, characterization and study of forbidden transitions to subradiant $1g$ states
- Variety of spectroscopic investigation of forbidden molecular transitions, including tuning of transition strength with magnetic field
- Gained working knowledge of theory and operation of frequency comb

Buffer-gas and Laser Cooling of BaH Research *Summer 2014 to Present*

- Design and construction of buffer gas cooling apparatus to cool laser ablated BaH molecules to K temperature beam. This stage included vacuum system, cryostat design and development, cryogenic buffer-gas cell development and progressive improvements
- Prototype implementation of molecular ablation to perform precise laser spectroscopy on BaH
- Theoretical study of BaH molecular Hyperfine structure and laser cooling of Hydrides to form molecular MOT
- Prospects for ultracold Feshbach dissociation of BaH to produce samples of ultracold Hydrogen

PEER-REVIEWED JOURNAL PUBLICATIONS

C. Lee, G. Z. Iwata, E. Corsini, J. M. Higbie, S. Knappe, M. P. Ledbetter, and D. Budker. **Small-Sized Dichroic Atomic Vapor Laser Lock (DAVLL)**. *Review*

of Scientific Instruments. 82, 043107 (2011).
doi:10.1063/1.3568824

D. Dounas-Frazer, P. Gandhi, and G. Iwata. **Uncertainty analysis for a simple thermal expansion experiment**. *Am. J. Phys.*. 81,338 (2013).
doi:10.1119/1.4789875

B. H. McGuyer, M. McDonald, G. Z. Iwata, M. G. Tarallo, W. Skomorowski, R. Moszynski, and T. Zelevinsky. **Precise study of asymptotic physics with subradiant ultracold molecules**. *Nat. Phys.*. 11, 32 (2015).
doi:10.1038/NPHYS3182

M. McDonald, B. H. McGuyer, G. Z. Iwata, and T. Zelevinsky. **Thermometry via Light Shifts in Optical Lattices**. *Phys. Rev. Lett.* 114, 023001 (2015).
doi:10.1103/PhysRevLett.114.023001

B. H. McGuyer, M. McDonald, G. Z. Iwata, M. G. Tarallo, A. T. Grier, F. Apfelbeck, T. Zelevinsky. **High-precision spectroscopy of ultracold molecules in an optical lattice**. *New J. Phys.*. 17, 055004 (2015).
doi:10.1088/1367-2630/17/5/055004

B.H. McGuyer, M. McDonald, G.Z. Iwata, W. Skomorowski, R. Moszynski, and T. Zelevinsky. **Control of Optical Transitions with Magnetic Fields in Weakly Bound Molecules**. *Phys. Rev. Lett.* 115, 053001 (2015).
doi:10.1103/PhysRevLett.115.053001

M. G. Tarallo, G. Z. Iwata, and T. Zelevinsky. **BaH molecular spectroscopy with relevance to laser cooling**. *Phy. Rev. A*. 93,032509 (2016).
doi:10.1103/PhysRevA.93.032509

Conference Publications

C. Lee, G. Z. Iwata, E. Corsini, J. M. Higbie, S. Knappe, M. P. Ledbetter, and D. Budker. **Small-Sized Dichroic Atomic Vapor Laser Lock (DAVLL).** In: *22nd International Conference on Atomic Physics*, July 25-30, 2010. Poster-abstract.

G. Iwata. **Measuring the Kerr constant and its temperature dependence in new zero-birefringent materials.** In: *Summer Undergraduate Research Fellows Conference*, August 23-24, 2011. Lecture Presentation.

G. Iwata, B.K. Park, and D. Budker. **Electro-Optical Kerr Effect in Solid PMMA.** In: *University of California, Berkeley Physics Undergradute Poster Session*, April 23, 2012. Poster-abstract.

G. Iwata and J. Shiode. **The Compass Project.** In: *American Museum of Natural History Astrophysics Department*, October 9, 2012. Lecture Presentation.

G. Iwata, M. McDonald, B. McGuyer, and T. Zelevinsky. **Precision spectroscopy of ultracold Sr_2 molecules in an optical lattice.** In: *45th APS Division of Atomic, Molecular and Optical Physics Meeting* June, 2014. Poster.

G. Iwata, M. McDonald, B. McGuyer, M. Tarallo, F. Apfelbeck, and T. Zelevinsky. **Precision studies of ultracold molecules: photoassociated $^{8}8Sr_2$ and buffer-gas cooled BaH .** In: *1st Conference on Cold and Controlled Molecules and Ions.* September, 2014. Poster.

G. Iwata, M. Tarallo, Fabian Sorensen, and T. Zelevinsky. **A cryogenic beam apparatus for laser cooling and ultracold fragmentation of BaH molecules.** In: *46th APS Division of Atomic, Molecular and Optical Physics Meeting* June, 2015. Lecture Presentation.

Other Publications

G. Iwata and D. Edelberg. **Magneto-optical Trapping: A Manual to the Physics 111 MOT experiment.** Physics 111 Advanced Laboratory Course, University of California, Berkeley, 2011.

Awards

Allan M. Sachs Teaching Award *2014*

The Allan M. Sachs Teaching Award has been presented since 1991 by the Physics Department to Physics graduate students who have made outstanding contributions to the department's instructional and laboratory programs. The Award is named in memory of the late Professor Allan Sachs, a distinguished former member of the Columbia Physics faculty.

Teaching Experience

Teaching Mad Science *Spring 2009*

After school program at local middle school for students interested in general science. Classes were facilitated and designed by college students. My responsibilities included course development and implementation of various topics in chemistry and physics. This consisted of creating various tangible models for topics ranging from momentum conservation to polymer chains. Course goals were to facilitate interest and qualitative understanding.

Campus Academic Services Center Physics Tutor *Fall 2010 thru Spring 2012*

Certified, paid position for university tutoring program offered in residence halls. My duties included tutoring all lower division physics courses, as well as preparing and giving review sessions for midterms, focusing on tutee understanding and independence. Also worked with other tutors to find methods to facilitate effective methods for tutoring. Training for tutoring was continual, with emphasis on making the tutee understand through self-exploration of the material.

UC Berkeley Physics 98 DeCal Co-teacher *Spring 2012*

Developed and co-taught the first iteration of a spring semester freshmen course focused on data/measurement interpretation and error analysis. This material is not available in undergraduate courses without significant self-study and we wanted to fill this gap by providing a resource for underclassmen that focuses on an exploration of why this topic is vital for physicists. In addition, this course will apply concepts of error analysis and systematic effects to the academic setting, treating course grades as imperfect measurements for success. We are to implement an innovative style of teaching that builds upon the core principles that the Compass Project (see below).

UC Berkeley Undergraduate Student Instructor: Physics Laboratory - Basic Semiconductor Circuits *Spring 2012*

Undergraduate Instructor position in Physics Laboratory class for physics majors. Duties included assisting students understand and complete weekly labs on basic electronic circuits and data acquisition, and grading corresponding lab reports. Required a teaching level understanding of circuit components and analysis, as well as proficiency in LabView.

Columbia University Teaching Assistant for Introductory Undergraduate Physics Laboratory Course *Fall 2012 - Spring 2013*

Weekly laboratory course for non-physics majors covering classical mechanics, optics, waves, electricity and magnetism, and modern physics. Laboratory instruction involved providing a brief lecture for students on the week's topic, and assisting students perform an experiment and write-up. Required a detailed understanding of concepts and experiments

in order to construct an effective lesson plan for students and to troubleshoot equipment.

Columbia University Preceptor *Fall 2013 - Present*
Position responsibilities include assigning and managing teaching assistants for undergraduate physics labs, proctoring and grading duties, and ensuring TAs are knowledgable and familiar with lab materials and procedures at bi-weekly TA meetings. I am also working with the adminstration to reform certain labs that are outdated or poorly recieved by students.

Service

The Compass Project *Summer 2008 to present*
The Compass Project is a program that supports community and diversity in the physical sciences at Berkeley, focusing on traditionally underrepresented students, and on removing barriers between undergraduate and graduate divisions in the department. My responsibilities have included working closely with the Berkeley administration for the past two summers to organize and implement the logistical aspects of the residential Summer Program offered to incoming freshmen. I was the first undergraduate to hold this position as a summer program coordinator. Also, I have been a part of the pedagogical committee for developing the core philosophies of the Compass Project for teaching and mentoring, and have been a senior mentor to freshmen, providing specialized support and advice as they need it. My active participation amongst the leadership has provided Compass with valuable undergraduate input and coordination capabilities to advance the program's goals and facilitate graduate-undergraduate collaboration. After graduation, I have presented on Compass's behalf at the American Museum of Natural History, and remain a part of the Compass alumni community.

PURNA workshop *May 2010*
Served as an undergraduate representative for the first meeting for the Physics Undergraduate Reform Network Alliance (PURNA), attended by physics faculty from around the country who are interested in reforming their undergraduate physics curricula.

Other

Skilled in operating machining tools
Fluent in Portuguese and Japanese
Programming Languages: Python, Mathematica, Labview 7 years experience and assistant teacher for Brazilian Martial Art: Capoeira
Avid rock climber and hiker
Two published short stories in UC Berkeley literary magazine
Participant in three MIT Mystery Hunts