

# Benjamin Hardy

Physics Ph.D.

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## EXPERIENCE

### 15.2T MAGNETIC RESONANCE MICROSCOPY | PROJECT LEAD

January 2021 – Current | Nashville, TN

- Implemented customized pulse sequence programming on a Bruker, Paravision 6, 15.2 Tesla scanner measuring the effects of diffusion on signal and the point spread function at spatial resolution beyond 8  $\mu$ m in phantoms and cell samples.
- Designed balanced tune and match circuits to facilitate micro solenoids and micro surface loops for imaging at 650 MHz.
- Led and trained two early career graduate students in development and application of project aims centered on denoising methods and diffusion characterization at Ultra-High Field.

### RF SHIMMING SIMULATION OVER 70 HEAD MODELS | RF SIMULATION AND HARDWARE

January 2019 – January 2021 | Nashville, TN

- Simulated (XFDTD) dense transmission arrays (upwards of 512 resonating loops) over anatomically detailed head models to approach optimum RF transmission over the human head within reasonable power constraints.
- Built and validated with simulations a 4x1 array of self-decoupled transmit loops tuned and matched for imaging at 300 MHz (7T).
- Calculated Specific Absorption Rate (SAR), transmit efficiency, field homogeneity of an 8-channel RF coil designed for 7T in silico, over 70 unique head and shoulder models to demonstrate the effects of intersubject differences on RF coil safety and performance metrics.

### THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY (JLAB) | INTERN

Summer 2016 | Newport News, VA

- 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.

## MANUSCRIPTS

### BENCH TO BORE RAMIFICATIONS OF INTER-SUBJECT HEAD DIFFERENCES ON RF SHIMMING AND SPECIFIC ABSORPTION RATES AT 7T | MAGNETIC RESONANCE

IMAGING

1st Round Revisions

- BM Hardy, R Banik, X Yan, AW Anderson. Bench to Bore Ramifications of Inter-Subject Head Differences on RF Shimming and Specific Absorption Rates at 7T. Magnetic Resonance Imaging. 2022

### MAGNETIC RESONANCE IMAGING OF MEAN CELL SIZE AND DENSITY OF HUMAN | MAGNETIC RESONANCE IN MEDICINE

2020

- 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.

## SKILLS

### PROGRAMMING

Proficient:

Matlab • Python • Bash  
XFDTD (Commercial Software)

Experienced:

Go • C • JavaScript  
L<sup>A</sup>T<sub>E</sub>X • C++ • SLURM  
git

Familiar:

Julia • CSS • HTML

## EDUCATION

### VANDERBILT UNIVERSITY

PHD IN PHYSICS

Aug 2017 - Present | Nashville, TN

Vanderbilt University Institute of Imaging Science (VUIIS)

Cum. GPA: 3.72 / 4.0

### BOWLING GREEN STATE UNIVERSITY

DOUBLE BACHELOR'S IN MATH AND PHYSICS



May 2017 | Bowling Green, OH

Selim Lab



Cum. GPA: 3.87 / 4.0

## REFERENCES

**John Gore**, Director, Vanderbilt University Institute of Imaging Science (VUIIS)

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**Adam Anderson**, Professor of Biomedical Engineering, Vanderbilt University

 adam.anderson@vanderbilt.edu  
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## PRESENTATIONS

1. **Conference Proceedings** Noise Considerations for a Microsolenoid at 15.2T Designed for MR Microscopy Proc. Intl. Soc. Mag. Reson. Med. 31 London, England 2022
2. **Conference Proceedings** Effects of Intersubject Differences on Scattering Parameters, SAR, and B1+ in a 7T 8ch. Head Coil Proc. Intl. Soc. Mag. Reson. Med. 31 London, England 2022
3. **Conference Proceedings** Intersubject Difference Driven Variations of SAR and B1+ at 7T in an 8ch Head Coil. The 2021 Minnesota Workshop on High and Ultra-high Field Imaging October 20-22, 2021
4. **Conference Proceedings** RF Shim Flexibility with Multi-Surface-Loop Arrays Over Varying Head Geometries. Proc. Intl. Soc. Mag. Reson. Med. 28 (2020) 4076 **Watch on YouTube**
5. **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 14th, 2019
6. **Department Seminar** Exploring intersubject head variability and the role of accurate anatomical modeling in silico at 7T. 2020 VUHS Friday Seminar. May 15th, 2020
7. **Course Presentation** Parallel Excitation With an Array of RF coils. Vanderbilt University department of Biomedical Engineering. April 22nd, 2019.
8. **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.
9. **Conference Proceedings** Magneto-Optic Kerr Effect in a Magnetized Electron Gun. Benjamin Hardy, Joseph Grames. Annual Fall Meeting of the Division of Nuclear Physics of the American Physical Society in Vancouver, British Columbia. October 13th-16th, 2015.
10. **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 7th-8th, 2016.
11. **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 1st, 2016.
12. **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 23rd, 2016.
13. **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 9th, 2016.

## OTHER RELEVANT EXPERIENCE

I frequently use network analyzers to tune and match RF circuits, Eagle or Kicad to design printed circuit boards (PCB), LDK Protomat to route boards, and FormLabs printers for 3D printing. Proficient with SolidWorks, Microsoft Office, Windows, and Linux.

## TEACHING EXPERIENCE

### CARRAWAY CENTER FOR TEACHING AND LEARNING | ACADEMIC SPECIALIST

Aug 2021 - Present

- Private tutor for STEM subjects and executive function coach.

### VANDERBILT UNIVERSITY | TEACHING ASSISTANT

August 2017 - 2019

- 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

### BOWLING GREEN STATE UNIVERSITY | TRIO TUTOR

Aug 2014 - Dec 2015

- 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.