

Curriculum Vitae

JOHN DAVID MATHEWS Professor of Electrical Engineering

Current Address: 323A Electrical Engineering East
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Education: Ph.D., Department of Electrical Engineering and Applied Physics
Case Western Reserve University (August, 1972)

M.S., Department of Electrical Engineering and Applied Physics
Case Western Reserve University (May, 1972)

B.S. with honors, in Physics
Case Institute of Technology (May, 1969)

Current Research Interests: Ionospheric electrodynamics, instabilities, and layering processes—
radar meteor studies including radio science, aeronomy of the meteoroid
mass flux, orbital determination and evolution, origins of interplanetary and
interstellar particles. System-of-Systems autonomous sensor systems, radar
signal processing, novel signal processing systems, radar holography.

Professional Recognition: Publication H-index: 29
Fellow of the Royal Astronomical Society (elected 12/10)
Fellow of the Institute of Electrical and Electronic Engineers (elected 11/11)
Fulbright Scholar, Swedish Institute of Space Physics, Kiruna (8/1996-1/97)
Sigma Xi (CWRU Chapter) Research Award (1979)

Professional Experience: (academic) Director, Communications and Space Sciences Laboratory (CSSL)
College of Engineering, The Pennsylvania State University (7/88 – 12/07)

Principal Investigator, NSF Space Science Faculty Development Grant
(6/05), \$900K/5 years to add a new tenure track faculty position in the space
sciences in CSSL

Principal Investigator - NSF Grants for Ionospheric Physics & Planetary
Astronomy (Aug. 1975 - present; support totaling ~\$12M through 2015)
(Current support ~\$1M thru 2018)

Full Professor (tenured): 7/87 - present
Department of Electrical Engineering
The Pennsylvania State University

Member, Science, Technology, & Society Faculty
The Pennsylvania State University (5/88 – 6/95)

Full Professor: 4/85 - 6/87
Associate Professor: 3/79 - 3/85 (tenured 1981)
Assistant Professor: 8/75 - 2/79
Department of Electrical Engineering & Applied Physics
Case Western Reserve University (CWRU)

Adjunct Professor (1978 - 1986)
The Pennsylvania State University
Department of Electrical Engineering

Visiting Scientist (9/72 - 7/75)
National Astronomy and Ionosphere Center
Arecibo, Puerto Rico (employed by Case Western Reserve University)

Full Time Lecturer (9/69 - 8/72)
Department of Electrical Engineering & Applied Physics, CWRU

**Professional
Experience:
(other)**

Chair, International Commission G of URSI (International Union of Radio Science), URSI Secretariat, Ghent, Belgium. (Vice-Chair: 08/08-08/11; Chair: 08/11 – 08/14; Immediate Past Chair: 08/14 - present).

Member 2010 - 2015, Chair 2012; MIT Haystack Observatory Visiting Committee.

Ex-officio, voting member, US National Committee for the International Union of Radio Science (10/09 – 12/31/2011).

Chair, USNC URSI (International Union of Radio Science) Commission G (1/06- 12/08); vice-chair (1/03-12/05).

Member, NSF CEDAR (Coupling, Energetics, & Dynamics of Atmospheric Regions) Steering Committee (6/03-7/06)

Member, Committee of Visitors (COV), NSF Upper Atmospheric Research Section (UARS), Division of Atmospheric Sciences (09/7-9/05)

Member, NSF Upper Atmosphere Facilities Review Panel (8/03-3/05)

Consultant to the National Astronomy and Ionosphere Center, Arecibo Observatory (1980- 2013)

Member, Arecibo Advisory Board and Visiting Committee (reported to the President of Cornell University) (Nov. 1989 - 1992)
Chairman (July 1991 - 1992)

Member, Arecibo Users & Scientific Advisory Committee of the National Astronomy and Ionosphere Center (Sept. 1977 - Sept. 1980 & 3/02 – 3/04)

Consultant for manuscript and script development of WPSX-TV's Artworks program, The Machines of Leonardo Da Vinci, as well as an on-camera interview (November 26, 1990)

Consultant to Engineering Service Group and Laser Engineering Group, Lawrence Livermore National Laboratories (1979-1987)

Consulting Engineer/Forensic Physicist in electrical failure analysis, radar, and natural plasmas (1975-1995)

**Administrative
Experience:
(PSU)**

Director, Communications and Space Sciences Laboratory (7/88-12/2007)
This interdisciplinary laboratory and college Center of Excellence, which was housed in Electrical Engineering, consisted of about 15 faculty and about 30 graduate students. The laboratory received \$6-10M in atmosphere, ionosphere, and electromagnetics research funding annually.

Organizer and host, A. H. Waynick Memorial Lecture Series (7/88-12/07)
Speakers in this series of distinguished visitors that give both a graduate colloquium and a public lecture in their 2-3 day visit. Speakers have included Ralph J. Cicerone, Neal Lane, Edward C. Stone, Gregory Benford, Joseph H. Taylor, Lawrence M. Krauss, Freeman Dyson, Jill Tarter, Antony Hewish, & other distinguished scientists and public intellectuals.

Chairman, Artist-in-Residence Program Steering Committee
(August 1989 - March 1990)

Director, Artist-in-Residence Program (April 1990 - June 1991)
Originated the College of Engineering, Artist in Residence Program. This experimental program (Mathews et al., 1990) ran from July 1988 through June 1991 and placed an internationally known computer-aided sculptor, Rob Fisher, in an engineering setting where he interacted with students and

faculty on a variety of projects, including scientific visualization.

Co-organizer and Co-host of the "Today's Leonardos" Symposium (14-15 Sept. 1990) and the "Tomorrow's Leonardos" Workshop (20 Oct. 1990) Both programs were presented by the Palmer Museum of Art with assistance from the College of Engineering and the College of Arts and Architecture at Penn State and the Pennsylvania Council on the Arts. The "Today's Leonardos" program brought faculty, students and other interested participants together with very interesting artists and researchers to explore relationships between contemporary art, science, and technology. The "Tomorrow's Leonardos" program provided regional science, math, and art students and teachers with an introduction to the field of engineering.

Faculty Associate for Renaissance House (Aug. 1989 - Aug. 1996)

Chair, Promotions and Tenure Committee, Department of Electrical Engineering (8/99 – 8/02)

Teaching Experience: (PSU)
Introduction to Electronic Measuring Systems (sophomore level)
Design Circuits & Systems (junior level)
Engineering Electromagnetics (junior level/graduate level)
Electronic Circuit Design (junior-senior level)
Introduction of Plasmas (senior-graduate level)
Constitution of the Ionosphere (upper graduate level)
Radio Waves and the Ionosphere (upper graduate level)
Interdisciplinary Projects in Art and Technology
Plasma Waves (upper graduate level)
Theory of Plasma Waves (upper graduate level)

Administrative Experience: (CWRU)
Departmental graduate program director in charge of recruiting, admissions and monitoring of student programs. (about 2000 inquiries, 500 applications, and 25 admissions per year to a 60-80 student program) (1982-1986)

Developed the Electromagnetic Waves and Wave Propagation Group (8 faculty) within Department of Electrical Engineering and Applied Physics. (1983-1986)

Teaching Experience: (CWRU)
Electronic Circuits I (sophomore level)
Electronic Circuits II (sophomore level)
Communication Electronic Circuits (junior-senior level)
Communications and Signal Analysis (senior- graduate level)
Antennas and Propagation (senior-graduate level)

Electromagnetic Scattering and Diffraction Theory (upper graduate level)
Electromagnetic Fields (graduate level)
Plasma Dynamics (graduate level)
Physics of the Atmosphere and Ionosphere (graduate level)
Random signals (upper graduate level)
Stochastic Electromagnetic Phenomena (upper graduate level)
Directed work toward 3 PhD and 9 MS theses as well as 17 senior projects.

**Professional
Society
Memberships:**

Sigma Xi
American Geophysical Union
URSI (International Union of Radio Science) - Commissions G & H
IEEE (Fellow)
European Geosciences Union
International Astronomical Union (IAU) Commission 22 (Meteors)
American Astronomical Society, Division of Planetary Sciences
Royal Astronomical Society (Fellow)

Awards:

Sigma Xi (CWRU Chapter) Research Award (1979)
Fulbright Scholar (8/1996-1/97; Swedish Institute for Space Physics, Kiruna, Sweden)
Fellow of the Royal Astronomical Society (2010)
Fellow Institute of Electrical and Electronics Engineers (IEEE, 2011)

Publication List

Papers Submitted and in Review

- Zhu, Q., R. Dinsmore, B. Gao, and J. D. Mathews, High-resolution radar observations of meteoroid fragmentation and flaring at the Jicamarca Radio Observatory, *Mon. Not. R. Astron. Soc.*, *in review* (2015).
- Raizada, S., C. M. Brum, C. A. Tepley, J. S. Friedman, J. D. Mathews, and F. T. Djuth, First Simultaneous Measurements of Na and K Thermospheric Layers along with TILs from Arecibo, *Geophys. Res. Lett.*, *in review* (2015).
- Zhu, Q., R. Volz, and J. D. Mathews, Radar Holography based on Compressed Sensing, *Radio Sci.*, *in review* (2015)
- Raizada, S., C. A. Tepley, Q. Zhou, S. Sarkhel, J. D. Mathews, N. A. Aponte, I. Seker, R. Kerr, and E. Cabassa, Influence of Sporadic E on Mesospheric Na and Fe layers over Arecibo, *Earth, Planets, Space*, *in review* (2015).

Non-Refereed Papers and News Articles

- Mathews, J. D., J. Urbina, and A. Malhotra, "Adapting the New Arecibo On-Dish High Frequency (HF) Transmitter System to Radar Mode", *International Innovation* (Environment Issue April 2012), Research Media Ltd, 93-95, ISSN 2041-4552 (2012).
- Meisel, D. D., V. S. Getman, J. D. Mathews, Y. T. Morton, Q. Zhou, R. G. Roper, and B. G. Marsden, "An unusual bolide with a near-Earth orbit", *Bul. American Astron. Soc.*, *26*, 1164-1165 (1994).
- Mathews, J. D., "Catching a Meteor in the Act," (News article with two figures) *Sky and Telescope*, *30*, #5, 468-469 (Nov. 1990).
- "Inbound Meteor Prompts Scientists To Urge Cataloging Space Objects", news article by Robert C. Cowen, *Christian Science Monitor*, Page 11 (1 August 1995).

Journal Articles and Reviewed Conference Proceedings (120 refereed papers):

- Gao, B., and J. D. Mathews, High-altitude radar meteors observed at Jicamarca Radio Observatory using a multi-baseline interferometric technique, *Mon. Not. R. Astron. Soc.*, *452*, 4252-4262, doi: 10.1093/mnras/stv1548 (2015).
- Sarkhel, S., J. D. Mathews, S. Raizada, R. Sekar, D. Chakrabarty, A. Guharay, G. Jee, J.-H. Kim, R. B. Kerr, G. Ramkumar, S. Sridharan, Q. Wu, M. G. Mlynczak, and J. M. Russell, A case study on occurrence of an unusual structure in the sodium layer over Gadanki, India, *Earth Planets Space*, *67*, doi: 10.1186/s40623-015-0183-5 (2015).
- Patil, A., A. Malhotra, A. K. Patra, T. R. Prasad, and J. D. Mathews, Evidence of meteoroid fragmentation in specular trail echoes observed using Gadanki MST radar, *Earth, Moon, Planets.*, *115*, doi: 10.1007/s11038-014-9456-4 (2015).
- Gao, B., and J. D. Mathews, High-altitude meteors and meteoroid fragmentation observed at Jicamarca, *Mon. Not. R. Astron. Soc.*, *446*, 3404-3415, doi: 10.1093/mnras/stu2176 (2015)
- Gao, B., and J. D. Mathews, Phase and pattern calibration of the Jicamarca radar using satellites, *Mon. Not. R. Astron. Soc.*, *446*, 3416-3426, doi: 10.1093/mnras/stu2177 (2015)
- Mathews, J. D., "Fifty years of radio science at Arecibo Observatory: A brief overview", *Radio Sci. Bull.*, *346*, 12-16 (2013).

- J. D. Mathews, "A short history of geophysical radar at Arecibo Observatory", *Hist. Geo- Space Sci.*, 4, 19-33, doi:10.5194/hgss-4-19-2013 (2013). (invited)
- S. Sarkhel, S. Raizada, J. D. Mathews, S. Smith, C. A. Tepley, F. J. Rivera, and S. A. Gonzalez, "Identification of large-scale billow-like structures in the neutral sodium layer over Arecibo", *J. Geophys. Res.*, 117, A10301, doi: 10.1029/2012JA017891 (2012).
- Mathews, J. D., "From here to ET", *J. British Interplanetary Soc.*, 64 no 6/7, 234-241 (2011).
- Mathews, J. D., "Underdense, overdense, and Bragg scattering in radar meteors", Proceedings of XXX URSI General Assembly and Scientific Symposium of the International Union of Radio Science, Istanbul, Turkey, 13-20 August, doi: 10.1109/URSIGASS.2011.6050923 (2011).
- Seker, I., W. E. Swartz, J. D. Mathews, and N. Aponte, "A new 3D display format relating azimuth-scanning radar data and all-sky images", Proceedings of XXX URSI General Assembly and Scientific Symposium of the International Union of Radio Science, Istanbul, Turkey, 13-20 August, doi: 10.1109/URSIGASS.2011.6050983 (2011).
- Klenzing, J. H., I. Seker, R. F. Pfaff, D. E. Rowland, S. F. Fung, and J. D. Mathews, "Multi-Instrument Observations of an MSTID over Arecibo Observatory", Proceedings of XXX URSI General Assembly and Scientific Symposium of the International Union of Radio Science, Istanbul, Turkey, 13-20 August, doi: 10.1109/URSIGASS.2011.6050874 (2011).
- Malhotra, A., and J. D. Mathews, "A statistical study of meteoroid fragmentation and differential ablation using the Resolute Bay incoherent scatter radar", *J. Geophys. Res.*, 116, pp. A04316, doi:10.1029/2010JA016135 (2011).
- Seker, I., S. F. Fung, and J. D. Mathews, "The relation between magnetospheric state parameters and the occurrence of plasma depletion events in the night-time mid-latitude F-region", *J. Geophys. Res.*, 116, A04323, doi:10.1029/2010JA015521 (2011).
- Djuth, F. T., L. D. Zhang, D. J. Livneh, I. Seker, M. P. Sulzer, J. D. Mathews, and R. L. Walterscheid, "Arecibo's thermospheric gravity waves and the case for an ocean source", *J. Geophys. Res.*, 115, A08305, doi:10.1029/2009JA014799 (2010).
- Mathews, J. D., S. J. Briczinski, A. Malhotra, and J. Cross, "Extensive meteoroid fragmentation in V/UHF radar meteor observations at Arecibo Observatory", *Geophys. Res. Lett.*, 37, L04103, doi:10.1029/2009GL041967 (2010).
- Malhotra, A., J. D. Mathews, and K. Ray, "Aspect sensitivity considerations in determining day-to-night variations in meteor trail durations", *Geophys. Res. Lett.*, 36, L22105, doi:10.1029/2009GL040815 (2009).
- Malhotra, A., and J. D. Mathews, "Low-altitude meteor trail echoes", *Geophys. Res. Lett.*, 36, L21106, doi:10.1029/2009GL040558 (2009).
- Livneh, D. J., I. Seker, F. T. Djuth, and J. D. Mathews, "Omnipresent vertically coherent fluctuations in the ionosphere with a possible worldwide-midlatitude extent", *J. Geophys. Res.*, 114, A06302, doi:10.1029/2008JA013999 (2009).
- Seker, I., D. Livneh, and J. D. Mathews, "A 3D empirical model of F-region MSTID bands using incoherent scatter radar and allsky imaging at Arecibo", *J. Geophys. Res.*, 114, A06302, doi:10.1029/2008JA014019 (2009).
- Briczinski, S. J., J. D. Mathews, and D. D. Meisel, "Statistical and fragmentation properties of the micrometeoroid flux observed at Arecibo", *J. Geophys. Res.*, 114, A04311, doi:10.1029/2009JA014054 (2009).

- Roy, A., S. J. Briczinski, J. F. Doherty, and J. D. Mathews, "Genetic algorithm based parameter estimation technique for fragmenting radar meteor head-echoes", *IEEE Geosci. Remote Sens. Lett.*, *6*, 363-367, doi:10.1109/LGRS.2009.2013878 (2009).
- Malhotra, A., J. D. Mathews, and J. Urbina, "Effect of Meteor Ionization on Sporadic-E observed at Jicamarca", *Geophys. Res. Lett.*, *35*, L15106, doi:10.1029/2008GL034661 (2008) [GRL Editor's Highlight article 9 August 2008].
- Roy, A., C.-H. Wen, J. F. Doherty, and J. D. Mathews, "Signal feature extraction from microbarograph observations using the Hilbert-Huang Transform," *IEEE Trans. Geos. Remote Sens.*, *46*, 1442-1447, doi: 10.1109/TGRS.2007.909916 (2008).
- Seker, I., J. D. Mathews, D. Livneh, and J. J. Makela, "Tracking F-region plasma depletion bands using GPS-TEC, incoherent scatter radar, and all-sky imaging at Arecibo," *Earth Planets Space*, *60*, 1-13 (2008).
- Malhotra, A., J. D. Mathews, and J. Urbina, "Aspect sensitivity considerations in interpreting radar meteor range-spread trail echo durations," *Earth, Moon, Planets.*, *web published*, doi: 10.1007/s11038-007-9211-1 (2008).
- Malhotra, A., J. D. Mathews, and J. Urbina, "Multi-static, common volume radar observations of meteors at Jicamarca," *Geophys. Res. Lett.*, *34*, L24103, doi:10.1029/2007GL032104 (2007).
- Mathews, J. D., S. J. Briczinski, D. D. Meisel, and C. J. Heinselman, "Radio and meteor science outcomes from comparisons of meteor radar observations at AMISR Poker Flat, Sondrestrom, and Arecibo," *Earth, Moon, Planets.*, *102*, 365-372, doi:10.1007/s11038-007-9168-0 (2008).
- Malhotra, A., J.D. Mathews, and J. V. Urbina, "A Radio Science Perspective on Long Duration Meteor Trails," *J. Geophys. Res.*, *112s*, A12303, doi:10.1029/2007JA012576 (2007).
- Roy, A., J.F. Doherty, and J.D. Mathews, "Analyzing radar meteor trails echoes using the Fresnel transform technique: A signal processing viewpoint," *Earth, Moon, Planets*, *101*, 27-39, doi: 10.1007/s11038-007-9147-5 (2007).
- Livneh, D., I. Seker, F. T. Djuth, and J. D. Mathews, "Continuous quasi-periodic thermospheric waves over Arecibo," *J. Geophys. Res.*, *112*, doi:10.1029/2006JA012225 (2007).
- Wen, C.-H., D.J. Livneh, J.F. Doherty, and J.D. Mathews, "Pulse-level interference and meteor processing of Arecibo ISR data," *J. Atmos. Solar-Terr. Phys.*, *69*, 973-980, DOI:10.1016/j.jastp.2007.03.004 (2007).
- Seker, I., J.D. Mathews, J. Wiig, P. Farias-Gutierrez, J.S. Friedman, and C.A. Tepley, "First results from the Penn State Allsky Imager at Arecibo Observatory," *Earth Planets Space*, *59*, 165-176 (2007).
- Malhotra, A., J. D. Mathews, and J. Urbina, "Solving the mystery of long duration non-specular meteor echoes," Proceedings of the Eleventh International Workshop on Technical & Scientific Aspects of MST Radar, Macmillan India Ltd., Gadanki, India, 183-186, 11-15 December (2006).
- Zhou, Q.-N., and J.D. Mathews, "On the physical explanation of the Perkins instability," *J. Geophys. Res.*, *111*, A12309, doi:10.1029/2006JA011696 (2006).
- Bilen, S.G., C.R. Philbrick, T.F. Wheeler, J.D. Mathews, R.G. Melton, and D.B. Spencer, "An overview of space science and engineering education at Penn State," *IEEE Aerospace and Electronic Systems Magazine*, *21(7)*, S_23-S_27 (2006).

- Briczinski, S.J., C.-H. Wen, J.D. Mathews, J.F. Doherty, and Q.-N. Zhou, "Robust voltage fitting techniques for meteor Doppler speed determination," *IEEE Trans. Geos. Remote Sens.*, *44*, 3490-3496 (2006).
- Zhou, Q.-N., J.D. Mathews, and C.A. Miller, "The evolution of nighttime mid-latitude mesoscale F-region structures: A case study utilizing numerical solution of the Perkins instability equations," *Planet. Space Sci.*, *54*, 710-718 (2006).
- Szasz, C., A. Pellinen-Wannberg, J. D. Mathews, N. J. Mitchell, and W. Singer, "Latitudinal Variations of Diurnal Meteor Rates," chapter in *Modern Meteor Science An Interdisciplinary View*, edited by R. Hawkes, et al., Springer Netherlands, ISBN 978-1-4020-4374-1 (2005).
- Wen, C.-H., J.F. Doherty, and J.D. Mathews, "Adaptive filtering for the separation of incoherent scatter and meteor signals for Arecibo observational data," *J. Atmos. Solar-Terr. Phys.*, *67*, 1190-1195 (2005).
- Zhou, Q.-N., J.D. Mathews, Q. Du, and C.A. Miller, "A preliminary investigation of the pseudo-spectral method numerical solution of the Perkins instability equations in the homogeneous case," *J. Atmos. Solar-Terr. Phys.*, *67*, 325-335 (2005).
- Szasz, C., A. Pellinen-Wannberg, J.D. Mathews, N.J. Mitchell, and W. Singer, "Latitudinal variations of diurnal meteor rates," *Earth, Moon, Plnts.*, *95*, 101-107 (2005).
- Wen, C.-H., J.F. Doherty, J.D. Mathews, and D. Janches, "Meteor detection and non-periodic bursty interference removal for Arecibo data," *J. Atmos. Solar-Terr. Phys.*, *67*, 275-281 (2005).
- Djuth, F.T., M.P. Sulzer, S.A. Gonzales, J.D. Mathews, J.H. Elder, and R.L. Walterscheid, "A continuum of gravity waves in the Arecibo thermosphere?," *Geophys. Res. Lett.*, *31*, L16801 (2004).
- Zhou, Q.-H., Y.T. Morton, J.D. Mathews, and D. Janches, "Aspect sensitivity of VHF echoes from field aligned irregularities in meteor trails and thin ionization layers," *Atmos. Chem. Physics*, *4*, 685-692 (2004).
- Raizada, S., C.A. Tepley, D. Janches, J.S. Friedman, Q. Zhou, and J.D. Mathews, "Lidar observations of Ca and K metallic layers from Arecibo and comparison with micrometeor sporadic activity," *J. Atmos. Solar-Terr. Phys.*, *66*, 595-606 (2004).
- Wen, C.-H., J.F. Doherty, J.D. Mathews, and D. Janches, "Time-frequency radar processing for meteor detection," *IEEE Trans. Geos. Remote Sens.*, *42* (3), 501-510 (2004).
- Mathews, J.D., "Radio science issues surrounding HF/VHF/UHF radar meteor studies," *J. Atmos. Solar-Terr. Phys.*, *66*#3, 285-299 (2004).
- Mathews, J.D., J.F. Doherty, C.-H. Wen, D. Janches, and D.D. Meisel, "An update on UHF radar meteor observations and associated signal processing techniques at Arecibo Observatory," *J. Atmos. Solar-Terr. Phys.*, *65*, 1139-1149 (2003).
- Janches, D., M.C. Nolan, D.D. Meisel, J.D. Mathews, Q.-H. Zhou, and D.E. Moser, "On the geocentric micrometeor velocity distribution," *J. Geophys. Res.*, *108*, SIA 1-1 - 1-14, (2003).
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- Meisel, D. D., D. Janches, and J. D. Mathews, "The size distribution of Arecibo interstellar particles and its implications," *Astrophys. J.*, 579, 895-904 (2002).
- Pasko, V.P., M.A. Stanley, J.D. Mathews, U.S. Inan, and T.G. Wood, Electrical discharge from a thundercloud top to the lower ionosphere, *Nature*, 416, 152-154 (2002).
- Janches, D., D. D. Meisel, and J. D. Mathews, "Dynamical and orbital properties of the Arecibo micrometeors," Proceedings of IAU Colloquium181/COSPAR Colloquium 11—Dust in the solar system and other planetary systems, Canterbury UK, 10-14 April 2000 (2002).
- Mathews, J. D., D. Janches, and D. D. Meisel, "Direct determination of the micrometeoritic mass flux into the upper atmosphere," Proceedings of IAU Colloquium181/COSPAR Colloquium 11—Dust in the solar system and other planetary systems, Canterbury UK, 10-14 April 2000 (2002).
- Meisel, D. D., D. Janches, and J. D. Mathews, "Extrasolar micrometeors radiating from the vicinity of the local interstellar bubble," *Astrophys. J.*, 567, 323-341 (2002).
- Mathews, J.D., S. Gonzalez, M.P. Sulzer, Q.-H. Zhou, J. Urbina, E. Kudeki, and S. Franke, "Kilometer-scale layered structures inside spread-F," *Geophys. Res. Lett.*, 28, 4167-4170 (2001).
- Mathews, J. D., D. Janches, Meisel, D. D., Q.-H. Zhou, "The micrometeoroid mass flux into the upper atmosphere: Arecibo results and a comparison with prior estimates," *Geophys. Res. Lett.*, 28, 1929-1932 (2001).
- Machuga, D. W., and J. D. Mathews, "Numerical simulations of three-dimensional E-region ion trajectories in realistic tidal wind and E-field structures: Layer formation and transport," *J. Atmos. Solar-Terr. Phys.*, 63, 1519-1528 (2001).
- Mathews, J. D., D. W. Machuga, and Q.-H. Zhou, "Observational evidence for electrodynamic linkages between spread-F, ion rain, the intermediate layer, and sporadic-E: Results from observations and simulations," *J. Atmos. Solar-Terr. Phys.*, 63, 1529-1543 (2001).
- Zhou, Q.-H., J. D. Mathews, T. Nakamura, "Implications of meteor observations by the MU radar," *Geophys. Res. Lett.*, 28, 1399-1402 (2001).
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- Janches, D., D. D. Meisel, and J. D. Mathews, "Orbital properties of the Arecibo micrometeoroids at Earth intersection," *Icarus*, 150, 206-218 (2001).
- Janches, D., J. D. Mathews, D. D. Meisel, and Q.-H. Zhou, "Micrometeor observations using the Arecibo 430 MHz radar: I. Determination of the ballistic parameter from observed Doppler velocity and deceleration results," *Icarus*, 145, 53-63 (2000).
- Janches, D., J. D. Mathews, D. D. Meisel, V. S. Getman, and Q.-H. Zhou, "Doppler studies of near-antapex UHF radar meteors," *Icarus*, 143, 347-353 (2000).
- Mathews, J. D., D. D. Meisel, D. Janches, V. S. Getman, and Q.-H. Zhou, "Direct Doppler and scattering mechanism studies of meteor head-echoes using the Arecibo 50/430 MHz radars," Proceedings of METEOROIDS 1998, Tatranska Lomnica, Slovakia, 17-21 August, 1998, published by Astronomical Institute, Slovak Academy of Sciences, edited by W. J. Baggaley and V. Porubcan, 79-82 (1999).

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- Zhou, Q.-H., Q.-N. Zhou, J. D. Mathews, "Arithmetic average, geometric average, and ranking: Application to incoherent scatter radar data processing," *Radio Science*, 34, 1227-1237 (1999).
- Zhou, Q.-H., J. D. Mathews, and Q.-N. Zhou, Incoherent scatter radar study of the impact of the meteoric influx on nocturnal E-region ionization, *Geophys. Res. Lett.*, 26, 1833-1836 (1999).
- Zhou, Q.-H., P. Perillat, J. Y. N. Cho, and J. D. Mathews, "Simultaneous meteor echo observations by large aperture VHF and UHF radars," *Radio Sci.*, 33, 1641-1654 (1998).
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Meeting Presentations

- Mathews, J. D., B. Gao, and Q. Zhu, The full range of radar meteors at the Jicamarca Radio Observatory, presented at Stanford Meteor Environment and Effects Workshop, Stanford University, 14-16 July 2015.
- Mathews, J. D., B. Gao, and Q. Zhu, The full range of radar meteors at the Jicamarca Radio Observatory, presented at Stanford Meteor Environment and Effects Workshop, Stanford University, 14-16 July 2015.
- Raizada, S., J. D. Mathews, J. Friedman, F. Djuth, B. C, and C. A. Tepley, High altitude metal observations from Arecibo: Evidence of Sputtering?, presented at Stanford Meteor Environment and Effects Workshop, Stanford University, 14-16 July 2015.
- Zhu, Q., R. Dinsmore, B. Gao, and J. D. Mathews, High-resolution radar observations of meteoroid fragmentation at Jicamarca Radio Observatory, presented at CEDAR 2015 Workshop, Seattle WA, 21-25 June 2015.
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