

Curriculum Vitae

Michael W. Ray
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EDUCATION

B.S. The Ohio State University (Columbus), Physics, June 2003

Ph.D. University of Massachusetts, Amherst, Physics, expected summer 2010
Thesis topic: Experiments in Solid ^4He
Thesis Adviser: Robert. B. Hallock

PROFESSIONAL EMPLOYMENT

6/05 to present: Research Assistant, Laboratory for low temperature physics, University of Massachusetts, Amherst. Designed and ran solid helium experiments. Mentored undergraduate students in their projects. Ordered supplies for the laboratory. Supervisor: R. B. Hallock.

Spring 2005: Physics Tutor, University of Massachusetts, Amherst. Worked in the physics tutor room helping students in their physics classes.

Fall 2004: Head Teaching Assistant, University of Massachusetts, Amherst. Taught undergraduate physics labs, set lab report grading criteria, led overview of each weeks lab with other T.A's. Supervisors: Tony Papirio, and Professor Edward Chang.

Summer 2004: Research Assistant, Laboratory for low temperature physics, University of Massachusetts, Amherst. Designed a pressure cell for use at cryogenic temperatures to test resistance strain gages for use as a pressure gauge. Supervisor: R. B. Hallock.

9/03 to 5/04: Teaching Assistant, University of Massachusetts, Amherst. Supervised undergraduate physics lab classes and graded lab reports. Supervisors: Tony Papirio, Professor Francis Pichanick and Heath Hatch.

5/01 to 8/03: Undergraduate Research Assistant, The Ohio State University (Columbus). Created software, both standalone and web-based, for 3-D visualization of simulation data. Supervisor: Professor John Wilkins.

9/00 to 3/01: Math Tutor, The Ohio State University (Columbus). Tutored students in calculus at the Mathematics Statistics Learning Center. Supervisor: Richard Brown.

ACADEMIC HONORS

The Ohio State University (Columbus)
National Buckeye Scholarship (1999-2003)

PROFESSIONAL DEVELOPMENT

Introduction to the C Programming Language – Summer 2002, Ohio Supercomputer Center, Columbus, OH. Learned the basics of programming in C including program structure, I/O, library functions, pointers and structures.

Machine Shop course – Summer 2005, University of Massachusetts, Amherst, MA Learned how to use machinists tools (e.g. lathe, milling machine, etc.) and how to read and create plans to build projects.

RESEARCH SKILLS

Cryogenic Systems – Extensive experience with low temperature systems including pumped helium refrigerators, and ^3He – ^4He dilution refrigerators.

Precision Capacitance and Resistance Measurements – Used a bridge and a lock-in amplifier as a null detector to make low temperature measurements of capacitance and resistance.

Frequency measurements – Experience measuring the resonant frequency of a quartz crystal oscillator using a phase-locked feedback method.

Experimental Design – Experience in Designing high pressure cells, and capacitance strain gauges for *in situ* measurements of pressure, and the use of TurboCAD to create plans for machinists.

Data and Analysis – Extensive experience with Origin and gnuplot data analysis programs. Experience with GPIB, and writing data taking code in C. Limited experience with LabView. Knowledgeable in the use of Mathematica.

RESEARCH ACCOMPLISHMENTS

Mass flow through solid ^4He with R. B. Hallock. In an attempt to observe supersolidity, we have observed flow through a cell filled with solid ^4He using a novel cell design which allows for the injection of helium atoms from the superfluid at pressures greater than the bulk melting pressure of solid helium.

Growth of Solid ^4He from the superfluid with R. B. Hallock. We grow solid helium crystals from the superfluid at constant temperature by increasing the pressure in the cell. The design of our cell allows us to continue to add atoms to the solid even after the pressure is higher than the bulk melting pressure. We observed sudden drops in the pressure, and accompanying transients in the temperature which we interpret as meta-stable liquid regions solidifying.

PUBLICATIONS

M.W. Ray and R.B. Hallock, "Observation of Unusual Mass Transport in Solid hcp ^4He ," *Phys. Rev. Lett.* **100**, 235301 (2008).

M.W. Ray and R.B. Hallock, "Ray and Hallock Reply:" *Phys. Rev. Lett.* **101**, 189602 (2008).

M.W. Ray and R.B. Hallock, "Observation of Mass Transport Through Solid ^4He ," *Phys. Rev. B*, **79**, 224302 (2009).

M.W. Ray and R.B. Hallock, "Observation of mass flux through hcp ^4He off the melting curve," *J. Phys.: Conf. Ser.* **150**, 032087 (2009).

M.W. Ray and R.B. Hallock, "Growth of Solid ^4He from the Superfluid," *J. Phys.: Conf. Ser.* **150**, 032088 (2009).

M.W. Ray and R.B. Hallock, "Mass Flow through Solid ^4He ," *J. Low Temp. Phys.* (2009)
D.O.I. 10.1007/s10909-009-9975-y.

M.W. Ray and R.B. Hallock, "Growth of Solid ^4He from the Superfluid," submitted to *Phys. Rev. B*.
(*rapid communications*)

CONFERENCES ATTENDED

2009 March Meeting of the American Physical Society, Pittsburgh, PA, March 16 – 20, 2009.

Supersolid Workshop 2009, Banff, AB, Canada, July 31 – August 4, 2009.

QFS2009: International Symposium on Quantum Fluids and Solids, Evanston, IL, August 5 – 11, 2009.
Presented poster "Mass Flow through Solid ^4He ," which was selected for an oral poster preview.

TALKS

"Searching for Supersolidity," Graduate Student Seminar, University of Massachusetts, Amherst, February 29, 2008.

"Observation of mass flux through solid ^4He ," 2009 March Meeting of the American Physical Society, March 19, 2009.

"Growth of Solid ^4He from the Superfluid," 2009 March Meeting of the American Physical Society, March 19, 2009.

"Observation of Mass Flow through Solid ^4He off the Melting Curve," Prepared by R.B. Hallock, but delivered by M.W. Ray in his absence. Supersolid Workshop 2009, August 2, 2009.

References available upon request