

Vern P. Hart

CURRICULUM VITAE

March 2020

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Orem, UT, 84058 MS 179

yhart@uvu.edu
(801) 863-7017

Assistant Professor of Physics	Utah Valley University	08/17-Present
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Previous Positions

Cox Distinguished Professor	William Woods University	08/16-08/17
Assistant Professor of Physics	William Woods University	08/13-08/17
Postdoctoral Research Fellow	Medical College of Wisconsin	02/12-08/13
Adjunct Instructor of Physics	Carroll University	01/13-08/13
AP/Honors Physics Teacher	Clear Creek High School	10/07-08/08

Education

Utah State University	Physics	PhD 2012
Brigham Young University	Physics	BS 2006

Honors, Awards, and Scholarships

- Outstanding Scholar – UVU Office of Sponsored Programs
- Clark Cox Distinguished Professor – Chair Endowed by the Kresge Foundation
- Three-time Professor of the Month – WWU Sorority Association
- Outstanding Presentation Award – Intermountain Graduate Symposium
- Elected to National Physics Honor Society (Sigma Pi Sigma)
- Recipient of the New Century Scholarship
- Recipient of the Centennial Scholarship
- Recipient of the Seely-Hinckley Scholarship

TEACHING

Courses Taught

Physics 4250 – Nuclear Physics	Utah Valley University	S18-Present
Physics 4150 – Medical Physics	Utah Valley University	F18-Present
Physics 4920 – Tomography	Utah Valley University	Su18-Present
Physics 2210 – University Physics I	Utah Valley University	F17-Present
Physics 2215 – University Physics I Lab	Utah Valley University	F17
Physics 2010 – College Physics I	Utah Valley University	S18
Physics 1010 – Physics Foundations	Utah Valley University	Su18
Physical Science 1000 – Foundations	Utah Valley University	F17-Present
Physics 201 – Introductory Physics I	William Woods University	F – 13-16
Physics 202 – Introductory Physics I Lab	William Woods University	F – 13-16
Physics 212 – Introductory Physics II	William Woods University	S – 14-17
Physics 213 – Introductory Physics II Lab	William Woods University	S – 14-17
Physics 315 – Modern Physics	William Woods University	F – 14-16
Physics 318 – Mathematical Methods	William Woods University	S – 17
Physics 321 – Classical Mechanics	William Woods University	F – 16
Physics 360 – Thermodynamics	William Woods University	S – 17
Physics 480 – Numerical Methods	William Woods University	F – 16
Science 130 – Foundations of Science	William Woods University	F/S - 13, 14, 15
Science 131 – Foundations of Science Lab	William Woods University	F/S - 13, 14, 15
Science 205 – The Scientific Enterprise	William Woods University	F/S - 13, 14, 15
Science 205 – The Scientific Enterprise: Online	William Woods University	S/Su - 14, 15
Science 223/224 – What is Life: Online	William Woods University	F - 15
Science 300 – Independent Research	William Woods University	F/S - 15
Physics 102 – Introductory Physics II	Carroll University	S - 13
Physics 2200L – Introductory Physics Lab	Utah State University	S - 09
AP Physics AB	Clear Creek High School	2007-2008
AP Physics BC	Clear Creek High School	2007-2008
Honors Physics	Clear Creek High School	2007-2008
Conceptual Physics	Clear Creek High School	2007-2008

Course Additions

I successfully developed the following course additions at WWU:

- Physics 300: Independent Research
- Physics 315: Modern Physics
- Physics 318: Mathematical Methods for Physics
- Physics 321: Classical Mechanics
- Physics 360: Thermodynamics and Statistical Mechanics
- Physics 381: Electrostatics and Magnetism

- Physics 382: Electrodynamics
- Physics 421: Quantum Mechanics I
- Physics 422: Quantum Mechanics II
- Physics 450: Advanced Laboratory Methods
- Physics 460: Optics
- Physics 480: Numerical Methods
- Physics 490: Senior Practicum

Other Curriculum Development

- Developed test preparation material for students taking the AP Physics exam.
- Designed a physical science section study course for students preparing to take the TAKS (Texas Assessment of Knowledge and Skills) exam.

Mentoring Experience

- Mentored science students at St. Matthias Parish School in Milwaukee during 2012-2013 school year.
- Participated in St. Matthias science fair judging, planning, and mentoring.

Tutoring Experience

- Tutor.com - Physics e-tutor (2010-2014)
- Sylvan Learning Center, Orem, Utah (2008)
- Clear Creek High School TAKS Preparation Program (2008)
- Utah State University Department of Physics Learning Center (2009)

SERVICE

Committee Membership

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|--------------------------------|---------------------------------|-------------------|
| • SCULPT Advisory Board Member | <i>UVU Faculty Organization</i> | Fall 2018-Present |
| • Academic Calendar Committee | <i>UVU Standing Committee</i> | Fall 2018-Present |
| • Search Committee Member | <i>Thomas Henage (UVU)</i> | Summer 2018 |
| • Search Committee Member | <i>Dustin Shipp (UVU)</i> | Spring 2018 |
| • Curriculum Committee Chair | <i>WWU Standing Committee</i> | Fall 15 – Fall 17 |
| • Honors Committee Member | <i>WWU Honors Program</i> | Fall 16 – Fall 17 |

- Search Committee Chair *Criminal Justice (WWU)* Summer 2015
- Search Committee Chair *History (WWU)* Spring 2016
- Library Enhancement Committee *Learning Commons (WWU)* Fall 15 – Fall 17

Community Outreach

The Science Demo Team

I founded an on-campus organization with a mission to promote scientific interest and literacy among the community. The team, consisting mostly of students, traveled to local elementary schools on a monthly basis to conduct science shows for students and the general public.

We have also hosted science night at several schools and have been featured in local media:

“McIntire hosts S.T.E.M activity night,” The Fulton Sun – Megan Favignano, Feb. 6th, 2015.
<http://www.fultonsun.com/news/2015/feb/06/mcintire-hosts-stem-activity-night/>

Student Organizations

- The Society of Physics Student (UVU): I currently serve as the faculty advisor for the local chapter of the Society of Physics Students (SPS- Physics Club). The organization provides weekly activities for physics students to develop comradery among their peers in the program.
- The National Society of Leadership and Success (WWU): I formerly sponsored an honor society on campus that promotes progress and development in the lives of students as they learn self-management, preparing them to set and achieve goals.
- Rooted (WWU): I formerly advised a student club dedicated to enhancing campus, specifically focused on landscaping and visual design. The group hosts a community garden to help students cultivate interests in horticulture and increased self-sufficiency.

Program Proposals

I successfully composed and implemented proposals to add the following programs at WWU:

- Physics *Bachelor of Science* 2015
- Pre-Engineering *Associate of Science* 2015

External Positions

- Webmaster *Utah Academy of Science* 2018-Present
- Vice President *Missouri Academy of Science* 2015 – 2017
- Webmaster *Missouri Academy of Science* 2014 – 2017

Press Releases

“UVU Professor Using AI to Recognize Cancer Cells Sooner,” The Daily Herald – Braley Dodson, August 9th, 2019. https://www.heraldextra.com/news/local/education/college/uvu/uvu-professor-using-ai-to-recognize-cancer-cells-sooner/article_a7c4a3f0-51be-5d7c-bded-f72d545ca352.html.

“WWU Team Presents Cancer Research,” The Fulton Sun – Mary Ann Beahon, April 4th, 2016. <http://www.fultonsun.com/news/news/story/2016/apr/04/wwu-team-presents-cancer-research/504755/>.

“Two WWU students present research findings at the annual meeting of the Missouri Academy of Science,” Hoot Magazine – Alaina Leverenz, May, 2015. http://www.williamwoods.edu/media_relations/publications.html.

Professional Memberships and Organizations

- American Association of Physicists in Medicine
- Utah Academy of Science
- Missouri Academy of Science
- American Physical Society

RESEARCH

Publications

*Denotes Undergraduate Author

†Denotes WWU or UVU Student

Refereed Journal Articles

1. E.Z. Dalah, C. Yang, **V.P. Hart**, Q. Zhang, Y. Hu, and X.A. Li, “Mapping transient hypoxia from *in-situ* activation of ¹⁵O by photon beams: A simulation study,” Rad. Phys. Chem. **172**, 108815 (2020).

2. **V.P. Hart**, T.E. Doyle, M.J. Taylor, B.L. Carruth, P.-D. Pautet, and Y. Zhao, “Investigating Gravity Waves in Polar Mesospheric Clouds Using Tomographic Reconstructions of AIM Satellite Imagery,” *Journal of Geophysical Research* **123**, 1 (2018).
3. **V.P. Hart**, D.T. Burrow,*† and X.A. Li, “A graphical approach to optimizing variable-kernel smoothing parameters for improved deformable registration of CT and cone beam CT images,” *Physics in Medicine and Biology* **62**, 6246 (2017).
4. **V.P. Hart**, and T.E. Doyle, “Simulation of diffuse photon migration in tissue by a Monte Carlo method derived from the optical scattering of spheroids,” *Applied Optics* **52**, 25 (2013).
5. **V.P. Hart**, T.E. Doyle, M.J. Taylor, B.L. Carruth, P.-D. Pautet, and Y. Zhao, “Three-dimensional tomographic reconstruction of mesospheric airglow structures using two-station ground-based image measurements,” *Applied Optics* **51**, 7 (2012).
6. T.E. Doyle, R.E. Factor,* C.L. Ellefson,* K.M. Sorensen,* B.J. Ambrose,* J.B. Goodrich,* **V.P. Hart**, S.C. Jensen,* H. Patel, and L.A. Neumayer, “High-frequency ultrasound for intraoperative margin assessments in breast conservation surgery: a feasibility study,” *BMC Cancer* **11**, 444 (2011).
7. T.E. Doyle, S. Martini, S.C. Jensen,* R.J.T. Pichardo,* and **V.P. Hart**, “Ultrasonic spectral analysis of cavitation bubbles in vegetable oils,” *J. Acoustic. Soc. Am.* **4**, 2314 (2010).
8. T.E. Doyle, **V.P. Hart**, and B. Ambrose,* “Simulation of ultrasonic scattering in breast tissue based on cell and tissue morphology,” *J. Acoustic. Soc. Am.* **126**, 2274 (2009).

Articles in Review

1. **V.P. Hart** and D.T. Burrow,*† “A Novel Approach to Generating Medial Representations from Incomplete 2D Surfaces for Use in Automated Image Segmentation,” *Journal of Mathematical Imaging and Vision*.

Presentations

*Denotes Undergraduate Author

†Denotes WWU or UVU Student

Conference Papers

1. M. Acree,†* C. Berneau,†* P. Densley,†* and **V. Hart**, “A deep learning approach to early cancer detection using near-infrared laser scattering profiles,” National Conference on Undergraduate Research, April 2019, Kennesaw State University, Atlanta, Georgia.

2. M. Acree,^{†*} G. Jensen,^{†*} and **V. Hart**, “A Deep Learning Approach to Early Cancer Detection using Near-Infrared Laser Scattering Profiles,” The Annual Meeting of the American Physical Society, March 2019, Boston, Massachusetts.
3. M. Acree,^{†*} **V. Hart**, et al., “A Convolutional Neural Network for Cancer Detection via Optical Scattering Classification,” The Annual Meeting of the American Physical Society – Four Corners Section, Colorado State University, Fort Collins, Colorado.
4. D. Burrow,^{†*} J. Strosnider,^{†*} T.J. O’Connor,^{†*} and **V. Hart**, “Medial representation splines applied to the auto-contouring of kidneys in cone-beam CT images,” Annual Meeting of the Missouri Academy of Science, April 2016, Lincoln University, Jefferson City, Missouri.
5. D. Burrow,^{†*} S. Brolaski,^{†*} and **V. Hart**, “A novel auto-segmentation algorithm applied to contouring of malignant kidney lesions in external beam radiotherapy,” Annual Meeting of the American Physical Society Prairie Section, November 2015, The University of Notre Dame, South Bend, Indiana.
6. R. Ostrem^{†*} and **V. Hart**, “Analysis of edge detection algorithms applied to image segmentation of cross-sectional CT images during adaptive radiotherapy,” Annual Meeting of the Missouri Academy of Science, April 2015, St. Joseph, Missouri.
7. **V. Hart**, “A diffeomorphic image registration algorithm for enhanced contrast during adaptive radiotherapy,” 2014 Annual Meeting of the American Physical Society – Prairie Section, November 2014, Monmouth, Illinois.
8. **V. Hart**, “A novel optical cellular scattering model developed from the signature of spheroidal particles for the detection of micro-cancer,” Annual Meeting of the Missouri Academy of Science, April 2014, Warrensburg, Missouri.
9. **V. Hart** and T.E. Doyle, “A novel approach to modeling photon propagation in biological tissue using the scattering signatures of spheroidal particles,” 2013 Annual Meeting of the American Physical Society – Prairie Section, November 2013, Columbia, Missouri.
10. **V. Hart** and X. Li, “A variable-kernel smoothing technique for improved convergence during CT-Cone Beam CT deformable image registration,” 2013 Annual Meeting of the American Association of Physicists in Medicine, 4-8 August 2013, Indianapolis, Indiana.
11. **V. Hart**, G.-P. Chen, and X. Li, “The effect of CT image quality on deformable image registration in radiotherapy,” 2013 Annual Meeting of the Radiological Society of North America, 1-6 December 2013, Chicago, Illinois.
12. **V. Hart**, T. Doyle, B. Carruth, Y. Zhao, and M. Taylor, “Tomographic imaging of noctilucent clouds,” 2010 Four Corners Section of the American Physical Society Fall Meeting, 15-16 October 2010, Ogden, Utah.
13. T.E. Doyle, **V. Hart**, and B. Ambrose,* “Simulation of ultrasonic scattering in breast tissue based on cell and tissue morphology,” 158th Meeting of the Acoustical Society of America, 26-30 October 2009, San Antonio, Texas. Abstract: Journal of the Acoustical Society of America **126** (4, Pt. 2), 2274 (2009).
14. S. Jensen,* T. Doyle, **V. Hart**, J. Goodrich,* L. Neumayer, R. Factor,* and C. Ellefson,* “The *ex-vivo* detection of human breast cancer through high-frequency ultrasound,” 2010 Four Corners Section of the American Physical Society Fall Meeting, 15-16 October 2010, Ogden, Utah.
15. C. Yang, I. Moraru, E. Dalah, **V. Hart**, E. Paulson, B. Erickson, X. A. Li, “Improving target delineation by using deformably registered multi-modality images for radiation therapy of pancreatic cancer,” 2013 Annual Meeting of the American Association of Physicists in Medicine, 4-8 August 2013, Indianapolis, Indiana.

16. S. Martini, R.J.T. Pichardo,* S.C. Jensen,* **V. Hart**, and T.E. Doyle, “Monitoring bubble dynamics in soybean oil,” 101st American Oil Chemists Society Annual Meeting and Expo, 16-19 May 2010, Phoenix, Arizona.

International Conference Papers

1. T.E. Doyle, S. Martini, S.C. Jensen,* R.J.T. Pichardo,* and **V. Hart**, “Ultrasonic spectral analysis of cavitation bubbles in vegetable oils,” Second Pan-American/Iberian Meeting on Acoustics, 15-19 November 2010, Cancun, Mexico. Abstract: Journal of the Acoustical Society of America **128** (4, Pt. 2), 2314 (2010).

Additional Presentations

1. **V. Hart** and X.A. Li, “A variable-kernel smoothing technique for improved convergence during CT-Cone Beam CT deformable image registration,” MCW Cancer Imaging Retreat 2013, Wauwatosa, Wisconsin, March 15, 2013.
2. **V. Hart** and T. Doyle, “Tomography of limited-angle projection data,” Intermountain Graduate Research Symposium, Logan, Utah, March 24, 2011.
3. **V. Hart** and T. Doyle, “The application of tomographic methods to the translation of multipole fields in multiple scattering,” Intermountain Graduate Research Symposium, Logan, Utah, March 31, 2010.
4. **V. Hart** and J.-F. Van Huele, “Airy wave packets as quantum solutions for recovering classical trajectories,” Spring Research Conference, Provo, Utah, March 11, 2006.

Poster Sessions

1. C. Berneau†*, P. Densley†*, A. Johnson†*, and **V. Hart**, “Mixed Cell Growth Protocols for Non-Invasive Imaging of Cancer,” Annual Meeting of the Utah Academy of Sciences, Weber State University, March, 2018, Ogden, Utah.
2. **V. Hart**, T. Liu, K Fishman, J. Wilson, and X. Li, “Deformable registration of CT and ultrasound images for radiation treatment of skin cancer,” 2013 Annual Meeting of the American Association of Physicists in Medicine, 4-8 August 2013, Indianapolis, Indiana.
3. **V. Hart** and J.-F. Van Huele “Is there a quantum mechanical description of Thomson’s e/m experiment?” College of Physical and Mathematical Sciences - Homecoming Week Alumni Poster Session, Brigham Young University, Provo, Utah, October 14, 2005.

Patents

Li, Paulson, Ahunbay, Yang, **Hart**, Adaptive Replanning based on Multimodality Imaging, 61922343, December 2013.

External Funding

- Rocky Mountain Power Foundation Grant: “Spectroscopic Observations of Micro-Cancer Clusters” *Spring 2018*. \$3,000

Internal Funding

- Grants of Research for Engaged Educators and Novices: “The establishment of an on-campus AI lab for interdepartmental collaborative data science” *Spring 2019*. \$15,000
- Scholarly Activities Committee Grant: “Travel funds for the 2018 NSF grant conference” *Fall 2018*. \$2,500
- Grant for Engaged Learning: “A near-infrared scanning system for earlier detection of micro-cancers.” *Fall 2017*. \$10,000
- Cox Endowed Fellowship: “Diffuse Optical Tomography – Sporadic photon migration and micro-cancer.” *Spring 2016*. \$45,000
- WWU Creative Grant: “Equipment startup funds for the establishment of a science demo team.” *Fall 2013*. \$3,000

Theses and Dissertations

1. Airy Wave Packets as Quantum Solutions for Recovering Classical Trajectories (BS – Vern Hart – Brigham Young University – 2006).
2. The Application of Tomographic Reconstruction Techniques to Sparse Imaging Configurations in Atmospheric Science and Biomedical Optics (PhD – Vern Hart – Utah State University – 2012).

Funded Research Projects

Seed Grant, Utah State University (2011)

Three-Dimensional Optical CT Scanner for Breast and Prostate Cancer

Role: Assistant Researcher

\$19,058

NSF, Grant No. ATM 0536876 (2006 – 2011)

Development and Optimization of Tomographic Imaging Methods for Advanced Gravity Wave Studies in the MLT Region

Role: Assistant Researcher

\$494,148

NIH-NCI, Grant No. 1 R21 CA131798-01A1 (2008 – 2010)
Histology-Based Computational Tools for Ultrasonic Differentiation of Neoplasms
Role: Assistant Researcher \$334,846

Co-Authored Proposals and Annual Reports

1. NIH RO1 Industrial-Academic Partnership Grant (2019), “Precision In Vivo Breast Cancer Diagnostics Using High Frequency Ultrasound-Enabled Forceps,” Submitted in collaboration with Turner Innovations and the University of Arizona – Funding Pending (\$5,000,000).
2. Seed Grant, Utah State University (2011) “Three-Dimensional Optical CT Scanner for Breast and Prostate Cancer,” Funded in 2010 (\$19,058).
3. Year-end (2010) report for NSF, Grant No. ATM 0536876, “Development and Optimization of Tomographic Imaging Methods for Advanced Gravity Wave Studies in the MLT Region.”
4. NIH Allergy and Infectious Diseases (2012), Grant No. FP00004459, “Mitigation of Radiation Nephropathy.”

Collaborators

- Medical College of Wisconsin, Milwaukee, WI (Dr. X. Allen Li PhD)
- Center for Atmospheric and Space Sciences, Logan, UT (Dr. Michael J. Taylor PhD)
- Huntsman Cancer Center, Salt Lake City, UT (Dr. Leigh Neumayer MD)
- Froedtert Hospital, Milwaukee, WI (Dr. J Frank Wilson MD)
- The University of Wisconsin – Milwaukee (Dr. Sarah Patch PhD)

Postdoctoral Courses Taken

Radiotherapy 421 – Cross-Sectional Anatomy	Medical College of Wisconsin	Fall 2012
Medical Physics S1 – Radiobiology	Medical College of Wisconsin	F12/S13
Medical Physics S2 – Radiation Therapy	Medical College of Wisconsin	F12/S13
Best Practices 500 – Online Instruction	William Woods University	Fall 2015

Research Activities

Medical Physics and Imaging

- Developed novel Monte Carlo simulation techniques based on optical scattering for modeling diffuse light in biological tissue.

- Assisted in experimental acoustic testing of breast cancer lesions extracted during lumpectomy surgeries.
- Designed computational models of high-frequency ultrasound propagation in tumors.

Deformable Image Registration

- Implemented numerical methods such as least-squares optimization and optical flow for use in registration of various CT imaging modalities.
- Established intra-modality registration program for use in radiotherapy treatment planning at Froedtert Hospital.
- Utilized Matlab and C++ languages to unify existing dose escalation software.
- Improved registration accuracy of Demons algorithm through the use of a variable kernel smoothing technique.

Digital Image Analysis

- Tested algorithms for use in computer vision applications such as edge detection, object recognition, and image segmentation.
- Analyzed image quality for PET and CT images and assessed its effect on registration accuracy.

Tomographic and Acoustic Imaging

- Designed sparse tomographic reconstruction algorithms for use in imaging mesospheric data from ground-based and satellite instrumentation.
- Experimentally analyzed the effects of high-intensity ultrasound on lipid crystallization properties at the microscopic level.

Programming Experience

- PYTHON
- C++
- MATLAB
- FORTRAN
- LaTeX
- Maple
- Labview

Clinical Rotations

Froedtert Hospital Cancer Center

Quality Assurance – Performed monthly inspection and calibration of SIEMENS external beam linear accelerator and cone beam CT machines. Verified x-ray energy outputs and beam symmetry with ion chamber.

Peer-Review

I have served as a peer-reviewer for the following journals:

- Non-destructive Evaluation
- Advances in Space Research
- Measurement Science and Technology
- Atmospheric Measurement Techniques Discussions
- The Journal of the Utah Academy of Science
- The Journal of the Missouri Academy of Science

Additional Experience

Scientific Editing

ACCDON LLC - Science Editor - Reviewed journal articles for language and technical content, provide clients with feedback in preparation for publication.

Outreach Participation

- WWU Science Demonstration Team (performed demo shows at local schools)
- Science Fair Judge (Clear Creek High School)
- BYU Science Demonstration Team (performed demo shows at local elementary schools)
- Participated in USU “Physics Day at Lagoon,” an outreach program for secondary science students in the state of Utah, summer 2009, 2010, and 2011 (assisted with physics knowledge bowl competition).

Volunteer Experience

- Y Group Leader, BYU New Student Orientation, summer 2005, fall 2005, fall 2006 (assisted in campus orientation of incoming freshman).
- Transfer Student Group Leader, BYU New Student Orientation, winter 2006 (assisted in campus orientation of incoming transfer students).

- Y Group Captain, BYU New Student Orientation, summer 2006 (conducted orientation seminar for new Y group leaders).

Additional Employment

Inventory Specialist - Quickutz, Inc. Orem, Utah, 2003-2004 (provided inventory management for scrapbooking company, used computer software to track supply quantities and predict shortages).

Authored Websites

[MAS](#)

Interests and Hobbies

Spending time with family, movies, and sports.