

Raul A. Monsalve

Curriculum Vitae (Rev. Feb. 2020)

Email:

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Main affiliation:

Research Associate
Department of Physics and McGill Space Institute
McGill University
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Montreal, Quebec H3A 2T8
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ORCID: <https://orcid.org/0000-0002-3287-2327>

Main research interests: experimental cosmology – statistical data analysis – radio astronomy

Education:

- 2012 Jun, Ph.D. in Physics, University of Miami
Thesis: “*Calibrations and Observations with the QUIET Radiotelescope*”,
Advisor: Joshua Gundersen
- 2007 Feb, B.Sc. in Electronics Engineering, Universidad de Concepción
Thesis: “*Study and Design of Radiofrequency Power Supply for Excitation of CO₂ Laser*”,
Advisor: Sergio Torres

Appointments:

- 2018 – present, Research Associate, Department of Physics and McGill Space Institute, McGill University
2017 – present, Visiting Researcher, Facultad de Ingeniería, UC de la Santísima Concepción
2016 – present, Visiting Researcher, School of Earth and Space Exploration, Arizona State University
2016 – 2018, Postdoctoral Associate, Center for Astrophysics and Space Astronomy, University of Colorado
2012 – 2016, Postdoctoral Associate, School of Earth and Space Exploration, Arizona State University
2012 – 2012, Graduate Teaching Assistant, Department of Physics, University of Miami
2007 – 2012, Graduate Research Assistant, Department of Physics, University of Miami
2006 – 2007, Undergrad Research Assistant, Department of Electrical Engineering, Universidad de Concepción
2006 – 2007, Undergrad Research Assistant, Department of Physics, Universidad de Concepción

Memberships:

- 2019 – present, Full member, Canadian Astrophysical Society – Société Canadienne D’Astronomie (CASCA)
2015 – present, Full member, American Physical Society (APS)
2014 – present, Full member, Institute of Electrical and Electronics Engineers (IEEE)
2010 – present, Full member, American Astronomical Society (AAS)

Scientific collaborations:

- 2018 – present, Mapper of the IGM Spin Temperature (MIST) PI: R. Bustos, UC Santísima Concepción
2016 – 2018, Network for Exploration and Space Sciences (NESS) PI: J. Burns, University of Colorado
2016 – 2018, Dark Ages Radio Explorer (DARE) PI: J. Burns, University of Colorado
2012 – present, Experiment to Detect the Global EoR Signature (EDGES) PI: J. Bowman, Arizona State University
2013 – 2016, Medidor Autónomo de Radio Interferencia (MARI) PI: R. Bustos, UC Santísima Concepción
2007 – 2013, Q/U Imaging Experiment (QUIET) PI: B. Winstein, University of Chicago

Research grant awards:

- 2019 – 2022, (Collaborator) “*Validating and Refining Global 21cm Measurements of Cosmic Dawn*”, NSF AST-1908933 (ATI), USD \$ 598,771
- 2018 – 2021, (Co-PI) “*DAC: Detector del Amanecer Cósmico*”, QUIMAL project 180003, CONICYT, Chile, USD \$220,000

2018 – 2021, (Collaborator) “*The Dawn of Hydrogen Cosmology: First Stars, Dark Matter, and the Thermal History of the Early Universe*”, NSF AST-1813850 (AAG), USD \$620,452

2018 – 2019, (Co-PI) “*Radio Telescopio DAC (Detector del Amanecer C6smico) de UCSC*”, UCSC project BIP-106, UC Sant6sima Concepci6n, Chile, USD \$120,000

2016 – 2019, (Contributor) “*Collaborative Research: Detecting the First Light and Reionization of the Universe using Advanced Radio Instrumentation*”, NSF AST-1609450 (ATI), USD \$769,856

2013 – 2015, (Co-PI) “*First step towards the construction of a Low-Frequency Telescope: RFI site-testing with MARI-UCSC*”, QUIMAL project 130005, CONICYT, Chile, USD \$106,000

Academic awards:

2000, “*Enrique Molina Garmendia*” undergraduate scholarship, Universidad de Concepci6n

2000, “*Padre Hurtado*” undergraduate scholarship, Universidad Cat6lica de Chile (declined)

Courses taught:

2012 Jan – 2012 Jul, PHY 208, University Physics Laboratory, University of Miami

Mentoring:

2020 Jan – present, Erika Hornecker, undergrad research,
Department of Physics, McGill University

2020 Jan – present, Megan Cvitan, undergrad research,
Department of Physics, McGill University

2019 Sep – present, Matheus Pessoa, Master’s degree research,
Department of Physics, McGill University

2019 Apr – present, Christian Bye, undergrad research,
Department of Physics, McGill University

2019 Mar – present, Oscar Restrepo, PhD research,
Department of Electrical Engineering, Universidad de Chile

2019 Mar – present, Mauricio Diaz, engineering,
Department of Electrical Engineering, UC de la Sant6sima Concepci6n

2017 May – 2017 Aug, Kent Ritchie, undergrad research,
Department of Astrophysical and Planetary Sciences, University of Colorado

2016 Mar – 2017 Apr, Katherine Pellicore, undergrad research and thesis project,
Department of Astrophysical and Planetary Sciences, University of Colorado

2014 Mar – 2016 Jan, Alexandra Suarez, undergrad research and thesis project,
Department of Physics, Universidad de Concepci6n

Professional service:

2018 – present, Member, McGill Astro Seminar Committee

2018 Jan, Session chair, AAS 231st Meeting

2016 – present, Referee, Monthly Notices of the Royal Astronomical Society

2013 – present, Referee, The Astrophysical Journal

Event organization:

2019 Oct, Chair of “*Second Global 21cm Workshop*”, McGill University, Canada
www.physics.mcgill.ca/global21cm2019

Work visits:

2019 Jul, McGill Arctic Research Station,
 Characterization of radio environment for low-frequency cosmology in the Canadian arctic

2018 Nov, Korea Astronomy and Space Science Institute,
 Analysis of EDGES Mid-Band data

2018 Oct, Kavli Institute for Cosmology, Cambridge University,
 Analysis of EDGES Mid-Band data and discussions on global 21-cm models

2018 Aug, Harvard-Smithsonian Center for Astrophysics,
 Analysis of global redshifted 21-cm models with EDGES data

2018 Jun, Astrophysics and Cosmology Research Unit, University of KwaZulu-Natal,
 Discussions with collaborators on low-frequency cosmology experiments

2015 Dec, Department of Electrical Engineering, UC Santísima Concepción,
 Analysis of data from RFI survey in the Atacama desert with MARI

2015 Jan, Department of Electrical Engineering, UC Santísima Concepción,
 Analysis of data from RFI survey in the Atacama desert with MARI

2008 Jun, Department of Physics, Princeton University,
 Return loss measurements of the QUIET W-band feedhorn array

2008 May, Department of Astronomy, Caltech,
 Pre-assembly and optical alignment of the QUIET radio telescope

2007 Jun, Department of Experimental Physics, Universidade de São Paulo,
 Development of stabilizer for Mach-Zender interferometer

2006 Aug – 2006 Dec, CICESE Monterrey,
 Development of 100-W RF power supply at 100 MHz

Courses, workshops, and summer schools attended:

2015 Apr, “*Keysight RF Simulation Back to Basics Workshop*”, Chandler, AZ

2014 May, “*14th NRAO Synthesis Imaging Workshop*”, NRAO Socorro

2013 Jun, “*Penn State University Summer School in Statistics for Astronomers*”, Pennsylvania State University

2011 Jul, “*Sixth NAIC/NRAO Summer School on Single Dish Radio Astronomy*”, NRAO Green Bank

2006 Sep, “*Fundamentals of Industrial Lasers: Applications and Safety*”, CICESE Monterrey

Astronomical observation experience:

2014 May, Pulsar observations with LWA

2013 – present, Low-frequency radio observations with EDGES

2011 Jul, Extragalactic observation with Arecibo

2008 – 2011, CMB polarization observations with QUIET

Refereed journal papers:

- 18) “Results from EDGES High-Band: III. New Constraints on Parameters of the Early Universe”, **Raul A. Monsalve**, Anastasia Fialkov, Judd D. Bowman, Alan E. E. Rogers, Thomas J. Mozdzen, Aviad Cohen, Rennan Barkana, Nivedita Mahesh, *The Astrophysical Journal*, 875, 67, April 2019, doi: 10.3847/1538-4357/ab07be
- 17) “Spectral Index of the Diffuse Radio Background Between 50 and 100 MHz”, T. J. Mozdzen, N. Mahesh, **R. A. Monsalve**, A. E. E. Rogers, J. D. Bowman, *Monthly Notices of the Royal Astronomical Society*, 483, 4416, December 2018, doi: 10.1093/mnras/sty3410
- 16) “Modeling the Radio Background from the First Black Holes at Cosmic Dawn: Implications for the 21cm Absorption Amplitude”, A. Ewall-Wice, T.-C. Chang, J. Lazio, O. Dore, M. Seiffert, **R. A. Monsalve**, *The Astrophysical Journal*, 868, 63, November 2018, doi: 10.3847/1538-4357/aae51d
- 15) “Results from EDGES High-band. II. Constraints on Parameters of Early Galaxies”, **Raul A. Monsalve**, Bradley Greig, Judd D. Bowman, Andrei Mesinger, Alan E. E. Rogers, Thomas J. Mozdzen, Nicholas S. Kern, Nivedita Mahesh, *The Astrophysical Journal*, 863, 11, August 2018, doi: 10.3847/1538-4357/aace54
- 14) “An absorption profile centred at 78 megahertz in the sky-averaged spectrum”, Bowman, J. D., Rogers, A. E. E., **Monsalve, R. A.**, Mozdzen, T. J., Mahesh, N., *Nature*, 555, 67–70, March 2018, doi: 10.1038/nature25792
- 13) “The Radio Synchrotron Background: Conference Summary and Report”, J. Singal, J. Haider, M. Ajello, D. R. Ballantyne, E. Bunn, J. Condon, J. Dowell, D. Fixsen, N. Fornengo, B. Harms, G. Holder, E. Jones, K. Kellermann, A. Kogut, T. Linden, **R. Monsalve**, P. Mertsch, E. Murphy, E. Orlando, M. Regis, D. Scott, T. Vernstrom, L. Xu, *Publications of the Astronomical Society of the Pacific*, 130:036001, March 2018, doi: 10.1088/1538-3873/aaa6b0
- 12) “Results from EDGES High-Band: I. Constraints on Phenomenological Models for the Global 21 cm Signal”, **Raul A. Monsalve**, Alan E. E. Rogers, Judd D. Bowman, Thomas J. Mozdzen, *The Astrophysical Journal*, 847, 64, September 2017, doi: 10.3847/1538-4357/aa88d1
- 11) “A Space-Based Observational Strategy for Characterizing the First Stars and Galaxies Using the Redshifted 21-cm Global Spectrum”, Jack O. Burns, Richard Bradley, Keith Tauscher, Steven Furlanetto, Jordan Mirocha, **Raul Monsalve**, David Rapetti, William Purcell, David Newell, David Draper, Robert MacDowall, Judd Bowman, Bang Nhan, Edward J. Wollack, Anastasia Fialkov, Dayton Jones, Justin C. Kasper, Abraham Loeb, Abhirup Datta, Jonathan Pritchard, Eric Switzer, Michael Bica, *The Astrophysical Journal*, 844, 33, July 2017, doi: 10.3847/1538-4357/aa77f4
- 10) “Calibration of the EDGES High-Band Receiver to Observe the Global 21-cm Signature from the Epoch of Reionization”, **Raul A. Monsalve**, Alan E. E. Rogers, Judd D. Bowman, Thomas J. Mozdzen, *The Astrophysical Journal*, 835, 49, January 2017, doi: 10.3847/1538-4357/835/1/49
- 9) “Improved Measurement of the Spectral Index of the Diffuse Radio Background Between 90 and 190 MHz”, T. J. Mozdzen, J. D. Bowman, **R. A. Monsalve**, and A. E. E. Rogers, *Monthly Notices of the Royal Astronomical Society*, 464, 4, February 2017, doi: 10.1093/mnras/stw2696
- 8) “One-Port Direct/Reverse Method for Characterizing VNA Calibration Standards”, **Raul A. Monsalve**, Alan E. E. Rogers, Thomas J. Mozdzen, Judd D. Bowman, *IEEE Transactions on Microwave Theory and Techniques*, 64, 8, August 2016, doi: 10.1109/TMTT.2016.2580141
- 7) “Limits on Foreground Subtraction from Chromatic Beam Effects in Global Redshifted 21 cm Measurements”, T. J. Mozdzen, J. D. Bowman, **R. A. Monsalve**, and A. E. E. Rogers, *Monthly Notices of the Royal Astronomical Society*, 455, 4, February 2016, doi: 10.1093/mnras/stv2601
- 6) “The Q/U Imaging Experiment: Polarization Measurements of the Galactic Plane at 43 and 95 GHz”, QUIET Collaboration: T. M. Ruud, U. Fuskeland, I. K. Wehus, M. Vidal, D. Araujo, C. Bischoff, I. Buder, Y. Chinone, K. Cleary, R.

N. Dumoulin, A. Kusaka, **R. Monsalve**, S. K. Naess, L. B. Newburgh, R. A. Reeves, J. T. L. Zwart, L. Bronfman, R. D. Davies, R. Davis, C. Dickinson, H. K. Eriksen, T. Gaier, J. O. Gundersen, M. Hasegawa, M. Hazumi, K. M. Huffenberger, M. E. Jones, C. R. Lawrence, E. M. Leitch, M. Limon, A. D. Miller, T. J. Pearson, L. Piccirillo, S. J. E. Radford, A. C. S. Readhead, D. Samtleben, M. Seiffert, M. C. Shepherd, S. T. Staggs, O. Tajima, K. L. Thompson, *The Astrophysical Journal*, 811, 89, August 2015, doi: 10.1088/0004-637X/811/2/89

5) “*The Q/U Imaging Experiment: Polarization Measurements of Radio Sources at 43 and 95 GHz*”, QUIET Collaboration: K. M. Huffenberger, D. Araujo, C. Bischoff, I. Buder, Y. Chinone, K. Cleary, A. Kusaka, **R. Monsalve**, S. K. Naess, L. B. Newburgh, R. Reeves, T. M. Ruud, I. K. Wehus, J. T. L. Zwart, C. Dickinson, H. K. Eriksen, T. Gaier, J. O. Gundersen, M. Hasegawa, M. Hazumi, A. D. Miller, S. J. E. Radford, A. C. S. Readhead, S. T. Staggs, O. Tajima, K. L. Thompson, *The Astrophysical Journal*, 806, 1, June 2015, doi: 10.1088/0004-637X/806/1/112

4) “*Radiometric Measurements of Electron Temperature and Opacity of Ionospheric Perturbations*”, A. E. E. Rogers, J. D. Bowman, J. Vierinen, **R. Monsalve**, T. Mozdzen, *Radio Science*, 50, 2, February 2015, doi: 10.1002/2014RS005599

3) “*The Q/U Imaging Experiment Instrument*”, QUIET Collaboration: C. Bischoff, A. Brizius, I. Buder, Y. Chinone, K. Cleary, R. N. Dumoulin, A. Kusaka, **R. Monsalve**, S. K. Naess, L. B. Newburgh, G. Nixon, R. Reeves, K. M. Smith, K. Vanderlinde, I. K. Wehus, M. Bogdan, R. Bustos, S. E. Church, R. Davis, C. Dickinson, H. K. Eriksen, T. Gaier, J. O. Gundersen, M. Hasegawa, M. Hazumi, C. Holler, K. M. Huffenberger, W. A. Imbriale, K. Ishidoshiro, M. E. Jones, P. Kangaslahti, D. J. Kapner, C. R. Lawrence, E. M. Leitch, M. Limon, J. J. McMahon, A. D. Miller, M. Nagai, H. Nguyen, T. J. Pearson, L. Piccirillo, S. J. E. Radford, A. C. S. Readhead, J. L. Richards, D. Samtleben, M. Seiffert, M. C. Shepherd, S. T. Staggs, O. Tajima, K. L. Thompson, R. Williamson, B. Winstein, E. J. Wollack, J. T. L. Zwart, *The Astrophysical Journal*, 768, 9, April 2013, doi: 10.1088/0004-637X/768/1/9

2) “*Second Season QUIET Observations: Measurements of the CMB Polarization Power Spectrum at 95 GHz*”, QUIET Collaboration: D. Araujo, C. Bischoff, A. Brizius, I. Buder, Y. Chinone, K. Cleary, R. N. Dumoulin, A. Kusaka, **R. Monsalve**, S. K. Naess, L. B. Newburgh, R. Reeves, I. K. Wehus, J. T. L. Zwart, L. Bronfman, R. Bustos, S. E. Church, C. Dickinson, H. K. Eriksen, T. Gaier, J. O. Gundersen, M. Hasegawa, M. Hazumi, K. M. Huffenberger, K. Ishidoshiro, M. E. Jones, P. Kangaslahti, D. J. Kapner, D. Kubik, C. R. Lawrence, M. Limon, J. J. McMahon, A. D. Miller, M. Nagai, H. Nguyen, G. Nixon, T. J. Pearson, L. Piccirillo, S. J. E. Radford, A. C. S. Readhead, J. L. Richards, D. Samtleben, M. Seiffert, M. C. Shepherd, K. M. Smith, S. T. Staggs, O. Tajima, K. L. Thompson, K. Vanderlinde, R. Williamson, *The Astrophysical Journal*, 760, 145, November 2012, doi: 10.1088/0004-637X/760/2/145

1) “*First Season QUIET Observations: Measurements of CMB Polarization Power Spectra at 43 GHz in the Multipole Range $25 \leq l \leq 475$* ”, QUIET Collaboration: Bischoff, C., Brizius, A., Buder, I., Chinone, Y., Cleary, K., Dumoulin, R. N., Kusaka, A., **Monsalve, R.**, Naess, S. K., Newburgh, L. B., Reeves, R., Smith, K. M., Wehus, I. K., Zuntz, J. A., Zwart, J. T. L., Bronfman, L., Bustos, R., Church, S. E., Dickinson, C., Eriksen, H. K., Ferreira, P. G., Gaier, T., Gundersen, J. O., Hasegawa, M., Hazumi, M., Huffenberger, K. M., Jones, M. E., Kangaslahti, P., Kapner, D. J., Lawrence, C. R., Limon, M., May, J., McMahon, J. J., Miller, A. D., Nguyen, H., Nixon, G. W., Pearson, T. J., Piccirillo, L., Radford, S. J. E., Readhead, A. C. S., Richards, J. L., Samtleben, D., Seiffert, M., Shepherd, M. C., Staggs, S. T., Tajima, O., Thompson, K. L., Vanderlinde, K., Williamson, R., Winstein, B., *The Astrophysical Journal*, 741, 111, October 2011, doi: 10.1088/0004-637X/741/2/111

Submitted journal papers:

1) “*Emulating the Global 21-cm Signal from Cosmic Dawn and Reionization*”, Aviad Cohen, Anastasia Fialkov, Rennan Barkana, **Raul Monsalve**, <https://arxiv.org/abs/1910.06274>

Conference papers:

1) “*Beam characterization for the QUIET Q-Band instrument using polarized and unpolarized astronomical sources*”,
Raul A. Monsalve, Proc. SPIE 7741, San Diego, June 2010, doi: 10.1117/12.856633

Conference proceedings:

1) “*Discovering the Sky at the Longest Wavelengths with Small Satellite Constellations*”, Xuelei Chen, Jack Burns, Leon Koopmans, Hanna Rothkaehi, Joseph Silk, Ji Wu, Albert-Jan Boonstra, Baptiste Cecconi, Cynthia H. Chiang, Linjie Chen, Li Deng, Maurizio Falanga, Heino Falcke, Quanlin Fan, Guangyou Fang, Anastasia Fialkov, Leonid Gurvits, Yicai Ji, Justin C. Kasper, Kejia Li, Yi Mao, Benjamin Mckinley, **Raul Monsalve**, Jeffery B. Peterson, Jinsong Ping, Ravi Subrahmanyam, Harish Vedantham, Marc Klein Wolt, Fengquan Wu, Yidong Xu, Jingye Yan, Bin Yue, <https://arxiv.org/abs/1907.10853>

White papers:

1) “*Canada and the SKA from 2020-2030*”, Kristine Spekkens, Cynthia Chiang, Roland Kothes, Erik Rosolowsky, Michael Rupen, Samar Safi-Harb, Jonathan Sievers, Greg Sivakoff, Ingrid Stairs, Nienke van der Marel, Bob Abraham, Rachel Alexandroff, Norbert Bartel, Stefi Baum, Michael Bietenholz, Aaron Boley, Dick Bond, Joanne Brown, Toby Brown, Gary Davis, Jayanne English, Greg Fahlman, Laura Ferrarese, James Di Francesco, Bryan Gaensler, Severin Gaudet, Vanessa Graber, Mark Halpern, Alex Hill, Julie Hlavacek-Larrondo, Judith Irwin, Doug Johnstone, Gilles Joncas, Vicky Kaspi, JJ Kavelaars, Adrian Liu, Brenda Matthews, Jordan Mirocha, **Raul Monsalve**, Cherry Ng, Chris O’Dea, Ue-Li Pen, Rene Plume, Tim Robishaw, Sarah Sadavoy, Viraj Sanghai, Paul Scholz, Luc Simard, Richard Shaw, Saurabh Singh, Kris Sigurdson, Kendrick Smith, David Stevens, Jeroen Stil, Sean Tulin, Cameron van Eck, Jasper Wall, Jennifer West, Tyrone Woods, Dallas Wulf, <https://arxiv.org/abs/1911.03250>

Other articles:

1) “*Reply to Hills et al.*”, Judd D. Bowman, Alan E.E. Rogers, **Raul A. Monsalve**, Thomas J. Mozdzen & Nivedita Mahesh, Nature, 564, E35, December 2018, doi: 10.1038/s41586-018-0797-4

Future talks, workshops, conferences, and visits:

2020 Mar 30, Invited Talk, Fundamental Physics at 21 cm Workshop, IFPU Trieste, Italy

Invited talks:

19) 2020 Jan, “*Results from the EDGES experiment*”,
 The First Billion Years of the Universe Conference, Indian Institute of Technology Indore, India

18) 2019 Oct, “*EDGES*”,
 21cm Cosmology Workshop, Paris-Saclay University, France

17) 2019 Jun, “*The Signature of the Cosmic Dawn in the Global Radio Spectrum*”,
 EWASS Symposium: The Universe in the First Billion Years, Lyon, France

16) 2019 Jun, “*New Evidence for an Absorption Feature in the Radio Spectrum from EDGES Mid Band*”,
 41st Photonics & Electromagnetics Research Symposium, Rome, Italy

15) 2019 Jun, “*The Signature of the Cosmic Dawn in the Global Radio Spectrum*”,
 Canadian Astronomical Society Meeting, Montreal, Canada

14) 2019 Mar, “*An Absorption Feature in the All Sky Radio Spectrum*”,
 Les Rencontres de Physique de la Vallee d’Aoste, Italy

- 13) 2019 Mar, “*The Signature of the First Stars in the Global 21 cm Signal*”,
Cosmosafari Conference, Hluhluwe, South Africa
- 12) 2019 Jan, “*EDGES Experiment and Results*”,
Discovering the Sky at the Longest Wavelength Forum, Beijing, China
- 11) 2019 Jan, “*Strengthening the Cosmological Interpretation of the EDGES Signal Through Instrumental Verification*”,
USNC-URSI National Radio Science Meeting, University of Colorado, Boulder, USA
- 10) 2018 Dec, “*An Absorption Feature in the Sky-Averaged Radio Spectrum*”,
Science at Low Frequencies V Meeting, Nagoya University, Japan
- 9) 2018 Sep, “*An Absorption Profile in the Sky-Averaged Radio Spectrum*”,
IGM2018 Workshop, Kavli IPMU, Kashiwa, Japan
- 8) 2018 Aug, “*Fingerprints of the First Stars in the Sky-Averaged Radio Spectrum*”,
TeVPA 2018 Conference, Berlin, Germany
- 7) 2018 Jul, “*EDGES Measurement of an Absorption Feature in the Global Radio Spectrum*”,
Tremendous Radio Arrays Workshop, Brookhaven National Laboratory, Upton, USA
- 6) 2018 Aug, “*Measurements of Reflection Coefficient*”,
Low-Noise Radio Receivers Workshop, Haystack Observatory, Westford, USA
- 5) 2018 Jun, “*An Absorption Feature in the Sky-Averaged Radio Spectrum*”,
Thermal History of the Universe at Intermediate Redshifts Workshop, CERN, Switzerland
- 4) 2018 Jun, “*Measuring the Global 21-cm Signal with EDGES*”,
Rise and Shine: Galaxies in the Epoch of Reionization Conference, Strasbourg, France
- 3) 2018 May, “*Fingerprints of the First Stars in the Sky-Averaged Radio Spectrum*”,
CIPANP 2018 Conference Plenary Talk, Indian Wells, USA
- 2) 2017 Jul, “*Synchrotron Radiation as a Foreground to the Global Redshifted 21-cm Measurement by EDGES*”,
Radio Synchrotron Background Workshop, University of Richmond, USA
- 1) 2016 Jul, “*Constraining the Global Redshifted 21-cm Signal with EDGES*”,
CMB Spectral Distortions from Cosmic Baryon Evolution Forum, Raman Research Institute, India

Contributed talks:

- 27) 2019 Dec, “*An absorption feature in the EDGES Mid-Band spectrum*”
Science at Low Frequencies VI Conference, Arizona State University, Tempe, USA
- 26) 2019 Oct, “*EDGES Mid-Band Analysis*”,
Second Global 21cm Workshop, McGill University, Montreal, Canada
- 25) 2018 Aug, “*An Absorption Signal in the Sky-Averaged Radio Spectrum*”,
Rencontres du Vietnam Conference, Windows on the Universe, Quy Nhon, Vietnam
- 24) 2018 Jul, “*Probing the First Galaxies and Black Holes with the Global Redshifted 21-cm Line*”,
The Early Growth of Supermassive Black Holes Workshop, Sexten, Italy
- 23) 2018 May, “*Extracting the Global Cosmological 21-cm Signal from EDGES Data using MCMC*”,
2nd URSI Atlantic Radio Science Meeting, Gran Canaria, Spain

- 22) 2018 Feb, “*Telerobotic Deployment of a Lunar Farside Low Frequency Telescope from the Deep Space Gateway*”, Deep Space Gateway Science Workshop, Denver, USA
- 21) 2018 Feb, “*Characterizing the Epochs of Heating and Reionization with EDGES High-Band*”, Cosmological Signals from Cosmic Dawn to Present Conference, Aspen Center for Physics, USA
- 20) 2018 Jan, “*Characterizing the 21-cm Signal from Neutral Hydrogen in the IGM at Redshifts $27 > z > 6$ with EDGES*”, 231st AAS Meeting, National Harbor, USA
- 19) 2017 Dec, “*Recent Progress by the EDGES Global 21-cm Experiment*”, Science at Low Frequencies IV Meeting, University of Sydney, Australia
- 18) 2017 Jul, “*Preparing for the Dark Ages Radio Explorer (DARE) through Ground-Based Observations*”, NASA Exploration Science Forum, NASA Ames, USA
- 17) 2017 Jan, “*The Properties of Primordial Stars and Galaxies Measured from the 21-cm Global Spectrum using DARE*”, 229th AAS Meeting, Grapevine, USA
- 16) 2017 Jan, “*Precision Cosmological Measurements with DARE and EDGES*”, USNC-URSI National Radio Science Meeting, University of Colorado, Boulder, USA
- 15) 2016 Dec, “*Constraining the Global Redshifted 21-cm Signal with EDGES in the Range $14.8 > z > 6.5$* ”, Science at Low Frequencies III Meeting, Caltech, USA
- 14) 2016 Oct, “*The Dark Ages Radio Explorer (DARE)*”, AeroSpace Ventures Day Conference, LASP, Colorado, USA
- 13) 2016 Jul, “*The EDGES and DARE Precision Cosmology Experiments*”, NASA Exploration Science Forum, NASA Ames, USA
- 12) 2016 Mar, “*Latest Constraints on the Global Redshifted 21-cm EoR Signal from the EDGES Experiment*”, The Reionization Epoch: New Insights and Future Conference, Aspen Center for Physics, USA
- 11) 2016 Jan, “*Preliminary Measurements with the EDGES Low-Band Instrument*”, USNC-URSI National Radio Science Meeting, University of Colorado, Boulder, USA
- 10) 2015 Dec, “*Characterizing Cosmic Dawn with the Low-Band EDGES Instrument*”, Science at Low Frequencies II Meeting, University of New Mexico, Albuquerque, USA
- 9) 2015 Oct, “*Characterization of Cosmic Dawn through Observations of the Redshifted 21-cm Line*”, APS 4 Corners Section Meeting, Arizona State University, Tempe, USA
- 8) 2015 Jul, “*Characterization of the EDGES Receiver and its Capability for Constraining the EoR*”, IEEE APS/URSI North American Conference, Vancouver, Canada
- 7) 2014 Dec, “*Characterizing the Cosmic Dawn through Observations of the 21-cm line*”, Chilean Astronomy Web Meeting, UNAB, Santiago, Chile
- 6) 2014 Dec, “*Overview and Status of the EDGES Experiment*”, Early Science with Low-Frequency Radio Telescopes Meeting, Arizona State University, Tempe, USA
- 5) 2014 Jan, “*Global 21-cm-line Measurements with the EDGES Telescope*”, USNC-URSI National Radio Science Meeting, University of Colorado, Boulder, USA

4) 2012 Nov, “*Opportunities and Challenges of Low Frequency Cosmology*”,
First AIUC Workshop, Santiago, Chile

3) 2012 Jan, “*Measuring the CMB Polarization at 95 GHz with the QUIET Experiment*”,
AAS 219th Meeting, Austin, USA

2) 2010 May, “*Impact of the Q/U Imaging Experiment on CMB Polarization Science*”,
AAS 216th Meeting, Miami, USA

1) 2009 Dec, “*CMB Studies with the QUIET Radiotelescope*”,
Miami Physics Conference, USA

Seminars and colloquia:

22) 2019 Nov, “*Emulators in 21-cm Cosmology*”
MSI Monday Lunch Talk, McGill University, Montreal, Canada

21) 2019 Apr, “*The Signature of the Cosmic Dawn in the All Sky Radio Spectrum*”,
Texas A&M University Astronomy Seminar, College Station, USA

20) 2018 Dec, “*An Absorption Feature in the Sky-Averaged Radio Spectrum*”,
McGill Special Astrophysics Seminar, Montreal, Canada

19) 2018 Dec, “*Constraining Cosmic Dawn and Reionization with the Global 21-cm Signal*”,
Yukawa Institute for Theoretical Physics Seminar, Kyoto, Japan

18) 2018 Nov, “*The Signature of the Cosmic Dawn in the Sky-Averaged Radio Spectrum*”,
Asia Pacific Center for Theoretical Physics Seminar, Pohang, South Korea

17) 2018 Nov, “*The Signature of the Cosmic Dawn in the Sky-Averaged Radio Spectrum*”,
Korea Astronomy and Space Science Institute Colloquium, Daejeon, South Korea

16) 2018 Oct, “*Constraining Cosmic Dawn and Reionization with the Global 21-cm Signal*”,
Department of Physics NPA Seminar, Yale University, USA

15) 2018 Jun, “*Characterizing the Early Universe with the Sky-Averaged Radio Spectrum*”,
Seminario Dipartimento di Fisica, Università degli Studi di Torino, Italy

14) 2018 Jun, “*EDGES Detection of an Absorption Feature at 78 MHz in the Sky-Averaged Radio Spectrum*”,
NITheP Seminar, University of Kwazulu-Natal, Durban, South Africa

13) 2018 Mar, “*Detecting the Fingerprints of the First Stars*”,
Special Physics Seminar, University of Colorado, Boulder, USA

12) 2018 Feb, “*Illuminating the Cosmic Dawn with Sky-Average Radio Measurements*”,
NRAO Socorro Colloquium, USA

11) 2017 Jul, “*Current Developments and Constraints of Redshifted 21-cm Models by EDGES*”,
Radio Astronomy Laboratory Seminar, UC Berkeley, USA

10) 2017 Apr, “*Constraints on Cosmic Dawn and the EoR from Global 21-cm Observations*”,
Astronomy Tea Talk, Caltech, USA

9) 2016 Sep, “*Constraining the Global 21-cm Signal from the Early Universe with EDGES and DARE*”,
ITC-CfA Colloquium, Harvard University, USA

- 8) 2016 Sep, “Polarization in the Foregrounds for Global 21-cm Measurements”, ITC-CfA Luncheon, Harvard University, USA
- 7) 2016 Jul, “Probing the large-scale evolution of the early Universe ($z > 6$) with the global redshifted 21-cm line”, KIPAC Tea Talk, SLAC, Stanford University, USA
- 6) 2015 Sep, “Characterization of Cosmic Dawn through Observations of the Redshifted 21-cm Line with EDGES”, Astrophysics Lunch Seminar, University of Colorado, Boulder, USA
- 5) 2015 Jul, “The EDGES Experiment: Calibrations and Status”, Physics Colloquium, University of British Columbia, Vancouver, Canada
- 4) 2015 Jan, “Characterizing Cosmic Dawn through Observations of the 21-cm line”, Physics Colloquium, University of Miami, USA
- 3) 2015 Jan, “Characterizing Cosmic Dawn through Observations of the 21-cm line”, Astrophysics Seminar, Florida State University, Tallahassee, USA
- 2) 2015 Jan, “Characterizing Cosmic Dawn through Observations of the 21-cm line”, Astronomy Seminar, Universidad de Concepción, Chile
- 1) 2015 Jan, “Characterizing Cosmic Dawn through Observations of the 21-cm line”, Engineering Seminar, UC de la Santísima Concepción, Chile

Posters:

- 3) 2017 Jan, “Instrumental and Calibration Advancements for the Dark Ages Radio Explorer”, AAS 229th Meeting, Grapevine, USA
- 2) 2015 Aug, “EDGES: Experiment to Detect the Global EoR Signature”, IAU XXIX General Assembly, Honolulu, USA
- 1) 2013 Jul, “Advances on the Calibration of a Differential Front-End for the Dark Ages Radio Explorer (DARE)”, NASA Lunar Science Virtual Forum, USA

Outreach and media:

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|----------------------|---|
| 2019 Nov 10, | Article in Chilean newspaper El Mercurio on the MIST project |
| 2018 Dec 13, | EDGES detection selected “Top 10 Breakthrough of 2018”, by Physics World magazine |
| 2018 Mar 16, | Radio interview for Radio Andina in relation to the EDGES project |
| 2018 Mar 2, | Radio interview for France Culture Le Journal Des Sciences in relation to the EDGES project |
| 2018 Mar 1, | Radio interview for NPR Morning Edition in relation to the EDGES project |
| 2018 Feb – 2018 May, | Interviews for printed and internet news outlets in relation to the EDGES project |
| 2014 – 2015, | Interviews for TV Channel Telemundo Arizona to discuss science news |
| 2013 – 2014, | Appearances in Chilean newspapers in relation to the MARI project |
| 2012 – 2015, | Expositor at STEM Open House Events at Arizona State University |

Technical memos:

Available on Haystack EDGES Memo Series webpage:

http://www.haystack.mit.edu/ast/arrays/Edges/EDGES_memos/EdgesMemo.html

2014/07/31, “Characterization of RFI at the UNR Gund Ranch”

2013/09/05, “Effect of Error in the VNA Calibration Standards, on Measured Reflection Coefficient”

2013/05/03, “Sensitivity of EDGES Antenna Prototype to Different Perturbations”

2012/12/13, “Stability measurements of VNA, coaxial cable, and antenna with Roberts balun”

Available on ASU Low-Frequency Cosmology Lab Memo webpage:

<http://loco.lab.asu.edu/memos/>

- 2020/01/28, “Fisher Matrix Analysis of Physical Foreground Model for EDGES”
- 2020/01/15, “Diffuse Foreground Parameters from Mid-Band Data”
- 2019/11/23, “Antenna Temperature and Beam Chromaticity Correction”
- 2019/11/08, “WIPL-D Simulations of the EDGES sMid- and Low-Band Antennas”
- 2019/10/25, “Antenna Simulations with WIPL-D Accounting for Soil”
- 2019/10/16, “Comparing Antenna Simulations from FEKO, WIPL-D, and HFSS-IE”
- 2019/08/30, “Mid-Band Calibration Comparison”
- 2019/08/15, “Mid-Band Spectral Residuals”
- 2019/08/15, “Mid-Band ‘Metadata’: GHA, Sun Elevation, Temperature, and Humidity”
- 2019/06/13, “Evaluation of the Keysight P9370A USB VNA”
- 2018/08/29, “Simple Parameter Estimation with PolyChord and GetDist”
- 2018/04/12, “First Tests of Absorption Feature Below 90 MHz in EDGES High-Band Data with Blade Antenna”
- 2018/01/26, “Constraints on Physical Parameters of 21-cm Models from Cohen/Fialkov/Barkana: Part 2”
- 2018/01/24, “Constraints on Physical Parameters of 21-cm Models from Cohen/Fialkov/Barkana”
- 2017/09/27, “Constraining Emission Feature in the Range 85-115 MHz with MCMC”
- 2017/09/25, “Revisiting the Signature Extraction from Low-Band 1 Data using MCMC”
- 2017/09/24, “Fit Configurations for EoR Constraints in Monsalve et al. (2017)”
- 2017/08/31, “Summary of Data Analysis: Low-Band 2, East-West Antenna, with NO Balun Shield”
- 2017/08/31, “Summary of Data Analysis: Low-Band 2, East-West Antenna, with Balun Shield”
- 2017/08/31, “Summary of Data Analysis: Low-Band 2, North-South Antenna”
- 2017/08/31, “Summary of Data Analysis: Low-Band 1, Extended Ground Plane”
- 2017/08/24, “Summary of Data Analysis: Low-Band 1, Original Ground Plane”
- 2017/08/16, “Airline Measurements at the Input of the Low-Band 1 Receiver”
- 2017/08/16, “Reflection Coefficient of Internal Calibration Standards”
- 2017/08/16, “Comparison of Methods for Reflection Calibration at the Receiver Input”
- 2017/08/01, “Verification of 2015 and 2017 Parameters of the Low-Band 1 Front-End Network”
- 2017/08/14, “Cross-check between Calibrations of Two Benchtop Keysight/Agilent VNAs”
- 2017/07/27, “New Test Calibration of a Subset of Low-Band 1 Data”
- 2017/06/15, “Summary of Low-Band Residuals”
- 2017/06/14, “21-cm Parameter Estimation using Markov Chain Monte Carlo”
- 2017/05/29, “Nominal Calibration Data and Results for the Low Band 1 and 2 Receivers at 25degC”
- 2017/05/27, “S-parameters of the Front-end Network in the Low-Band 1 Receiver”
- 2017/05/11, “Progress in the Rejection of Physical Global 21 cm Models”
- 2017/04/19, “Lowband-2 Calibration Summary 2016”
- 2017/03/05, “Estimation of the Reflection Magnitude Accuracy with the Agilent E5061A VNA: Part 2”
- 2017/03/05, “Initial Calibration Results for Second EDGES Low-Band Receiver”
- 2017/02/27, “Estimation of the Reflection Magnitude Accuracy with the Agilent E5061A VNA at -30 dBm”
- 2017/02/16, “Rejection of Tanh Models for the Global 21-cm Signal: PART 4, χ^2 Sliding Window Approach (ongoing work)”
- 2017/02/07, “Rejection of Tanh Models for the Global 21-cm Signal from Simulated Data: PART3 Sliding Window Approach”
- 2017/02/01, “Rejection of Tanh Models for the Global 21-cm Signal from Simulated Data: PART2”
- 2017/01/31, “Rejection of Tanh Models for the Global 21-cm Signal from Simulated Data (ongoing work)”
- 2016/12/13, “Preliminary Rejection of Gaussian Models for the Global 21-cm with EDGES High-Band (ongoing work)”
- 2016/11/23, “Preliminary Rejection of Global 21-cm Models with EDGES High-Band (ongoing work)”
- 2016/11/17, “EDGES High-Band Average Spectrum (ongoing work)”
- 2016/09/02, “Measurements of Low- and High-band Antenna S11 at the MRO on August 30-31, 2016”
- 2016/04/20, “Spectral Index Comparisons Between GSM and EDGES High-Band Measurements”
- 2016/07/20, “Estimating the Accuracy of the Antenna S11 Measurements at the MRO”
- 2016/03/16, “Estimates for the Sky Polarization Intensity at ~150 MHz averaged over Wide Solid Angles”
- 2015/12/10, “Reflection Coefficient Measurements of the EDGES Low-Band BLADE Antenna Starting on 2015/12/08”
- 2015/09/26, “Pictures of the Low-band Receiver Assembly”
- 2015/09/25, “Stability of the Antenna Reflection Coefficient Measurements at the MRO”

2015/09/22, "Reflection Coefficient Measurements of the EDGES High-Band BLADE Antenna Starting on 2015/09/19"
2015/08/04, "Reflection Coefficient Measurements of the EDGES High-Band BLADE Antenna Starting on 2015/07/31"
2015/06/11, "Reflection Coefficient Measurements of the EDGES High-Band Fourpoint Antenna Starting on 2015/06/06"
2015/06/04, "Comparison of Alternatives for Calibration of the High-Band Receiver 2015 at 25oC"
2015/05/13, "Antenna S11 Measurements at MRO, April/May 2015"
2015/03/05, "Summary of Antenna S11 Measurements at MRO Starting on 2015/02/27"
2015/02/19, "Progress Toward a Full Uncertainty Propagation Machinery for EDGES: II"
2015/02/12, "Progress Toward a Full Uncertainty Propagation Machinery for EDGES"
2014/12/11, "Testing the Temperature Controller on 2014/12/11"
2014/12/08, "EDGES - Temperature Control Circuit"
2014/12/08, "Testing the Temperature Controller on 2014/12/08"
2014/11/10, "Antenna S11 Measured Between Nov 07 and 10"
2014/11/05, "S11 Measurements Before and During the EDGES Deployment of October 2014"
2014/10/30, "Developments at ASU for the EDGES Deployment of October 2014"
2014/08/18, "Characterization of SPDT RF Switch"
2014/07/13, "Studying the Forward-Reverse Method Through Simulations: II"
2014/07/07, "Studying the Forward-Reverse Method Through Simulations"
2014/06/23, "Choosing a Test Network for the Forward-Reverse Method of VNA Standard Characterization"
2014/06/23, "Comparison Between Global Sky Model and Haslam Map when Convolved with FEKO Beam"
2014/06/11, "Correction of EDGES Data using CST Beam"
2014/05/30, "First Look at Good-Quality EDGES Data"
2014/05/12, "Toward an Accurate Calibration of EDGES Using Temperature References: II"
2014/05/02, "Toward an Accurate Calibration of EDGES Using Temperature References"
2014/01/13, "EDGES-2 Base Plate Drawing"
2013/11/27, "Performance of Antenna Measurement Setup"
2013/11/21, "Linear Antenna Dependence on Temperature"
2013/11/14, "Quick Look at Antenna S11 Data Taken at Boolardy"
2013/11/13, "Status of the EDGES Antenna at the Site After Deployment of November 2013"
2013/10/23, "Correction of Reflection Coefficient of 6-dB Attenuator Measured with a FieldFox VNA"
2013/10/23, "Correction of Reflection Coefficient of 10-dB Attenuator Measured with a FieldFox VNA"
2013/10/03, "Cross-Check Between Short Standards"
2013/10/02, "Temperature Coefficients for DC Resistance of Match and Reference Attenuators"
2013/09/28, "Using a Labjack U3 with Python on Linux"
2013/08/29, "Effect of Error in Open and Short Standards on Measurement of Attenuator"
2013/08/22, "Ground Plane Test in the Softball Field"
2013/08/15, "Antenna Measurements in a Softball Field"
2013/08/12, "Cross-check of Short and Open Standards"
2013/08/11, "New Antenna Measurements with and without the Shield"
2013/08/07, "Effect of Loss on VNA Calibration Standards"
2013/08/01, "VNA Accuracy Test 3"
2013/08/01, "Sensitivity of Antenna to Different Perturbations"
2013/07/26, "Heating and Cooling Test"
2013/07/21, "VNA Accuracy Test 2"
2013/07/18, "VNA Accuracy Test"
2013/07/13, "Revisiting the Calibration Method"
2013/07/11, "Measurement of Antenna (Aluminum Base)"
2013/06/20, "Quick Look at Changes in Antenna Reflection Coefficient When Applying Heat with Heat Guns"
2013/05/22, "Measurement of Antenna using Air-dielectric Adapters and No Teflon in Tuner"
2013/05/14, "First Measurement of Antenna using Mechanical Switch"
2013/05/02, "Propagation of Instrumental Errors to the Sky Temperature Measurement"