

STEPHEN H. IRONS

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EDUCATION

Ph.D. Condensed Matter Physics - University of California, Davis. Degree conferred September 1996. Dissertation: *Techniques for the Synthesis of Superconducting Single Crystals of A_3C_{60} ($A=K, Rb$) and Measurement of Their Magnetic Properties.*

Research Advisor: Dr. Robert N. Shelton.

B.S. Physics, College of William and Mary in Virginia. Minor in Philosophy. Conferred May 1990. Phi Beta Kappa (1990).

EXPERIENCE

Director, Instructional Laboratories; Lecturer, Yale University, 7/2001–Present

Managing: Manage and develop the instructional resources within the physics department including revising existing labs as well as creating new lab experiments. Oversee the preparation of laboratory equipment for introductory and advanced student labs. Direct the use, maintenance, and creation of physics lecture demonstrations for use in department classes. Supervise the duties of two full-time technical assistants and temporary summer help. Control and budget the spending of the instructional laboratory funds.

Teaching and Teaching Support at Yale

- **Section/Course Instructor (2001–Present)** Section or course instructor for at least one section per year in either Physics 205/206 or Physics 165/166 Introductory Physics Lab. Topics included, Mechanics, Kinematics, Rotation, Electricity and Magnetism, basic electricity and electronics, and modern physics.
- **Instructor (F2018)** Developed and co-taught course entitled “Electronics for the Physicist.” This course covered basic electronics and then focused on electronic circuit design of particular interest and utility to the experimental physicist.
- **Instructor (S2011, S2012, S2014)** Instructor and co-developer for Physics 101: Movie Physics. Used video from historic and contemporary films to teach numerical estimation and fundamental physics principles.
- **Instructor (F2014, F2015)** Developed and taught Physics 112-Practical Electronics. This course taught basic electronics concepts and practical skills using hands-on mini-lab activities, quizzes and a final project and presentation.
- **Instructor (S2010)** Instructor for Physics 110b-Development in Modern Physics. This course taught non-science majors the fundamental concepts of modern physics including: relativity, classical mechanics, electromagnetism and the basics of quantum theory.
- **Instructor (F2005, F2007, F2008)** Instructor for Physics 180-Advanced General Physics As described in Yale Blue Book.
- **Instructor (S2008)** Instructor for Physics 181-Advanced General Physics as described in Yale Blue Book.
- **Curriculum Development (2001–Present)** Updated and rewrote lab materials. Developed Millikan Oil Drop, 2D collision and X-ray, and optical diffraction experiments. Spearheaded and promoted the implementation of peer-instruction techniques using personal response systems (Clickers) within the department and the University. Appointed as a facilitator for National Academies Summer Institute on Undergraduate Science and Engineering Education, May 27-29, 2015 at Yale University.
- **Instructional Support (2001–Present)** Advised/faculty lab instructors for 205/206. Maintained, repaired and purchased equipment, updated course materials, developed and administered practical examinations, acted as substitute lab instructor.
- **Demonstrations:** Researched, developed and created many physics demonstrations for use in lecture, lab and outreach. Designed and implemented (and currently maintain) an online multimedia Demonstration Database for the Yale Physics department for use by faculty and student instructors.
- **Research:** Developed and implemented online pre-and post testing for Yale’s introductory physics classes. Analyzed data to evaluate teaching efficacy. Assisted faculty in developing and administering student satisfaction surveys.
- **Outreach:** Chairperson of the annual *Yale Physics Olympics* outreach program for regional high school physics students. Executive committee member for *GSI:New Haven*, a science outreach program targeting middle school (ages 12-14) girls. Multiple personal visits to area schools (Grades 3-12) to demonstrate science concepts and discuss careers in science. Performed Demo show for Yale University Science Olympiad in 2016 and 2017.

Previous Teaching Experience

Visiting Assistant Professor, Wesleyan University, 9/98–6/2001

Taught Quantum Mechanics (Fall '98 & '99) to undergraduate and graduate students. Assigned & graded problems and research papers, designed & administered exams and held office hours and problem solving sessions. Taught undergraduate Electricity and Magnetism (Spring 2000).

RESEARCH EXPERIENCE

Post Doctoral Research Fellow and Visiting Assistant Professor, Physics Dept., Wesleyan University, 8/98-6/01

Investigated the low temperature properties in the 1 dimensional spin system $\text{SrCuPtIr}_{1-x}\text{O}_x (x = 0 - 1)$. Performed measurements as a function of temperature and applied field. Developed computer interfaces for automation and improvement of an ac susceptometer involving a lock-in amplifier, temperature controller and a 100 ampere magnet power supply for a 0.3 K Oxford He³ Cryostat. Worked with undergraduates to develop computer-control of 10 K closed-cycle refrigerator. Constructed high sensitivity magnetic susceptometer. Assisted graduate student in the development of a small sample calorimeter.

Post Doctoral Researcher, Physics Dept., Washington University 8/96-7/98

Investigated the mechanisms of the growth of carbon nanofibers and nanotubes. Developed a method for growing these fibers via a chemical vapor deposition technique that would allow the determination of critical parameters affecting nanofiber growth. Involved in a collaboration with chemistry department to investigate the use of biomolecules in synthesizing nanofibers. Proficient in scanning electron microscopy. Practiced in the use of atomic and magnetic force microscopy on a Digital Instruments Nanoscope IIIa. Experienced in the maintenance and operation of high-vacuum vapor deposition systems for the synthesis of thin films of both fullerenes and metals. Designed new laboratory space and purchased equipment for experiments.

Doctoral Research, Physics Dept., UC Davis, 6/90–8/96

Performed magnetic hysteresis measurements on samples of superconducting K_3C_{60} and Rb_3C_{60} single crystals to determine $H_{c1}(T)$ and the critical current density $J_c(T)$. Also investigated the internal defects structure and the dependence of the effective vortex pinning potential on the applied field and temperature of these compounds through magnetic time relaxation experiments. Assisted in the development of a method for the large scale production of C_{60} . Devised method for its rapid purification and growth of high-quality large single crystals. Developed technique for their doping with precise stoichiometric amounts of alkali metals to produce superconducting samples. Conducted DC magnetization measurements on a variety of superconducting and paramagnetic materials. Estimated valence state of doped magnetic ions within a C_{60} matrix. Determined structure through the analysis of powder X-ray diffraction patterns. Operated and maintained a closed-cycle refrigeration unit, Thermogravimetric Analysis system, and high temperature tube and arc furnaces.

COMPUTER SKILLS

Experienced in computerized data acquisition with LabVIEW™ and the design and implementation of modular virtual instruments. Experience with the Arduino and Raspberry Pi as well as EagleCAD PCB layout software. Computer programming abilities Python, C, HTML (enough to get by) as well as extensive experience with both Macintosh and Windows operating systems. Familiar with techniques of computer aided instruction and desktop publishing.

ACADEMIC SERVICE

Yale Physics Department - Committee on Undergraduate Physics Education (2010-Present)

Faculty advisor to the Yale Drop team: an undergraduate group that builds and flies experiments on the NASA zero gravity airplane. (2011-Present)

Faculty advisor to the Yale Undergraduate Aerospace Association: an undergraduate organization that builds and launches high altitude weather balloons and rockets. (2010-2012)

PROFESSIONAL AFFILIATIONS

American Physical Society (1992 - 2014)

American Association of Physics Teachers (2002 – present)

Physics Instructional Resource Association (PIRA- <http://www.pira-online.org>) (2002-present); Treasurer and Newsletter Editor (2003 – 2005), Vice President (2014-2015), President (2015-2016).

COMMUNITY SERVICE

Volunteer Firefighter – North Haven, Connecticut (2002-Present); Lieutenant 03/2012-Present.

PUBLICATIONS, POSTERS AND PRESENTATIONS

- S. H. Irons, *The Physics of Phyre Phytng*, Contributed Talk, AAPT Winter Meeting, January 06 – 09, 2018, Town and Country, San Diego, CA.
- S. H. Irons, *Practical Electronics: A New Course for Non-Science Majors*, Contributed Talk, AAPT Summer Meeting, July 25 – 29, 2015, UM-College Park, College Park, MD.
- S. H. Irons, *The Dipolar Express: An electromagnetically driven train*, *The Physics Teacher*, **53**(3) 8-10 (2015).
- S. H. Irons, *Good Things Come to Those Who are Weightless*, Invited Talk, New England Section – AAPT Spring Meeting, March 20-21, 2015, Salem State College, Salem Mass
- S.B. Cahn, S. Mochrie, R. Ramos, S. Irons: Biologic: A digital analog to the genetic toggle switch and repressilator for the undergraduate physics lab, Poster session, Conference on Introductory Physics for the Life Sciences, March 14-16, 2014.
- S. H. Irons, S. K. Lamoreaux, S. B. Cahn, *Test of Bell's inequality using entangled photons*, Poster session, 2012 Conference on Laboratory Instruction Beyond the First Year of College, AAPT Summer meeting, July 25-27, 2012
- S. H. Irons, *The Monty Hall problem as a class activity using clickers*, *The Physics Teacher*, **50**(1) 14-16 (2012).
- S. H. Irons, *Revisiting Monty Hall*, Contributed Talk, AAPT Summer meeting, August 2nd 2012.
- S. H. Irons, *Online pre and post diagnostic testing across multiple classes*, Poster session, AAPT Summer meeting, August 2nd 2012.
- S. H. Irons, L. M. Cerrito, *Undergraduate and graduate particle accelerator experiments at Yale*, Talk, 18th International Conference on the Application of Accelerators in Research and Industry (CAARI), August 15th 2008, Ft. Worth Texas.
- S. H. Irons P. Parker, *Yale Physics Olympics: 10 years of Student Outreach*, Poster session, AAPT Summer meeting, July 28-August 1, 2007, Greensboro, North Carolina.
- S. H. Irons, C. M Urry, *Improving student learning through the use of remote polling and peer instruction techniques*. Poster session, Symposium on Technology in Undergraduate Science Education, June 15-16, 2006, Harvard University
- S. H. Irons, T. D. Sangrey, K. M. Beauchamp, M. D. Smith and H.-C. zur Loye, *ac Susceptibility of Sr.CuPt.Ir._{1-x}O.: a Magnetic System with Competing Interactions and Dimensionality*, *Physical Review B*, **61** 11594 (2000).
- S. H. Irons, N. I. Nemchuk, H. W. Rohrs, T. Kowalewski, B. O. Faircloth, R. R. Krchnavek and R. S. Ruoff. *New Techniques for the Synthesis of Nanometer-sized Particles for Use in Carbon Nanofiber Growth*. Proc. Symposium on the Recent Advances in the Chemistry and Physics of Fullerenes & Related Materials vol. 97-14, 875-883, (1997)
- A. S. Ginwalla, A. L. Balch, S. M. Kauzlarich, S. H. Irons, P. Klavins, and R. N. Shelton, *Synthesis and Characterization of the Europium Fullerenes EuC₆₀ (x = 1-6)*. *Chemistry of Materials*, **9** 278 (1997).
- L. Zhang, J. Z. Liu, C. Hoellwarth, S. H. Irons, R. N. Shelton, and M. D. Lan, *Hysteresis loop, irreversibility line and flux creep studies in TlBa₂CaCu₂O_{7-δ} single crystals*. *Physica C*, **268** (3&4), 287-294 (1996).
- S. H. Irons, J. Z. Liu, P. Klavins, and R. N. Shelton. *Magnetic Properties of Superconducting K₃C₆₀ & Rb₃C₆₀ Synthesized from Large Single Crystal Fullerenes*. *Physical Review B*, **52** 15517 (1995).
- A. Ginwalla, K. Song, S. M. Kauzlarich, S. H. Irons, J. Z. Liu, P. Klavins, and R. N. Shelton. *Investigation of the Lanthanide-C₆₀ Compounds: Eu_xC₆₀ and Yb_xC₆₀ (x = 2-6)*. Proc. of the Electrochemical Society, May 21-26, 1995. Invited Talk.
- S. H. Irons, M. D. Lan, P. Klavins, J. Z. Liu, K. Song, S. M. Kauzlarich, and R. N. Shelton. *Synthesis and Properties of Ytterbium Doped C₆₀*. Proceedings of the Materials Research Society (1994), Paper and Presentation.
- P. E. Anderson, T. T. Anderson, P.L. Dyer, J. W. Dykes, S. H. Irons, C. A. Smith, R. D. Kylin, P. Klavins, and R.N. Shelton. *Optimization of Fullerene Yields in a Plasma Arc Reactor*. Proc. Symposium on the Recent Advances in the Chemistry and Physics of Fullerenes & Related Materials vol. 94-24, 40-49 (1994).
- J. Z. Liu, I. C. Chang, S. H. Irons, P. Klavins, and R. N. Shelton. *Giant Magnetoresistance at 300 K in Single Crystals of La_{0.65}(PbCa)_{0.35}MnO₃*. *Applied Physics Letters*, **66** 3218 (1994).