

## Benjamin Michael Hardy

Vanderbilt Department of Physics and Astronomy  
6301 Stevenson Science Center  
6403 C  
Nashville, Tennessee 37212

benjamin.m.hardy@vanderbilt.edu

Ph: 517-817-6322

### Education

<b>Vanderbilt University</b> PhD candidate, Research Assistant	2017 – Present
---	----------------

<b>Bowling Green State University</b> Magna cum laude, with Honors	BS Physics, BS Mathematics 2017
---	---------------------------------

### Research Experience

<b><i>Vanderbilt University Institute of Imaging Science (VUIIS)</i></b>	2019- Present
--	------------------

Currently designing and simulating Radio Frequency coils to be used in High Field Magnetic Resonance Imaging (MRI). Advanced simulation techniques relying on the Finite Difference Time Domain Method will be implemented to test electrical design and magnetic field distribution across voxel based human models. The structural designs conceived will be 3D printed using state of the art 3D printers via SolidWorks software design. The radio frequency circuitry is curated using tuning and matching circuits, cable traps, resonant loops, and phantom development.

Worked a year in an MRI diffusion lab reviewing relevant and recent literature in structural MRI topics of research and clinical applications. Using Matlab, processed cell size measurements with image segmentation in order to confirm cell size distributions. Aided in developing software integration of a custom Matlab application for a Philips 3T scanner.

<b><i>Thomas Jefferson National Accelerator Facility (JLab)</i></b>	2018
---	------

Ten-week Research Experience for Undergraduates (REU) program funded by the National Science Foundation. Researched, developed, and calibrated a magnetic field diagnostic for a magnetized electron source. The diagnostic would prove valuable for the grand project of a beam “cooling” technique for the Electron Ion Collider (EIC) at Jefferson Lab.

<b><i>Bowling Green State University</i></b>	2016
--	------

Studied and reported on properties of Neutron Irradiated Zinc Oxide. Studied and investigated characterization techniques such as X-Ray Diffraction, Hall Effect measurements, and Positron Annihilation Lifetime Spectroscopy.

### Teaching Experience

<b><i>Vanderbilt University</i></b> - TA	Aug 2017-
--	-----------

Taught two sections per semester of an introductory physics lab. Prepared ten to twenty-minute lectures given biweekly elaborating on concepts and lab activities. Played an active role in guiding students to conceptual connections between equations and the physical phenomena of the lab. Graded weekly labs and quizzes.

Dec 2018

### ***Bowling Green State University*** – TRIO program tutor

Tutored financially underprivileged, first generation college students, one-on-one on a biweekly basis in STEM subjects. The tutoring model hinged on helping the students establish personal study skills while fostering independence in thinking towards problem solving.

Aug 2014–  
Dec 2015

### **Scholarships and Awards**

---

ISMRRM Trainee Stipend \$330	2020
Russell G. Hamilton Travel Grant \$1000	2019
McMinn Physics Award \$1800	2018
James Robert and Gretchen Overman Scholarship \$1000	2015, 2016
Bowman Research Award \$1000	2016
George S. John Memorial Scholarship \$500	2014

### **Skills and Experience**

---

I frequently use network analyzers to tune and match RF circuits, Eagle or Kicad to design printed circuit boards (PCB), LDKF Protomat to route boards, and FormLabs printers for 3D printing.

Proficient in C++, Matlab, Remcom XFDTD, git, Bash, JavaScript, Go, Python, SolidWorks, Microsoft Office, and Windows.

### **Presentations**

---

1. **Conference Proceedings** RF Shim Flexibility with Multi-Surface-Loop Arrays Over Varying Head Geometries. Proc. Intl. Soc. Mag. Reson. Med. 28 (2020) 4076  
<https://www.youtube.com/watch?v=B3H1zcqG6aA>
2. **Conference Proceedings** RF Shim Flexibility With 40 to 480, 1cm Radius Magnetic Dipole Loop Elements for Brain Imaging. 2019 Minnesota Workshop on High and Ultra-high Field Imaging November 14<sup>th</sup>, 2019
3. **Department Seminar** Exploring intersubject head variability and the role of accurate anatomical modeling in silico at 7T. 2020 VUIIS Friday Seminar. May 15<sup>th</sup>, 2020
4. **Course Presentation** Parallel Excitation With an Array of RF coils. Vanderbilt University department of Biomedical Engineering. April 22nd, 2019.
5. **Course Presentation** Understanding Magnetic Resonance Imaging through the lens of Boltzmann Statistics. Presented at an auxiliary min-conference through the Vanderbilt University department of Physics and Astronomy. April 21st, 2018.
6. **Conference Proceedings** Magneto-Optic Kerr Effect in a Magnetized Electron Gun. Benjamin Hardy, Joseph Grames. Presented at the Annual Fall Meeting of the Division of Nuclear Physics of the American Physical Society in Vancouver, British Columbia. October 13<sup>th</sup>-16<sup>th</sup>, 2015.
7. **Conference Proceedings** Magneto-Optic Kerr Effect in a Magnetized Electron Gun. Benjamin Hardy, Joseph Grames. Presented at the Fall Meeting of the APS Ohio-Region Section in Bowling Green, Ohio. October 7<sup>th</sup>-8<sup>th</sup>, 2016.
8. **Department Colloquium** Invited to present research on Magneto-Optic Kerr Effect in a Magnetized Electron Gun. Benjamin Hardy, Joseph Grames Presented to Department of Physics and Astronomy at Bowling Green State University, Bowling Green Ohio. September 1<sup>st</sup>, 2016.

9. **Conference Proceedings** Silver Nanoparticles as a Potential Solar Absorber. Benjamin Hardy, F. A. Selim. Presented at the Colloquium for the Center for Undergraduate Research and Scholarship Symposium at Bowling Green State University, Bowling Green Ohio. April 23<sup>rd</sup>, 2016.
10. **Conference Proceedings** Silver Nanoparticles as a Potential Solar Absorber. Benjamin Hardy, F. A. Selim. Presented at the Ohio - Region American Physical Society at the University of Dayton, Dayton Ohio. April 9<sup>th</sup>, 2016.

## Manuscripts

---

J Xu, X Jiang, H Li, LR Arlinghaus, ET McKinley, SP Devan, **BM Hardy**, J Xie, H Kang, AB Chakravarthy, JC Gore. **Magnetic resonance imaging of mean cell size and density of human breast tumors.** Magnetic Resonance in Medicine. 2020 Jun;83(6):2002-2014. doi: 10.1002/mrm.28056. Epub 2019 Nov 25.