Urvashi Rao Venkata

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An algorithm scientist with 7 years of experience in leadership and coordination of scientific software development, working with a diverse team of scientists and software engineers and balancing requirements and deliverables for multiple stakeholder groups and telescopes. Over 20 years of core technical experience in end-to-end algorithm R&D for image reconstruction and data analysis in radio interferometry, with specializations in wideband/widefield imaging and interference mitigation.

Education

- **PhD Physics**   Aug 2004 - May 2010
  New Mexico Institute of Mining and Technology, Socorro, NM, USA
  "Parameterized Deconvolution for Wide-Band Radio Synthesis Imaging"
- **MS Computer Science (Scientific Computing)**   Sep 2002 - Jun 2004
  University of California, San Diego, CA, USA
  "A performance model and load balancer for a Parallel Monte-Carlo Cellular Microphysiology Simulator"
- **MSc(Hons) Physics & BE(Hons) Computer Science**   Aug 1997 - Jun 2002
  Birla Institute of Technology and Science, Pilani, Rajasthan, India

Work Experience

- **Scientist - CS** , NRAO, Socorro, NM, USA   [Mar 2018 - present]

  - Group Lead and Product Manager for the CASA software team (Apr 2022+)
  - Scientific Dev Lead (and Deputy Group Lead) for the CASA software team (Mar 2019-Mar2022)
  - Models and measurements of the effect of interference from LEO satellites on interferometric imaging.
  - Algorithm development for joint single dish and interferometry image reconstruction.
  - Participation in conceptual and preliminary design reviews for the DSA-2000 radio telescope.
  - In-depth evaluation and commissioning of the VLASS wideband mosaic imaging strategy.
  - A proposal and compute-cost model for integrated interference mitigation strategies for the ngVLA.

- **Associate Scientist - CS**, NRAO, Socorro, NM, USA   [Mar 2014 - Feb 2018]

  - CASA coordination activities as the interim CASA Group Lead (received NRAO Star Award).
  - Technical lead for the commissioning and release of the refactored Imager.
  - Feature development to support new ALMA pipeline imaging requirements.
  - R&D for automatic tuning of RFI-flagging algorithms and RFI modeling and subtraction.

- **Assistant Scientist - CS** , NRAO, Socorro, NM, USA   [Aug 2010 - Mar 2014]

  - Implemented CASA's MT-MFS wideband imaging algorithm (with multi-scale and wide-field support).
  - Performed detailed use-case simulations to quantify deep imaging limits of the wideband VLA.
  - Algorithm development for reconstructing sky structures that vary with both time and frequency.
  - A study of ALMA's imaging dynamic range limits due to antenna-to-antenna surface variations.
  - Refined and implemented the TFCrop automatic flagging algorithm within CASA.
  - Led a team of 3 scientists/developers for the refactoring of the CASA Flagging module (2011,2012).
  - Led a team of 4 scientists/developers for the refactoring of the Imaging module of CASA (2013-2015).

- **Reber Fellow / Grad. Intern**, NRAO, Socorro, NM, USA   [Summer 2003/2004, Aug 2007-May 2010]

  – Prototyped and validated two wideband image reconstruction algorithms for radio interferometers.
  – A linear algebraic analysis of all radio interferometric imaging/algorithms cast in a common framework.
  – Evaluated accuracy limits of narrow-band algorithms and prototyped a hybrid wideband imaging scheme.
  – Developed an MCMC based imaging algorithm using atom-based modeling of diffuse spatial structure.

- **CASA Programmer (part-time)**, NRAO, Socorro, NM, USA   [Sep 2004 - Jul 2007]

  – Designed and implemented an interactive data visualization tool for radio interferometry data.

- **Research/Teaching Assistant**, Computer Science Dept., UC San Diego, CA, USA [Sep 2002 - Jun 2004]

  – A predictive performance model and load balancer for a parallel 3D cell microphysiology simulator.
  – Assisted with a senior level *Introduction to High Performance and Parallel Computing* course.

- **Undergraduate Internships/Projects**   [Jan 2000 - Jun 2002]

  – Prototyped an algorithm to automate the identification of interferometric data corrupted by RFI.
  – Implemented three linear algebraic techniques for antenna gain calibration in radio interferometry.
  – Software debugging for an early prototype of an e-book reader at Texas Instruments, Bangalore, India.
  – Studied and implemented algorithms for computed axial tomography, fragile watermarking for digital image security, wavelet image compression and simulated water table evolution around a well.
  – Built a simple antenna and receiver system to detect decametric radio bursts from Jupiter.

Professional Activities

- **Publications :** 17 refereed papers (4 as first author and 2 via direct student mentoring) in IEEE, Astrophysical Journal, Astronomical Journal, Astronomy and Astrophysics. 6 conference proceedings and several technical memos.

- **Talks and lectures :** Over 40 research talks at multiple venues (12 invited), including the international SKA Calibration and Imaging workshop series, the International Radio Science Union and the SPIE. Over 20 invited lectures at radio interferometry workshops aimed at training graduate students and early career astronomers on imaging techniques.

- **Reviews and Committees :** Imaging papers in Astronomy and Astrophysics, Publications of the Astronomical Society of the Pacific and Monthly Notices of the Royal Astronomical Society. Served on DSA-2000 and ALMA-WSU design review committees, 2 NSF panels, and numerous hiring committees.

- **Student mentoring and outreach :** Supervised/advised 10 students on summer-internship and longer-term graduate level projects on algorithm development topics related to RFI modeling and excision, quantifying imaging accuracy limits for the VLA and ALMA, machine-learning for algorithm automation in the areas of RFI flagging and image artifact recognition, and the joint reconstruction of wideband single dish and interferometry data.

- **Management and Leadership :** 2 years of personnel management and administration for a team of 17 scientists and software engineers as well as programmatic coordination for a team of 30 as product manager. 7 years of balancing scientific development requirements and deliverables across a 8-member stakeholder group, working alongside colleagues in a 4-person leadership team.

Journal Publications

- *"Resolving the bow shock and tail of the cannonball pulsar PSR J0002+6216"*, P. Kumar, F. K. Schinzel, G. B. Taylor, M. Kerr, D. Castro, **U. Rau**, S. Bhatnagar, The Astrophysical Journal, Volume 945, Number 2, March 2023

- *"CASA, the Common Astronomy Software Applications for Radio Astronomy"*, **The CASA team, et al**, Publications of the Astronomical Society of the Pacific, pp 134, 114501, November 2022

- *"A Joint deconvolution algorithm to combine single dish and interferometer data for wideband multi-term and mosaic imaging "*, **Rau, U.**; Naik,N. ; Braun, T., The Astronomical Journal Volume 158, Number 1, June 2019

- *"Direction-dependent Corrections in Polarimetric Radio Imaging. I. Characterizing the Effects of the Primary Beam on Full-Stokes Imaging "*, Jagannathan, P.; Bhatnagar, S.; **Rau, U.**; Taylor, A. R. The Astronomical Journal, Volume 154, Issue 2, article id. 56, 8 pp., August 2017

- *"Understanding Systematic Errors Through Modeling of ALMA Primary Beams"*, K.Kundert, **U.Rau**, S.Bhatnagar, E.J.Bergin, IEEE Transactions on Antennas and Propagation, Vol 65 issue 2, pp. 644-653, Feb 2017

- *"Automated Tuning of RFI Identification and Flagging Algorithms"*, Bruno J. Martins, **U.Rau**, IEEE 2016 Radio Frequency Interference (RFI), Socorro, NM, 2016, pp. 59-64.

- *"VLA and ALMA Imaging of Intense Galaxy-wide Star Formation in z2 Galaxies"* , Rujopakarn, W.; Dunlop, J. S.; Rieke, G. H.; Ivison, R. J.; Cibinel, A.; Nyland, K.; Jagannathan, P.; Silverman, J. D.; Alexander, D. M.; Biggs, A. D.; Bhatnagar, S.; Ballantyne, D. R.; Dickinson, M.; Elbaz, D.; Geach, J. E.; Hayward, C. C.; Kirkpatrick, A.; McLure, R. J.; Michałowski, M. J.; Miller, N. A. Narayanan, D.; Owen, F. N.; Pannella, M.; Papovich, C.; Pope, A.; **Rau, U.**; Robertson, B. E.; Scott, D.; Swinbank, A. M.; van der Werf, P.; van Kampen, E.; Weiner, B. J.; Windhorst, R. A., The Astrophysical Journal, Vol 833, Issue 1, article id. 12, 11 pp., December 2016

- *"Deep wideband single pointings and mosaics in radio interferometry : How accurately do we reconstruct intensities and spectral indices of faint sources ?"*, **U.Rau**, S.Bhatnagar, F.N.Owen, Astronomical Journal, Volume 152, No. 5, October 2016

- *"Efficient implementation of the adaptive scale pixel decomposition algorithm"*, L.Zhang, S.Bhatnagar, **U.Rau**, M.Zhang, Astronomy and Astrophysics, Volume 592, August 2016

- *"The population of compact radio sources in the Orion Nebula Cluster (& VizieR Online Data Catalog)"*, J.Forbrich, V.M.Rivilla, K.M.Menten, M.J.Reid, C.J.Chandler, **U.Rau**, S.Bhatnagar, S.J.Wolk, S.Meingast, Astrophysics Journal, Vol 822, No.2, May 2016

- *"The non-thermal superbubble in IC 10: the generation of cosmic ray electrons caught in the act"*, Volker Heesen, Elias Brinks , Martin G. H. Krause , Jeremy J. Harwood ,**Urvashi Rau** , Michael P. Rupen , Deidre A. Hunter , Krzysztof T. Chyzy , Ged Kitchener, MNRAS Volume 447,No. 1, L1-L5, February 2015

- *"Wideband Very Large Array Observations of A2256. I. Continuum, Rotation Measure, and Spectral Imaging"*, Owen, Frazer N.; Rudnick, Lawrence; Eilek, Jean; **Rau, Urvashi**; Bhatnagar, Sanjay; Kogan, Leonid, The Astrophysical Journal, Volume 794, Issue 1, article id. 24, 14 pp., October 2014.

- *"Wide-field wide-band full polarization interferometric imaging: The WB A-Projection algorithm"*, Bhatnagar,S. , **Rau,U.**, Golap,K. ,Astrophysical Journal, Volume 770, issue 2, id 91, pp.9, June 2013.

- *"A Group Sparsity Imaging Algorithm for Transient Radio Sources"*, Wenger, S., **Rau,U**, Magnor,M., Astronomy and Computing, Volume 1, pp 40-45, February,2013.

- *"A multi-scale multi-frequency deconvolution algorithm for synthesis imaging in radio-interferometry"*, **U.Rau**, T.J.Cornwell, Astronomy and Astrophysics, Volume 532, A71, August 2011.

- *"Deep Radio Continuum Imaging of the Dwarf Irregular IC 10: Tracing Star Formation and Magnetic Fields"*, Volker Heesen, **U. Rau**, Michael P. Rupen, Elias Brinks, Deidre Hunter, The Astrophysical Journal Letters, Volume 739, Issue 1, L23, September 2011.

- *"EVLA Observations of Galactic Supernova Remnants: wide-field continuum and spectral-index imaging"*, Sanjay Bhatnagar, **U. Rau**, David A. Green, and Michael P. Rupen, The Astrophysical Journal Letters, Volume 739, Issue 1, L20, September 2011.

- *"SparseRI: A Compressed Sensing Framework for Aperture Synthesis Imaging in Radio Astronomy"*, Wenger, S. Magnor, M. Pihlström, Y. Bhatnagar, S. **Rau, U.**, Publications of the Astronomical Society of the Pacific, Volume 122, issue 897, pp.1367-1374.

- *"Advances in Calibration and Imaging Techniques in Radio Interferometry"*, **U.Rau**, S.Bhatnagar, M.A.Voronkov, T.J.Cornwell, Proceedings of the IEEE, Vol.97, No.8, p-1472, August 2009.

Conference Proceedings

- *"Synergy between radio and optical interferometry: image reconstruction, calibration and data analysis"*, Rau.U. , Proc. SPIE 10701, Optical and Infrared Interferometry and Imaging VI, 107011C, 9 July 2018

- *"Direction-Dependent Effects In Wide-Field Wideband Full-Stokes Radio Imaging"*, Jagannathan, P.; Bhatanagar, S.; **Rau, U.**; Taylor, R., Astronomical Data Analysis Software an Systems XXIV (ADASS XXIV), Astronomical Society of the Pacific, p379, September 2015

- *"Wideband Mosaic Imaging with the VLA - quantifying faint source imaging accuracy"*, **Rau, U**; Bhatnagar, S; Owen, F. N., Bulletin of the Astronomical Society of India, March 2014

- *"Radio interferometric imaging of spatial structure that varies with time and frequency"*, **U.Rau**, Proc. SPIE 8500, Image Reconstruction from Incomplete Data VII, 85000N, October 15, 2012.

- *"Monte-Carlo Image analysis in Radio Interferometry"*, **U.Rau**, T.J.Cornwell, Astronomical Data Analysis Software and Systems XIV ASP Conference Series, Vol. 347, p-168, 2004

- *"Solving for Polarization Leakage in Radio Interferometers Using Unpolarized Sources"*,Bhatnagar S., **Urvashi R.V.**, Nityananda R., Astronomical Data Analysis Software and Systems XII ASP Conference Series, Vol. 295, p-469, 2003.

AAS Abstracts / Posters

- *"Direction Dependent Effects In Widefield Wideband Full Stokes Radio Imaging"*, Jagannathan, Preshanth; Bhatnagar, Sanjay; **Rau, Urvashi**; Taylor, Russ, American Astronomical Society, AAS Meeting #225, id.336.31, January 2015

- *"A Radio Continuum Study of Dwarf Galaxies: 6 cm imaging of LITTLE THINGS"*, Kitchener, Ben; Brinks, Elias; Heesen, Volker; Hunter, Deidre Ann; Zhang, Hongxin; **Rau, Urvashi**; Rupen, Michael P.; Little Things Collaboration American Astronomical Society, AAS Meeting #225, id.248.16 , January 2015

- *"Rotation Measure Synthesis of Cassiopeia A"*, DeLaney, Tracey; Stadelman, Matthew; Rudnick, Lawrence; Rupen, Michael P.; **Rau, Urvashi**; Bhatnagar, Sanjay; Greisen, Eric; Petre, Robert American Astronomical Society, HEAD meeting #14, id.120.15, August 2014

- *"Using Rotation Measure Synthesis to Study Shocks in Cassiopeia A"*, Stadelman, Matt; DeLaney, T.; Rupen, M. P.; Rudnick, L.; **Rau, U.**; Bhatnagar, S.; Greisen, E.; Petre, R. American Astronomical Society, AAS Meeting #223, id.353.06, January 2014

- *"Quantifying Deep-Imaging Limits of the VLA"*, Mayeshiba, Julia; Mayeshiba, J.; **Rau, U.**; Owen, F. N. American Astronomical Society, AAS Meeting #223, id.255.07, January 2014

- *"Deep Radio Continuum Imaging Of The Dwarf Irregular Galaxy IC 10: Tracing Star Formation And Magnetic Fields"*, Heesen, Volker; **Rau, U.**; Rupen, M. P.; Brinks, E.; Hunter, D. A. American Astronomical Society, AAS Meeting #219, id.148.08, January 2012

- *"Comparison and Verification of RFI Excision Techniques"*, Houston, Caroline; **Rau, Urvashi** American Astronomical Society, AAS Meeting #219, id.145.07, January 2012

- *"Wide-Field Wide-Band Imaging With The EVLA : Initial Results With Images And Error Estimates"*, **Rau, Urvashi** American Astronomical Society, AAS Meeting #215, id.357.01; Bulletin of the American Astronomical Society, Vol. 42, p.540, January 2010

Theses

- *"Parameterized Deconvolution for Wide-Band Radio Synthesis Imaging"*, **Urvashi R.V.**, Ph.D. Dissertation, New Mexico Institute of Mining and Technology, Socorro, NM, USA, May 2010.

- *"A performance model and load balancer for a Parallel Monte-Carlo Cellular Microphysiology Simulator"*, **Urvashi R.V.**, M.S. Thesis, University of California, San Diego, June 2004.

Selected Technical Memos

- *ngVLA Memo 71 : RFI Mitigation in the ngVLA System Architecture*, Rob Selina, Alan Erickson, Feb 2020

- *ngVLA Memo 70 : RFI Mitigation for the ngVLA : A Cost-Benefit Analysis*, Urvashi Rau, Rob Selina, Alan Erickson, Dec 2019

- *"Radio Interferometric Imaging Algorithms - Summer 2018"*, U.Rau, ARDG Note, July 2018.

- *"ARDG Report on VLASS Wideband Mosaic Imaging"*, U.Rau & S.Bhatnagar, ARDG Memo, Sept 2018.

- *"Convention for UVW calculations in CASA"*, **U.Rau**, CASA Memo, 2013.

- *"Imaging Algorithms in CASA"*, **U.Rau**, CASA documentation, 2010/2011/2012/2013.

- *"Multi Frequency Synthesis Imaging for the EVLA : An initial investigation"*, **Urvashi R.V.**, T.J.Cornwell, S.T.Myers, EVLA Memo 101, April 2006

- *"Monte Carlo Methods for Bayesian Image Reconstruction and Analysis in Radio Astronomy"*, **Urvashi R.V.**, T.J.Cornwell, EVLA Memo 102, February 2006

- *"Automatic RFI identification and flagging"*, **Urvashi R.V.**, A. Pramesh Rao, NCRA Technical Report No. R00202, October 1 2003

Selected Technical/Research Presentations

- *"Introduction to Radio Astronomy for Medical Imagers"*, i2i Workshop, Center for Advanced Imaging Innovation and Research, 19 October 2023, NYU Langone, New York

- *"Overview : Radio Interferometry Data Analysis and Compute Needs"*, HPC Workshop on Radio Astronomy Data Analysis in the SKA Era, 40th Meeting of the Astronomical Society of India, 25 Mar 2022, IIT Roorkee, India (Virtual)

- *"Quantifying Scientific Correctness in Radio Interferometric Imaging"*, ADASS XXXI (Astronomical Data Analysis Software and Systems), 28 October 2021. Cape Town (Virtual).

- *"Introduction to Radio Astronomy (for Medical Imaging Professionals)"*, Cells To Galaxies Speaker Series, Oct 2021, NRAO, Socorro (Virtual).

- *"Wideband Imaging of Multiscale structure"*, CHANG-ES (Continuum Halos in Nearby Galaxies - an EVLA Survey) Annual Meeting, 23 July 2020, (Virtual)

- *"RFI Mitigation for the ngVLA - A cost benefit analysis"*

  - CalTech Radio Camera Imager (and DSA) Seminar series, 25 Sept 2020, (Virtual Talk series)
  - APS-URSI 2020, 10 July 2020, (Virtual)

- *"Peering Through The Reeds - Radio Astronomy versus Commercial Spectrum Use"*, New Mexico Tech Physics Dept Colloquium, 7 Nov 2019, Socorro

- *"RFI Mitigation Options in Radio Interferometry"*, Presentation to the Committee on Radio Frequencies, National Academies of Sciences, Engineering, Medicine, 17 September 2019, Socorro.

- *"Introduction to Radio Interferometry - Algorithms and Computing"*, Presentation at the CHTC-NRAO Meeting, 26 August 2019, Socorro.

- *"Synergy between Radio and Optical Interferometry - Image Reconstruction, Calibration and Data Analysis"*, SPIE Optical and Infrared Interferometry and Imaging, 13 June 2018, Austin, TX, USA.

- *"Computing and Algorithms in Radio Interferometry"*, Computer Science Department, New Mexico Tech, 20 April 2018, Socorro, NM, USA

- *Combining single dish and interferometer data for joint wideband multi-term deconvolution "*

  - URSI 2018 - National Radio Science Meeting, 4 January 2018, Boulder, CO, USA
  - Wednesday-Lunch talk at the NRAO/SOC, 11 July 2018, Socorro, NM, USA

- *"Automated Tuning of RFI Identification and Flagging Algorithms"*

  - URSI 2018 - National Radio Science Meeting, 6 January 2018, Boulder, CO, USA
  - RFI2016 - Coexisting with Radio Frequency Interference , 20 October 2016, Socorro, NM, USA.

- *"Radio Interferometric imaging of spatial structure that varies with time and frequency - Orion with the VLA "*, Talk at the 9th SKA Calibration and Imaging Workshop , 11 October 2016, Socorro, NM, USA.

- *"Understanding imaging limits due to approximatioms in ALMA primary beam models "*, Talk at the ALMA Future Science Development Program Workshop, 25 August 2016, Charlottesville, Virginia, USA.

- *"How accurately do our imaging algorithms reconstruct intensities and spectral indices of weak sources?"*

- Wednesday-Lunch talk at the NRAO/SOC, 13 Nov 2013, Socorro, NM, USA
- Talk at the 29th Annual New Mexico Symposium, 17 January 2014, Socorro, NM, USA
- Talk at the 8th SKA Calibration and Imaging Workshop, 6 March 2014, Kiama, NSW, Australia (via Skype from Socorro)
- Tuna Lunch talk at NRAO Charlottesville, 23 August 2016, Charlottesville, Virginia, USA.

- *"Wideband Mosaics - Accuracy of deep imaging surveys"* , Talk at the Meter Wavelength Sky conference, 12 Dec 2013, GMRT/NCRA, Pune, India.

- *"Wideband mosaics"*, Talk at the Seventh SKA Calibration and Imaging workshop (all participants invited), 5 December 2012, Cape Town, South Africa

- *"Radio Interferometric Imaging of spatial structure that varies with time and frequency"*,

  - Talk at the SPIE Optical Engineering+Applications Meeting, 15 August 2012, San Diego, CA, USA
  - Wednesday-Lunch talk at the NRAO/SOC, 29 August 2012, Socorro, NM, USA
  - Talk at the ATNF/CASS,CSIRO, 18 September 2012, Sydney,Australia.

- *"Sky-domain algorithms to reconstruct spatial, spectral and time-variable structure of the sky-brightness distribution"*, Colloquium at the National Centre for Radio Astrophysics, TIFR, 2 July 2012, Pune, India.

- *"Correcting for wide-band primary-beam effects during imaging and deconvolution"*, Wednesday Lunch talk at the NRAO/SOC, 28 March 2012, Socorro, NM, USA.

- *"Synthesis Imaging in Radio Astronomy - Reconstructing spatial and spectral structure of an astronomical source"*, Talk at the Biomedical and Astronomical Signal Processing (BASP) Frontiers Workshop (all participants invited), 06 September 2011, Villars, Switzerland.

- *"Multi-frequency synthesis and wide-field imaging with the EVLA"*, Talk at the URSI General Assembly, 17 August 2011, Istanbul, Turkey,

- *"Recent Imaging Results with EVLA data, and lessons learnt so far"*, Talk at the Sixth SKA Calibration and Imaging Workshop (all participants invited), 26 July 2011, Manchester, UK (via Skype).

- *"Pilot Project for an EVLA wide-band Galactic-plane survey : first results"* , Talk at the 26th Annual New Mexico Symposium, 5 November 2010, Socorro, NM, USA.

- *"A few imaging results using wide-band EVLA data"*, Wednesday Lunch talk at the NRAO/SOC, 3 November 2010, Socorro, NM, USA.

- *"Wide-field Wide-band image reconstruction with the EVLA"*, Physics Seminar at the Univ. of New Mexico Physics Dept., 30 September 2010, Albuquerque, NM, USA.

- *"Feasibility of wide-band imaging (using MS-MFS)"*, Talk at the Fifth SKA Calibration and Imaging workshop (all participants invited), 23 August 2010, Dwingeloo, The Netherlands.

- *"Wide-Field Wide-Band Imaging in Radio Interferometry"*, Colloquium at the National Centre for Radio Astrophysics, 12 July 2010, Pune, India

- *"Parameterized Deconvolution for Wide-Band Radio Synthesis Imaging"*, Colloquium / PhD Thesis defense, 17 May 2010, Socorro, NM, USA

- *"Wide-Field Wide-Band Imaging with the EVLA"*, Talk at the 215th American Astronomical Society (AAS) meeting, 6 January 2010, Washington D.C., USA

- *"Wide-Field Wide-Band Imaging in Radio Interferometry"*, Talk at the ATNF Student Symposium, 16 June 2009, Sydney, AU (via audio link from Socorro)

- *"Remote Sensing, Image Making and Radio Telescopes "*, Colloquium at the New Mexico Tech Physics Department, 09 Apr 2009, Socorro, USA

- *"Wide-Field Wide-Band Imaging with the EVLA - initial results"*, Talk at the Fourth SKA Calibration and Imaging Workshop (all participants invited), 31 March 2009, Socorro, USA

- *"Multi Frequency Synthesis Imaging with Wideband EVLA data"*, Lunch Talk at the EVLA Advisory Committee Meeting, 19-20 March 2009, Socorro, USA

- *"Multi-Frequency Synthesis Imaging with Multi-Scale Deconvolution (EVLA, e-MERLIN)"*, Talk at the Workshop on Imaging and Calibration Algorithms for EVLA, eMERLIN and ALMA, 02 December 2008, Oxford, UK (via video link from Socorro)

- *"Multi-Frequency Synthesis Imaging with Wide-Band (E)VLA data"*, Talk at the 24th Annual New Mexico Symposium, 24 October 2008, Socorro, USA

- *"Multi-Frequency Synthesis Imaging with Multi-Scale Deconvolution"*, Invited Talk at the XXIX URSI General Assembly, 15 August 2008, Chicago, USA

- *"Wide-Band Imaging - Algorithms and Errors"*, Talk at the Third SKA Calibration and Imaging Workshop (all participants invited), 09 April 2008, Perth, AU

- *"Multi-Frequency Synthesis Imaging with Multi-Scale deconvolution"*, Talk at the Second SKA Calibration and Imaging Workshop, 05 December 2006, Cape Town, South Africa

- *"Wide Bandwidth Imaging: Challenges and prospects for the EVLA and beyond"* ,Talk at the URSI National Radio Science Meeting, 06 January 2006, Boulder, USA

Lectures at Interferometry Schools and Imaging Workshops

- *"Imaging in Radio Interferometry"*, Lecture at the VLTI and ALMA Synthesis Imaging workshop, January 9-12, ESO,Garching (remote)

- *"Imaging and Deconvolution"*, Summer Student lecture, Socorro (June 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022,2023)

- *"WideBand and WideField Imaging - Parts I & II", "Wide Band and Full Beam Imaging"*

  – NCRA Radio Astronomy School (13-24 March 2023), Pune, India (remote)
  – 18th NRAO Synthesis Imaging Workshop, July 2022, Socorro, NM, USA (Virtual)
  – 17th NRAO Synthesis Imaging Workshop, July 2020, Socorro, NM, USA (Virtual)
  – NCRA Radio Astronomy School, 22 and 23 August 2019, Pune, India (remote).
  – 16th NRAO Synthesis Imaging Workshop, 21 May 2018, Socorro, NM, USA
  – NCRA-GMRT Radio Astronomy School, 7 September 2017 (remote)
  – 15th NRAO Synthesis-Imaging Workshop, 6 June 2016, Socorro
  – 14th NRAO Synthesis-Imaging Workshop, 19 May 2014, Socorro.
  – 13th NRAO Synthesis Imaging Workshop, 31 May 2012, Socorro, NM, USA.

- *"Overview of Data Combination Methods - II"*, Lecture at the 'Improving Image Fidelity on Astronomical Data : Interferometer and Single Dish Data Combination' Workshop, 12 August 2019, Leiden, Netherlands (remote from Socorro).

- *Calibration and Imaging in Radio Interferometry* , Lecture at the Cells to Galaxies workshop, 17 April 2019, Charlottesville, VA, USA.

- *"Imaging and Image Analysis","Imaging Fundamentals"*

  - 7th VLA Data Reduction Workshop, 8 Oct 2019, Socorro
  - VLA Data Reduction Workshop, 23 October, 2017

- *"RFI Identification and Automatic Flagging "*, Lecture at the VLA Data Reduction Workshop, 15 March 2016, Socorro

- *"Wide-band wide-field imaging (sky-domain) + RFI identification and flagging"*, EVLA Data Reduction Workshop, 9 April 2013, Socorro

- *"Deconvolution and wide-band imaging"*, Third-generation Calibration (3GC3) Interferometry School, 13 February 2013, Port Alfred, South Africa (via Skype from Socorro).

- *"Wideband Imaging"*, CSIRO Astronomy and Space Sciences Radio Astronomy School, 27 September 2012, Narrabri, NSW, Australia.

- *"Imaging and Deconvolution"*, CSIRO Astronomy and Space Sciences Radio Astronomy School, 25 September 2012, Narrabri, NSW, Australia.

- *"Wide-band wide-field imaging (sky-domain) + RFI identification and flagging"*, EVLA Data Reduction Workshop, 24 Feb 2012, Socorro

- *"Wide-field Wide-band Imaging with the EVLA - II"*, EVLA Data Reduction Workshop, 15 September 2011, Socorro

Students Mentored

- **Spring 2019+ :** Brian Kirk, PhD student student at NMT, Socorro, USA
  Topic : Automating the decision process of radio interferometric data analysis, using machine learning.

- **2020-2021 :** Shrishti Yadav, Graduate student at NMT, Socorro, USA
  Topic : Understanding the effect of decorrelation on RFI from LEO satellites.

- **Fall 2018 :** Ravali Kommuri, Graduate student at NMT, Socorro, USA
  Topic : Applying machine learning techniques to artifact recognition and classification in images.

- **Fall 2018+:** Tim Braun, Graduate student at UNM, Albuquerque, NM, USA
  Topic : Applying wideband single dish and interferometry combination algorithms to VLA+GBT data.

- **August 2018 :** Lucas Wilkins, Undergraduate student
  Topic : Wideband calibration and imaging of 2017/2018 VLA calibrator survey data.

- **Summer 2017:** Nikhil Naik, Undergraduate student at IIT, Kharagpur, India.
  Topic : Prototype wideband single dish and interferometer combination algorithms.

- **May 2017+**: External thesis committee member for PhD student, Edinburgh, UK.
  Topic : A primal-dual algorithm for Hyper Spectral Imaging

- **Summer 2017, Fall 2018:** Michael Lambert, Graduate student at Brigham Young University.
  Topic : Demonstration of RFI excision by subspace projection on real VLA data

- **Summer 2016:** Bruno Martins, Undergraduate student at University of South Santa Catarina, Brazil and an exchange student at University of Virginia, Charlottesville.
  Topic : Auto-tuning of RFI autoflag algorithms via machine learning and evolutionary algorithms

- **Summer 2013, Fall 2013, Summer 2014 :** Kara Kundert, Undergraduate student at Oberlin College, Ohio, USA / University of Michigan, Ann Arbor, USA
  Topic : Imaging accuracy and dynamic range limits due to ALMA antenna-to-antenna beam variations

- **Summer 2013 :** Julia Mayeshiba, Undergraduate student at University of Wisconsin, Madison, USA
  Topic : Simulations of imaging accuracy and confusion limits for the VLA

- **Summer 2011 :** Caroline Houston, Undergraduate student at Rochester Institute of Technology, NY, USA.
  Topic : Prototype and compare several linear algebraic RFI excision algorithms

Fellowships/Awards/Funding

- NRAO 10 year service award (2021)
- Co-I on an ngVLA Community Study award - for 3 months of student funding (2021)
- NRAO Star Award (Jan 2018) for interim CASA coordination work.
- Co-I on an ALMA Cycle 5 development proposal for Full Mueller Imaging with ALMA (P.I. S.Bhatnagar, $190,000) (Fall 2017 - Fall 2018)
- Travel grant from URSI Commission-J towards attending the URSI-GASS in Istanbul, Turkey (Aug 2011)
- NRAO Pre-Doctoral (Reber) Research Fellowship (Jan 2008 - Dec 2009)

Education and Public Outreach

- Participation (few hours) at the NRAO table during WomenFest Socorro (2022, 2023)
- Interactive presentation on STEM careers in Radio Astronomy to 6th graders at Sarracino middle School, Socorro.
- Talk at 2018 NRAO summer camp on Radio Astronomy and Physics.
- Ongoing work to create and add a 'How we make images' page along with interactive applets to the new NRAO webpages (2017+)
- Tour guide for the Very Large Array at open-house events in 2005, 2008, 2010.
- Coached two Science Olympiad teams from the Sarracino Middle School, Socorro, NM (2011, 2014)
- Remotely delivered lecture on *"A radio eye on the universe"* as part of the "Storming Aurora" conference organized by the Astronomy Club at the Birla Institute of Technology and Science, Goa, India, 17th November, 2012.
- Alumni web-lectures as part of the BITS-Embryo project (http://www.bitsembryo.org), aimed at introducing undergraduate students at the Birla Institute of Technology and Science, India, to current research and technology trends in various disciplines. (1) *"Remote Sensing At Its Extreme - the interdisciplinary nature of observational radio astronomy"*, BITS-Pilani, Nov 2007 and (2)*"Remote Sensing and Image Making"*, BITS-Goa, Jan 2009.
- An introductory lecture about the working of a radio interferometer, for a group of 16 high-school students who visited the NRAO, Socorro,NM in April 2009.

Software Skills

- Programming languages : C, C++, Python (largely within CASA or for work related to radio interferometric analysis and visualization).
- Environments : Unix/Linux
- Packages : Scipy/Numpy/XArray/Dask, Matplotlib and other Python visualization tools, Qt basics, GNU Scientific Library, Numerical Recipes, Bayesys, TensorFlow basics, OMP and MPI for parallelization.

Scientific and Technical Reviews

- Committee to review the ALMA-WSU Conceptual Design documentation (Mar 2024)
- Deep Synoptic Array (DSA2000) Preliminary Design Review Committee (Oct 2023)
- DOE/ASCR panel on Scientific Software Sustainability (Jan 2023)
- A proposal review for the NSF (Division of Astronomical Sciences (June 2023)
- Deep Synoptic Array (DSA2000) Conceptual Design Review Committee (May 2022)
- VLA X-Proposal Technical Review Committee (2021)
- Manuscript reviews

    1. Astronomy and Astrophysics (10)
    2. Publications of the Astronomical Society of the Pacific (4)
    3. Monthly Notices of the Royal Astronomical Society (2)
    4. Bulletin of the Astronomical Society of India (1)

NRAO Committees

- DMS Data Processing System - Project Director Hiring Committee (Mar 2024)
- DMS Pipeline Group Lead Hiring Committee (Feb 2023)
- RFI Scientitist Hiring Committee (Feb 2023)
- CASA Scientific Staff Hiring committee (mgr) (Nov 2022)
- DSOC Digital Electronics Group Software Engineer Hiring Committee (2023)
- VLBA Research Assistant Hiring Committee (2022)
- NRAO CASA Software Engineer / Assistant Scientist Search Committee (4 positions) (2019/2020)
- STEAM Senior Education Specialist Hiring Committee (2019)
- NRAO CASA Pipeline Lead Search Committee (2018)
- NRAO ngVLA Research Associate Search Committees (2017, 2018)
- NRAO CASA Group Lead Search Committee (2017)
- NRAO CASA Liaison Search Committee (2016)
- NRAO Jansky Postdoc Selection Committee (2014,2015,2016)
- NAASC Sci-Staff Hiring Committee (2014)

- NRAO Scientist Performance Review Committee - SPRC (2016, 2017, 2018, 2019, 2020)
- NRAO Observatory Science and Technical Council - OSTC (2015,2016,2017)
- NRAO Student Programs Review Committee (2013)