

## CURRICULUM VITAE

**Richard Frederick Bradley**

**June 2020**

National Radio Astronomy Observatory  
NRAO Central Development Laboratory (CDL)  
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### EDUCATION

Ph. D., *University of Virginia*, Electrical Engineering, 1992

**Dissertation:** "The Application of Planar Monolithic Technology to Schottky Varactor Millimeter Wave Frequency Multipliers"

**Advisors:** A. Kerr (NRAO), R. Mattauch (UVA), and S. Weinreb (Martian Marietta Laboratories)

M. S., *Carnegie-Mellon University*, Electrical Engineering, 1983

**Thesis:** "Electrohydrodynamic Augmentation of Forced Convection Heat Transfer"

**Advisor:** J. F. Hoburg

B. S., *Carnegie-Mellon University*, Electrical Engineering, 1982 with concentration in psychology

### APPOINTMENTS

2020	Director, NRAO CDL Space Electronics Laboratory
2009	Continuing Appointment, Senior Scientist, NRAO
2006-present	Interim Project Engineer, FASR (NRAO)
1991-present	Scientist / Research Engineer, NRAO
1998-present	Research Professor of Astronomy, University of Virginia
1992-present	Visiting Assistant Professor, Dept. of E. C. E., University of Virginia
1987-1991	Res. Asst., University of Virginia, Prof. R. Mattauch, supervisor
1983-1987	Electronics Engineer, National Radio Astronomy Observatory
1982-1983	Res. Asst., Carnegie-Mellon Univ., Prof. J. Hoburg, supervisor
1983	Summer Intern, National Radio Astronomy Observatory, Green Bank
1981	Summer Intern, National Radio Astronomy Observatory, Green Bank
1980	Summer Intern, S. P. Kinney Engineering, Inc., Carnegie, PA

### AWARDS

**Patent:** Payne, J. M., D. Parker, and R. F. Bradley, "Optical Electronic Distance Measuring Apparatus With Movable Mirror," U.S. patent #5455670 issued Oct. 3, 1995.

**Patent:** Bradley, R. F. and R. Gawande, "Active, Inverted Conical Sinuous Antenna above a Ground Plane," U.S. Patent #9,054,516 issued on June 9, 2015

**NRAO Distinguished Service Award:** (2020)

**Outstanding Referee:** Review of Scientific Instruments (2010, 2012)

**NRAO Service:** 10 Years (1993), 20 Years (2005), 30 Years (2015)

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### PROFESSIONAL AND HONORARY SOCIETIES

*International Union of Radio Science (URSI) of the National Academies*, 1991-present

Commission D (Electronics and Photonics)

Commission J (Radio Astronomy) - Chair of URSI-USNC, 2011-2014.

International URSI Commission J Vice-Chair, 2014-2017

International URSI Commission J Chair, 2017-present

*International Astronomical Union (IAU)*, 2015 - present

*Sigma Xi – The Scientific Research Honor Society*, 1988 - present

Elected Associate Director for Mid-Atlantic Region, July 1, 2013 – June 30, 2015

Re-Elected Associate Director for Mid-Atlantic Region, July 1, 2015 – June 30, 2018

Committee on Nominations, 2018-2020, Chair 2020

*American Geophysical Union (AGU)*, 2005 - present

*American Astronomical Society (AAS)*, 1991 - present

*American Institute of Physics (APS)*, 1991-present

*Institute of Electrical and Electronic Engineers (IEEE)*, 1980 - present

Microwave Theory and Techniques Society

Antennas and Propagation Society

*Tau Beta Pi*, 1989-present; *Eta Kappa Nu*, 1989-present

### ACCOMPLISHMENTS IN APPLIED RESEARCH AND DEVELOPMENT

\*\*\* References are to Selected Publications \*\*\*

**Precision Array for Probing the Epoch of Reionization.** Co-PI: Developed the specialized antenna, front-end, electronics, and receiver. Managed the construction, evaluation, and deployment of the RF subsystems for the 128-element science array in the Karoo, South Africa and the 32-element engineering array in Green Bank, WV

**Pioneered the first fully-sampled, focal plane array receiver for radio astronomy.** Co-PI on a 19-element, 1-2 GHz proof-of-concept array evaluated on the NRAO 140-foot telescope [1]. This array used novel balanced low-noise sinuous antenna elements and a very high isolation RF cross-bar switch.

**Pioneered the first real-time adaptive interference canceling receiver for radio astronomy.** Co-PI on proof-of-concept system evaluated on the NRAO 140-foot telescope. [2, 3]. Co-PI on an NSF MRI grant to develop adaptive signal blanking techniques for radar excision [4] and Co-PI on an NSF AST grant for real-time reduction of GLONASS signals in GBT data and focal plane arrays.

**Developed the record lowest noise cryogenic HFET balanced amplifiers** for the 300-2000 MHz frequency range [5]. Designed cryogenic low-noise amplifiers for S-, C-, X-, Ku-, and K-bands.

**Created the first millimeter-wave MMIC-based frequency multiplier** [6]. Designed several millimeter- and submillimeter-wave frequency multipliers based on planar varactor technology [7].

**Developed a unique 1.5 GHz infrared laser modulator/demodulator units** for the GBT laser metrology system [8] for which we received a patent.

**Participated in the development of the first planar Schottky-diode-based 585 GHz mixer** [9].

**Co-discovered and investigated the Lorentz noise effect in HFETs** [10].

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### ACCOMPLISHMENTS IN APPLIED RESEARCH AND DEVELOPMENT (continued)

**Originated the strawman millimeter wave local oscillator system design for the MMA project** [11]. This approach was later adopted as a significant part of the baseline plan for ALMA.

**Collaborator** - Axion Dark Matter eXperiment (ADMX) [12, 13].

**Co-discovered and characterized the electrohydrodynamic (EHD) enhancement of forced convection heat transfer** [14].

**Developed and maintain one of the world's most sensitive, high resolution, solar radio burst monitoring station for 20-1000 MHz.** [15, 17]. See <http://www.nrao.edu/astrores/gbsrbs/>

**Developed an inexpensive, yet highly effective screened enclosure for instrument RFI mitigation** [18]. This approach is being adopted site-wide in Green Bank and at the Radio Astronomy Park in Boolardy, Australia.

**Ultra-Broadband Sinuous Feed for 150-3000 MHz** – Results show significant improvements in noise temperature and beam purity compared with the state-of-the-art [19].

**Possible ground plane artifact in global signal measurements** – analysis of soil absorption under the ground plane that could lead to false signal detection [21].

### CURRENT ACTIVITIES IN APPLIED RESEARCH AND DEVELOPMENT

**Dark Ages Polarimeter Pathfinder (DAPPER)** - This work is funded by the NASA Lunar Science Institute LUNAR program (J. Burns). It is a Explorer-class, lunar-orbiting space mission to measure the spectrum of the 21 cm hydrogen line from 40-120 MHz over a 3 year time span. My work has focused on helping to prepare for the NASA proposal. This includes developing concepts for the spacecraft antenna and receiver, developing a radiometer calibration method with the goal of achieving  $10^6$  dynamic range, defining an Instrument Verification Plan, and overseeing the ground-based engineering prototype instrument.

**Search for the Epoch of Reionization** – Developed a 128-element array radio telescope (PAPER) dedicated to the search for the redshifted 21-cm HI signature in the range  $6.5 < Z < 10$ . Activities in both Green Bank and South Africa. It is a component of the Hydrogen Epoch of Reionization Array (HERA) scientific road map and was highlighted in the Astro2010 New Worlds New Horizons. Collaboration with A. Parsons (U. C. Berkeley), J. Aguirre (U. Penn.), C. Carilli (NRAO) [20].

**Developing a method for measuring the *in situ* beam pattern of an antenna using signals from low earth orbiting satellites** – This work is important for HERA. Collaboration with J. Hewitt (MIT).

**Developing a wide-bandwidth feed for reflector antennas** – developed and characterizing a cryogenic version of our successful sinuous feed.

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### MANAGEMENT EXPERIENCE

**Director, *Space Electronics Division, CDL*** – Established this new division at the NRAO CDL for the development of space-borne instrumentation. Responsible for finding new projects through scientific and technical collaborations, securing funding, and oversight of all development activities.

**CO- I, *NASA Dark Ages Polarimeter Pathfinder (DAPPER)*** – Responsible for the development of the science instrument for the Dark Ages Polarimeter Pathfinder mission in collaboration with NASA Ames Research Center, Berkeley Space Sciences Laboratory, and U. Colorado Boulder.

**Co-PI, *Precision Array for Probing the Epoch of Reionization (PAPER)*** – Was responsible for the development, fabrication, evaluation, packaging, shipment, and deployment of antenna and RF subsections of the 128-element array in South Africa and the 32-element engineering array in Green Bank, WV.

**Group Lead, *Low Frequency Radiometer Laboratory, CDL*** – Created and managed a laboratory is dedicated to R&D of specialized instrumentation packages and components for radio astronomy below 5 GHz. Strong student involvement in these projects is highly encouraged. It is an integral component of the CDL.

**Interim Project Engineer, *Frequency Agile Solar Radio Telescope*** - Responsible for coordinating R&D activities and overall instrument design during the early phases of the project.

**Project Lead, *ALMA Local Oscillator*** – Responsible for the development of frequency multiplier technologies and evaluation procedures needed for the ALMA Project.

**Project Lead, *Waveguide Electroplating*** – Developed an apparatus to gold plate the inside of stainless-steel waveguides in a consistent and uniform manner. This procedure was adopted by N. Erickson for use in his sub-mm wave power meter – an essential test instrument for ALMA.

**Project Lead, *Compact Cryogenic Dewar*** – Developed a very compact, bench-top, 70 K cryogenic test Dewar for use in evaluating frequency multipliers for the ALMA Project.

**Project Manager, *GBT Beam-Forming Array Project*** – Worked toward creating a fully-functional low-noise instrument for the Green Bank Telescope. Project is currently on hold pending additional research funds.

**Project Manager, *Physical Plant for the NRAO CDL*** – Responsible for designing new office and laboratory space to support R&D activities and the ALMA Front-End Integration Center. Worked with an architect and building contractor to ensure new facilities met functional requirements. Coordinated move to the new facilities. Helped to combine Tucson site and CDL activities effectively.

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## ACADEMIC HIGHLIGHTS

**Research adviser** - to many undergraduate and graduate (including Ph.D.) students at the University of Virginia in the Departments of ECE and Astronomy over the past twenty years. Also served as mentor to several summer interns at the NRAO.

**Dissertation and Exam Committees** - Served on several Masters and Ph.D. dissertation committees and Ph.D. Qualifying Exam committees at the University of Virginia. Also, served as a reviewer for a Ph.D. thesis at Macquarie University (Australia).

### **Developed Curriculum and Taught several courses at the University of Virginia**

ENGR204 - Electrical Science (undergraduate)

ASTR314 - Introduction to Radio Astronomy (undergraduate)

ASTR5350 – Fundamentals of Radio Astronomy Instrumentation (graduate)

**Research Mentor** – U. Virginia Undergraduate Student Opportunities in Academic Research (USOAR) (2014-2015)

### **Established the Radio Astronomy Teaching Laboratory at the University of Virginia -**

Founded in June 2000, this laboratory continues to provide opportunities for both graduate and undergraduate students to learn the fundamentals of radio astronomy instrumentation in a hands-on learning environment [16].

**REU Student Site Coordinator** (NRAO NTC - 2004, 2005) – Reviewed student applications, matched students with advisers, coordinated activities, and organized a lecture series.

**Co-Organizer and Instructor** - NSF Secondary Science Teachers Institute, NRAO Green Bank, 1988.

**ACT National Curriculum Survey** – invited participation (2011)

## REFEREEING

### **Editorship**

Associate Editor of *Radio Science* (2004 – present)

Special *Radio Science* Section on Radio Arrays and the Ionosphere  
(with A. Coster, MIT / Haystack)

### **Refereeing - Papers**

IEEE Transitions and Letters (MTT, APS, MWCL)

Proceedings of the IEEE

Journal of Applied Physics

Review of Scientific Instruments

Radio Science

ASME Journal

Physics Today – “Search and Discovery”

Cryogenics

Nuclear Instrumentation and Methods in Physics Research

Journal of Geophysical Research

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## **REFEREEING (continued)**

### **Refereeing – Funding Proposals (proposal reviews and panels)**

National Science Foundation (NSF)  
Astronomy – Advanced Technologies and Instrumentation (ATI)  
Physics – Frontiers Centers Program  
National Space Weather Program  
Division of Atmospheric Sciences  
Small Business Innovation Research (SBIR)  
Major Research Instrumentation (MRI)  
National Aeronautics and Space Administration (NASA)  
Planck/HIFI Local Oscillator Reviews  
Breakthrough Sensor Proposals  
NASA APRA (particle physics), NASA APRA (detectors)  
U.S. Civilian Research and Development Foundation  
Chilean Comision Nacional de Investigacion Cientifica y Tecnologica  
Dutch Technology Foundation Proposal  
Dutch Innovational Research Incentives Scheme Vidi grant  
U. Virginia Harrison Fellowship  
Double Hoo Research Awards

### **Oversight Panels**

NRAO ALMA Manufacturing Readiness Review (2008)  
Special NSF panel to review MWA re-baseline effort (2009-2010)  
MWA - Antenna and Beamforming CDR (2009-2010)

### **Judging**

Piedmont Virginia Regional Science Fair  
Space Sciences, Physics, and Engineering Categories (2005 – present)  
Virginia State Science and Engineering Fair  
Physics, Astronomy, and Engineering Categories (2009, 2011-present)  
Best in Show – 2018, 2019.  
USNC-URSI Student Paper Competition (2010-2014)  
URSI (International) Student Paper Competition (2018-2020)

### **Book Reviews**

*Physics Today* – C. J. Coleman, Foundations of Radio for Scientists, May 2019  
*Physics Today* – I. R. Morus, Nikola Tesla and the Electrical Future, March 2020

## **MEETINGS ORGANIZED**

2018: URSI Atlantic Radio Science Conference, Gran Canaria, Spain, Commission J program  
2020: URSI General Assembly and Scientific Symposium, Rome Italy, Commission J program  
Postponed to 2021 due to COVID-19  
2014: Session Co-Chair – J1, J2, URSI Boulder, CO  
2013: Session Co-Chair – J3, J5, URSI Boulder, CO  
2012: Session Co-Chair – J2, J3, J5, URSI Boulder, CO  
2011: Session Co-Chair – J2, J4, and GJ1, URSI Boulder, CO  
2010: Session Co-Chair – J4, URSI Boulder, CO

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### MEETINGS ORGANIZED - continued

2009: Session Co-Chair – J4, URSI Boulder, CO  
1997, 1995, 1993: Organizing Committee Member and Session Co-Chair,  
International Semiconductor Device Research Symposium, Charlottesville, VA.  
1996: Session Chair – 7<sup>th</sup> Int. Symp. on Space THz Tech., Charlottesville, VA  
1996: Session Co-Chair – Joint B/C/J Session, URSI, Boulder, CO  
1995, 1994: Co-Chair – Central Virginia Section, IEEE MTT/ED  
1994: Session Co-Chair – Joint D/J Session, URSI, Boulder, CO

### COMMITTEE SERVICE

2018 - 2020: Sigma Xi Committee on Nominations for Society President  
2016 - present: NASA NESS Steering Committee  
2014, 2018-2020: Scientist Performance Review Committee for Scientists and Research Engineers  
2012 - Present: Observatory Science and Technical Council  
2010 - 2013: HERA Coordination Committee Chair  
2010 - 2013: NASA NLSI/LUNAR Program Steering Committee  
2011 - 2012: Scientist Performance Review Committee for Research Engineers  
2011 - present: Virginia Space Grants Consortium – Small Satellite Working Group  
2006 – 2011: NRAO - Observatory Technical Council (OTC).  
2004: NRAO - NTC Organizing Committee

### PERSONAL INTERESTS

History of Science and Technology  
Philosophy of Science  
Amateur Radio (W3DZC since 1977 – Extra Class)  
Honorary Life Member – Albemarle Amateur Radio Club, 2012  
Steel City Amateur Radio Club, Pittsburgh, PA, 1978-1985

### RESEARCH GRANTS

NASA DALI, Agile Radiometer for Regolith Observations using microWaves (ARROW) –  
\$650,000 subaward to NRAO from NASA Goddard for antenna development – *proposal pending*

NASA, Dark Ages Polarimeter Pathfinder (DAPPER) – **Co-I R. Bradley**, \$1,600,000 subaward to  
NRAO from U. Colorado - *on going*

Gordon and Betty Moore Foundation - HERA: Epoch of X-Ray Heating - \$500,000 subaward to  
UVA from MIT. - *on going*

Network for Exploration & Space Science (NESS) of the Solar System Exploration Research Virtual  
Institute (SSERVI) - **Co-I R. Bradley**, \$380,000 subaward to UVA from U. Colorado – *on going*

HERA: Illuminating the Universe – **Co-PI R. Bradley** - \$107,000 to NRAO from NSF – *completed*.

ADMX Upgrade – **Co-I R. Bradley**, \$25,000 - *completed*

NSF Follow-on to PAPER for 128 elements in South Africa – **R. Bradley Lead PI**, \$4,500,000  
total. - *completed*

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### **RESEARCH GRANTS - continued**

Lunar University Node for Astrophysics Research (LUNAR) (PI: Dr. Jack Burns (U. Colorado) – a component of the NASA Lunar Science Institute, Co-I on NRAO Subcontract: \$246,794 – *completed*

Integrated amplifiers for the QSC Feed – G. Cortes (Cornell) PI: R, Bradley, \$43,000 – *completed*

MIT/LL Bi-Static Radar Project – Cryogenic broadband feed, Co-I on NRAO contract for feed development \$64,000 - *completed*

NSF-ATI - “Collaborative Proposal: The Precision Array to Probe the Epoch of Reionization (PAPER),” PI: **R. F. Bradley** and D. Backer (U.C. Berkeley) and Co-PI: R. Rood (U. Virginia). Awarded: \$2 M total, \$1.0M to U. Virginia - *completed*

NASA Astrophysics Strategic Mission Concept Studies 2007 – Proposal 07-ASMCS07-0005, ALARC – A Lunar Array for Radio Cosmology, PI: J. Hewitt (MIT), **Co-I: R. Bradley**. NRAO to receive \$20k of \$250 k award– *completed*.

**Bradley, R.** and R. Norrod, NRAO Individual Engineering Research Grant, “Cryogenic Version of the Sinuous Feed, April 2007, Awarded: \$15k – *completed*

NSF-AST-0607759 - “Collaborative Proposal for PAPER- The Precision Array to Probe the Epoch of Reionization,” PI: **R. F. Bradley** and D. Backer (U.C. Berkeley) and Co-PI: R. Rood (U. Virginia) . Awarded: \$125k - *completed*.

NSF-MRI-0079162 – “Development of Interference Countermeasures for High Sensitivity Radio Astronomy,” PI: J. R. Fisher, (NRAO) and Co-PI: **R. F. Bradley**, - *completed*.

NSF-AST-9987339 - “Real-Time Adaptive Cancellation of Non-Stationary Interference in Radio Astronomy,” PI: B. Jeffs (BYU) and Co-PIs: K. Warnick (BYU), J. R. Fisher (NRAO) and **R. F. Bradley** -*completed*.

NSF-MRI-0320967 - “Development of the Green Bank Radio Burst Spectrometer: Exploring the Drivers of Space Weather,” PI: T. Bastian (NRAO) and Co-PIs: **R. F. Bradley** and S. White (U. MD) – *completed*.

NSF-MRI-0452760 - “Development of Real-Time Interference Mitigation and Instrumentation for Radio Astronomy,” PI: J. R. Fisher (NRAO) and Co-PIs: **R. F. Bradley**, B. Jeffs (BYU), and K. Warnick (BYU), - *completed*.

NSF-ATI-0352705 - “RFI Mitigation for Radio Astronomy with Emphasis on Array Feeds,” PI: B. Jeffs (BYU) and Co-PIs: **R. F. Bradley**, J. R. Fisher (NRAO), M. Jensen (BYU), and K. Warnick (BYU), -*completed*.



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### SELECTED PUBLICATIONS

More than 100 technical publications in journals, symposia proceedings, and workshops. A listing of the most significant publications is given below. A complete bibliography is available upon request.

- [1] Fisher, J. R. and **R. F. Bradley**, "Array Feed Cross-Correlation for Beam Forming and RFI Suppression," presented at *XXVI<sup>th</sup> General Assembly of URSI*, Toronto, Canada, Aug. 13-21, 1999.
- [2] Barnbaum, C. and **R. F. Bradley**, "A New Approach to Interference Excision in Radio Astronomy: Real Time Adaptive Cancellation," *Astronomical Journal*, vol. 116, Nov. 1998, pp. 2598-2614.
- [3] **Bradley, R. F.** and J. R. Fisher, "Measured Properties of a Real-Time Adaptive Canceler," (invited), *2001 URSI North American Radio Science Digest*, Boulder, CO, Jan. 2001.
- [4] Zhang, Q., Y. Zheng, S. G. Wilson, R. Fisher, and **R. Bradley**, "Combating Pulsed Radar Interference in Radio Astronomy," *Astronomical Journal*, vol. 126, pp. 1588-1594, 2003.
- [5] **Bradley, R. F.**, "Cryogenic, Low-Noise, Balanced Amplifiers for the 300-1200 MHz Band Using Heterostructure Field-Effect Transistors," (invited), *Nuclear Physics B: Proceedings Supplemental*, vol. 72, 1999, pp. 137-144.
- [6] **Bradley, R. F.** and R. J. Mattauch, "Planar Monolithic Schottky Varactor Diode Millimeter-Wave Frequency Multipliers," *Final Technical Report RL-TR-92-187*, Rome Laboratory, Air Force Systems Command, June 1992.
- [7] Filipovic, D. F., **R. F. Bradley** and G. M. Rebeiz, "A Planar Broadband Balanced Doubler Using a Novel Balun Design," *IEEE Microwave and Guided Wave Letters*, vol. 4, no. 7, pp. 229-231, July 1994.
- [8] Payne, J. M., D. Parker and **R. F. Bradley**, "Rangefinder With Fast Multiple Range Capability," *SPIE Milestone Series*, vol. MS-115, Selected Papers on Laser Distance Measurements, T. Bosch and M. Lescuré, eds., SPIE Optical Engineering Press, Bellingham, WA, 1995, pp. 257-262.
- [9] Hesler, J. L., W. R. Hall, T. W. Crowe, R. M. Weikle, B. S. Deaver, **R. F. Bradley** and S.-K. Pan, "Fixed Tuned Submillimeter Wavelength Waveguide Mixers Using Planar Schottky Barrier Diodes," *IEEE Trans. On Microwave Theory & Tech.*, vol. 45, no. 5, May 1997, pp. 653-658.
- [10] Daw, E. and **R. F. Bradley**, "Effect of High Magnetic Fields on the Noise Temperature of a HFET Low-Noise Amplifier," *J. Applied Physics*, vol. 82, no. 4, Aug. 15, 1997, pp. 1925-1929.
- [11] Millimeter Array Design and Development Plan, *NRAO*, Sept. 1992, pp. 31-34.
- [12] Asztalos, S., E. Daw, H. Peng, L. J. Rosenberg, C. Hagmann, D. Kinion, W. Stoeffl, K. van Bibber, P. Sikivie, N. S. Sullivan, D. B. Tanner, F. Nezrick, M. S. Turner, D. M. Moltz, J. Powell, M.-O. Andre, J. Clarke, M. Muck, and **R. F. Bradley**, "Large-Scale Microwave Cavity Search for Dark-Matter Axions," *Physical Review D*, vol. 64, Oct. 2001, pp. (092003)-1-28.

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### SELECTED PUBLICATIONS (continued)

- [13] **Bradley, R.**, J. Clarke, D. Kinion, S. Matsuki, M. Muck, L. J. Rosenberg, P. Sikivie, and K. van Bibber, "Microwave Cavity Searches for Dark-Matter Axions," *Rev. Mod. Phys.*, vol. 75, no. 3, July 2003.
- [14] **Bradley, R. F.** and J. F. Hoburg, "Electrohydrodynamic Augmentation of Forced-Convection Heat Transfer," *IEEE Trans. on Industry Applications*, vol. IA-21, no. 6, Nov./Dec. 1985, pp. 1373-1376.
- [15] **Bradley, R.F.**, C. Parashare, S. White, and T. Bastian, "Instrument Development for the Green Bank Solar Radio Burst Spectrometer," (invited), *ASP Conference Series "From Clark Lake to the Long Wavelength Array: Bill Erickson's Radio Science."*, 2005.
- [16] **Bradley, R.F.** "Blending Science and Technology in the Development of Radio Astronomy Instrumentation: The NRAO/UVA Education Initiative," (invited), *National Radio Science Meeting*, Boulder, CO, Jan. 4-6, 2006.
- [17] White, S. M., C. Mercier, R. Bradley, T. Bastian, A. Kerdraon, and M. Pick, "Imaging Observations of a Very High Frequency Type II Burst," *2006 AGU Joint Assembly*, Baltimore, MD., May, 2006.
- [18] **Bradley, R.**, "A low Cost, Screened Enclosure for Effective Control of Undesired Radio Frequency Emissions," *NRAO Electronic Division Internal Report*, No. 317, July 17, 2006.
- [19] R. Gawande, and **R. Bradley**, "Ultra Wideband, Low Noise, Active Sinuous Feed for Next Generation Radio Telescopes," *IEEE Trans. Antennas and Propagation*, March 2011.
- [20] Aaron R. Parsons, Donald C. Backer, **Richard F. Bradley**, James E. Aguirre, Erin E. Benoit, Chris Carilli, Griffin S. Foster, Nicole E. Gugliucci, David Herne, Daniel C. Jacobs, Mervyn J. Lynch, Jason R. Manley, Chaitali R. Parashare, Daniel J. Werthimer, Melvyn C. H. Wright, "The Precision Array for Probing the Epoch of Reionization: Eight Station Results," *Astronomical Journal*, vol. 139, pp. 1468-1480, April 2010.
- [21] **Bradley, Richard F.**, Keith Tauscher, David Rapetti, and Jack O. Burns. "A Ground Plane Artifact that Induces an Absorption Profile in Averaged Spectra from Global 21 cm Measurements, with Possible Application to EDGES." *The Astrophysical Journal*, 874, no. 2, p153 , 2019.