

## Curriculum Vitae

**Alan P. Marscher**

**Name** Alan P. Marscher

**Birthplace** Utica, New York; U.S. citizen

**Address** Department of Astronomy  
Boston University  
725 Commonwealth Ave.  
Boston, MA 02215

**Phone** 617-353-5029 **Fax** 617-353-5704

**Education** Ph.D., Astronomy, University of Virginia, 1977  
M.S., Astronomy, University of Virginia, 1974  
B.S., Engineering Science, Cornell University, 1973

### **Positions Held**

1992-present Professor of Astronomy, College of Arts and Sciences, Boston University  
2013-present Associate Director, Core Curriculum, College of Arts and Sciences, Boston University  
2011-present Director, Institute for Astrophysical Research, Boston University  
2003-2007 Director, Center for Excellence in Teaching, Boston University  
1999-2003 Associate Dean, College of Arts and Sciences, Boston University  
1990-91 Visiting Scientist, Smithsonian Astrophysical Observatory  
1987-1997 Chairman, Department of Astronomy, Boston University  
1987-1992 Associate Professor of Astronomy, Boston University  
1986-1987 Chairman *ad interim*, Department of Astronomy, Boston University  
1981-1987 Assistant Professor of Astronomy, Boston University  
1978-1981 Postgraduate Research Physicist, U. of California, San Diego  
1977-1978 NAS-NRC Postdoctoral Research Associate at NASA Goddard  
Space Flight Center  
1976-1977 Junior Research Associate (Thesis Student), National Radio  
Astronomy Observatory, Charlottesville, Virginia  
1976-1977 Instructor of Physics, Mary Baldwin College, Staunton, Virginia  
1975 Summer Student, National Radio Astronomy Observatory

**Honors** Vice President, LYCHNOS Graduate Honor Society, University  
of Virginia  
Listed in *Who's Who in the World*, *Who's Who in American  
Education*, and *Who's Who in Science & Technology*  
Recipient of 1998 Gitner Award for Distinguished Teaching, College of  
Arts and Sciences, Boston University  
Distinguished Member of the National Society of Collegiate Scholars (inducted in 2003)  
Honorary membership in Phi Beta Kappa (inducted in 1999)  
*21st Century Award for Achievement, International Biographical Centre*

**Ph.D. Thesis** "Effects of Nonuniform Structure in Compact Synchrotron Sources"

**Ph.D. Advisor** Dr. Robert L. Brown, National Radio Astronomy Observatory

**Professional Societies** American Astronomical Society  
International Astronomical Union  
American Association for the Advancement of Science  
Astronomical Society of the Pacific

### Major Professional Committees

Chair, NASA Fermi Gamma-ray Space Telescope Users Group, 2009–present  
Member, Electorate Nominating Committee, Section on Astronomy, American Association of Professional Astronomers, 2003–2007  
Member, external oversight committee for the VERITAS  $\gamma$ -ray Cherenkov telescope, 2003–2007  
Member, NASA Gamma-ray Large Area Space Telescope Users Committee, 2003–2007  
Member, Committee of Visitors, Division of Astronomical Sciences, National Science Foundation, 2003–2007  
Member, *ad hoc* panel to map the future of VLBI research in the US, 2003  
Member, Panel on Radio and Submillimeter Astronomy, Decadal Astronomy and Astrophysics Survey, National Academy of Sciences, 1998–2000 & 2004–2005  
AUI Visiting Committee for the National Radio Astronomy Observatory, 1992–95  
National Science Foundation Advisory Committee on Astronomical Sciences, 1988–92  
National Radio Astronomy Observatory Users Committee, 1984–87, 1990–93  
ARISE Space VLBI Advisory Committee, 1998–1999  
NASA Compton Gamma Ray Observatory Users Committee, 1995–98  
Secretary-Treasurer of High Energy Astrophysics Division of the American Astronomical Society, 1997–99  
Chairman of Nominating Committee, High Energy Astrophysics Division of the American Astronomical Society, 1988  
At-large member of Very Long Baseline Interferometry telescope consortium, 1984–88  
Various panels reviewing funding proposals for NASA and NSF  
Various scientific organizing committees for astronomical conferences  
Member of panel reviewing proposals to use the Very Long Baseline Interferometer Network, 1982–89  
Member of panel reviewing proposals to use the Coordinated Millimeter-Wave VLBI Array, 1995–2000  
Member of board of Associated Universities for Research in Astronomy, 1993–1994

### Major University Committees

College of Liberal Arts (CLA) Petitions Committee, 1983–84  
CLA Natural Sciences Curriculum Committee, 1984–86, 2009–present  
Integrated Core Curriculum development committee, 1985–88  
Core Curriculum science development committee, 1987–89, 91–92  
(chairman, 1988–89, 91–92)  
CLA Academic Policy Committee, 1988–90 (chairman, 1988–89)  
Advisory Board, Center for Excellence in Teaching, 2000–2003  
Provost's Advisory Board on Distance Education, 2007–08

### Academic Advising

Advisor of Astronomy majors, 1982–90, 1993–1999, 2007–  
Advisor of Astronomy minors, 1982–1997  
General College advisor (mainly undeclared majors), 1983–84  
General College summer orientation advisor, 1983–88, 2002  
Director of Undergraduate Advising, Department of Astronomy, 1984–90  
Tutoring of (mainly) first-year Astronomy majors, 1992–1997 (started program)

## Courses Taught

CC 105 Evolution of the Universe and of the Earth (Core Curriculum)  
AS 101 The Solar System (for non-science majors)  
AS 102 The Astronomical Universe (for non-science majors)  
AS 105 Survey of the Universe (for non-science majors)  
AS 109 Cosmology (for non-science majors)  
AS 312 Stellar and Galactic Astronomy (for science majors)  
AS 413 Extragalactic Astrophysics & Cosmology (for science majors)  
AS 503 Galactic Astronomy (graduate level)  
AS 711 Cosmic Mechanics & Dynamics (graduate level)  
AS 712 Radiative Processes in Astrophysics (graduate level)  
AS 755 Radio Astrophysics (graduate level)  
AS 757 High Energy Astrophysics (graduate level)  
AS 793 Graduate seminar on quasars and active galactic nuclei  
PH 101/102 Introductory Physics (non-calculus; at Mary Baldwin College)

## Supervision of Theses and Dissertations

Apostolos Mastichiadis (Ph.D., 1985) (joint supervision with K. Brecher)  
Sridhar Subramanian (M.A., 1986)  
James C. Kilian (M.A., 1986)  
Linda Shore (M.A., 1986)  
Ruth A. Daly (Ph.D., 1987)  
Steven D. Bloom (Ph.D., 1994)  
Yun Fei Zhang (Ph.D., 1994)  
Matthew L. Lister (Ph.D., 1998)  
Markos Georganopoulos (Ph.D., 1999)  
Andrei Sokolov (Ph.D., 2004)  
Ritaban Chatterjee (Ph.D., 2009)  
Francesca D’Arcangelo (Ph.D., 2009)  
Monica Bruecker Young (Ph.D., 2010) (Joint supervision with M. Elvis)

## Narrative Summary of Academic Activities at Boston University

Although I have taught a number of Astronomy courses for non-majors, majors, and graduate students while at Boston University, currently I teach mainly in the Core Curriculum of the College of Arts and Sciences. The course is CC 105, The Evolution of the Universe and the Earth; I was the primary architect of the course, but a number of other professors contributed substantially. I was the course coordinator (lead faculty member) of the course from 1989 to 2002, save for two sabbatical years. With some help from my colleagues Scott Mohr, Scott Whitaker, and Declan De Paor, I wrote a textbook for the course entitled *From Nothing to Everything: The Evolution of the Universe and the Earth*. It was custom-published by Pearson Custom Publishing in 2002. I have adapted and expanded my portion of the book to write a new book, *From Nothing to Everything: The Story of the Universe*, which is available as an e-book, with free downloads, for AS109 and CC105 students, as well as the public. I compose pop songs for AS109 and CC105 and perform them in my lectures. The textbook and recorded versions are available on my research group’s website, [www.bu.edu/blazars](http://www.bu.edu/blazars).

## Narrative Summary of Current Research

I and my research group study the extremely energetic plasma jets that emanate from a class of active galactic nuclei called “blazars” (radio-bright quasars and BL Lacertae objects, whose brightness tends to be highly variable and whose continuum spectra are non-thermal). The general consensus of the field is that ultra-massive (over a billion solar masses) black holes residing at the center of many galaxies

power blazars as they accrete matter from their surroundings. The black holes swallow most of the gas and dust, but expel a small fraction in winds and jets along the rotation axes, at flow speeds very close to the speed of light. Such relativistic motions create illusions of faster-than-light speeds and beams the radiation emitted such that observers viewing the jet almost along the axis measure a very high brightness that varies on timescales as short as hours. The work of my group focuses on monitoring the changing brightness at radio, infrared, X-ray, and gamma-ray frequencies as well as the evolving radio-frequency structure of the jet on sub-milliarcsecond scales. Telescopes used currently include the Very Long Baseline Array (VLBA) and Very Large Array of the National Radio Astronomy Observatory, NASA's Hubble Space Telescope, Spitzer Space Telescope (infrared), Chandra X-ray Observatory, Rossi X-Ray Timing Explorer (RXTE), Swift satellite observatory, and Fermi Gamma-ray Space Telescope, the Lowell Observatory Perkins Telescope, the James Clerk Maxwell Telescope, and the European Space Agency's INTEGRAL (hard X-ray, soft gamma-ray) and XMM-Newton (X-ray) space observatories.

In addition to this observational program, I lead my group in theoretical studies focused on the radiative processes and gas dynamics that occur in the jets of blazars. The main goal is to provide models that can be used to interpret images, polarization, and multifrequency monitoring observations of blazars in the hopes of figuring out the physics of jets: what produces them (what evidence can we obtain that it is really an accreting supermassive black hole?), what focuses and accelerates their flows to speeds very close to the velocity of light (twisting magnetic fields, gas pressure, or radiation pressure?), what accelerates the electrons to ultrarelativistic energies (shock waves - transverse to the jet axis or oblique? reconnection of magnetic fields? turbulence?), and what processes affect the emission (bends in the jet, accelerations in the flow, instabilities, precession?).

An extensive website on the research of my group is located at <http://www.bu.edu/blazars>. The site includes background information, many images of jets, and some animations of sequences of images and light curves as well as artists' conceptions of the activity at the heart of a quasar.

### **Narrative Summary of Administrative Experience at Boston University**

From September 2013 to the present, I have served as an associate director of the Core Curriculum in the College of Arts and Sciences, Boston University. In this capacity, I am the lead instructor of the physical science course CC105, and advise the Core director on current and future directions of the program.

From July 2011 to the present, I have served as the Director of the Institute for Astrophysical Research at Boston University. The IAR administers astrophysics research grants and coordinates research activities.

From June 2003 to September 2007, I served as the Director of the Center for Excellence in Teaching (a half-time administrative position). I led a program of workshops, consultations, orientations, informational web pages, and other activities devoted to the improvement of teaching of faculty and graduate teaching fellows at the Charles River Campus of Boston University.

From 1999 to 2003, I served as an Associate Dean in the College of Arts and Sciences at Boston University (half-time), with primary responsibility for faculty issues. Among my main duties are oversight of the College web site, running of orientation programs for new graduate teaching fellows and new "adjunct" faculty, coordination of continuing programs of language instruction for international graduate teaching fellows, identifying physical problems in classrooms that need to be fixed and acting as a liaison between instructors and Media Group, formation of a panel to determine recipients of College teaching awards, compilation of grading statistics in Arts and Sciences courses, and providing guidance to departmental chairs and to faculty.

I served as chairman of the Department of Astronomy from 1986 to 1997. During that time, the size of the academic faculty grew from 8 to 15 members, while that of the research faculty increased from 1 to 7. The department thrived in all areas (as it continues to do), especially in grant and contract activity and the teaching of undergraduate students.

## BIBLIOGRAPHY

### Books

Marscher, A.P., DePaor, D.G., Mohr, S.C., and Whitaker, J.S. *From Nothing to Everything: The Evolution of the Universe and the Earth* (Boston: Pearson Custom Publishing) (2002). Textbook for Boston University Core Curriculum physical science course.

Marscher, A.P. *From Nothing to Everything: The Story of the Universe*, published as an e-book, distributed *gratis* to students and the public. The book is available for free download at <http://www.bu.edu/blazars/textbook.html>.

### Refereed Journal Papers

1. Bergh, S. van den, Marscher, A.P., and Terzian, Y. "An Optical Atlas of Galactic Supernova Remnants," 1973, *Astrophysical Journal Supplement Series*, **26**, 19-36 (no. 227).
2. Marscher, A.P., and Brown, R.L. "An Interpretation of the Radio Outbursts of Cygnus X-3," 1975, *Astrophysical Journal*, **200**, 719-726.
3. Goldstein, S.J., Marscher, A.P., and Rood, R.T. "On the Aggregate Flux of Weak Point Sources at 1400 MHz," 1976, *Astrophysical Journal*, **210**, 321-325.
4. Brown, R.L., and Marscher, A.P. "Energetic Secondary Electrons in Dense Interstellar Clouds," 1977, *Astrophysical Journal*, **212**, 659-663.
5. Marscher, A.P. "Effects of Nonuniform Structure on the Derived Physical Parameters of Compact Synchrotron Sources," 1977, *Astrophysical Journal*, **216**, 244-256.
6. Marscher, A.P. "Structure of Radio Sources with Remarkably Flat Spectra: PKS 0735+178," 1977, *Astronomical Journal*, **82**, 781-784.
7. Marscher, A.P. "Relativistic Blast-Wave Model for Superlight Motion in Compact Double Radio Sources," 1978, *Astrophysical Journal*, **219**, 392-399.
8. Brown, R.L., and Marscher, A.P. "Are Supernovae Radio Sources? A Search for Radio Emission from Young Supernova Remnants," 1978, *Astrophysical Journal*, **220**, 467-473.
9. Marscher, A.P., and Brown, R.L. "Origin and Evolution of the Radio Emission from Immediate Post-Outburst Supernovae," 1978, *Astrophysical Journal*, **220**, 474-483.
10. Marscher, A.P., and Brown, R.L. "Energetic Secondary Electrons and the Nonthermal Galactic Radio Background: A Probe of the Magnetic Field in Interstellar Clouds," 1978, *Astrophysical Journal*, **221**, 588-597.
11. Marscher, A.P. "Relativistic Blast-Wave Model for the Rapid Flux Variations of AO 0235+164 and Other Compact Sources," 1978, *Astrophysical Journal*, **224**, 816-825.

12. Marscher, A.P. “Interaction between Emission Line Filaments and Highly Energetic Explosions in QSOs,” 1978, *Astrophysical Journal*, **225**, 725-731.
13. Marscher, A.P., and Weaver, R.P. “On the Formation and Confinement of Dense Clouds in QSOs and Active Galactic Nuclei,” 1979, *Astrophysical Journal*, **227**, 705-709.
14. Marscher, A.P. “Absorption Models for Low-Frequency Variability in Compact Radio Sources,” 1979, *Astrophysical Journal*, **228**, 27-33.
15. Marscher, A.P., Marshall, F.E., Mushotzky, R.F., Dent, W.A., Balonek, T.J., and Hartman, R.F. “Search for X-Ray Emission from Bursting Radio Sources,” 1979, *Astrophysical Journal*, **233**, 498-503.
16. Shaffer, D.B., and Marscher, A.P. “VLBI Observations of Galactic Nuclei at 18 cm,” 1979, *Astrophysical Journal (Letters)*, **233**, L105-L108.
17. Marscher, A.P. “Relativistic Jets and the Continuum Emission in QSOs,” 1980, *Astrophysical Journal*, **235**, 386-391.
18. Marscher, A.P., and Scott, J.S. “Superluminal Motion in Compact Radio Sources,” 1980, *Publ. Astron. Soc. Pacific*, **92**, 127-133.
19. Marscher, A.P., and Shaffer, D.B. “VLBI Observations at 18 and 2.8 cm: 0133+47, 0735+178, OH471, OQ172, 1633+38, and NRAO 667,” 1980, *Astronomical Journal*, **85**, 668-672.
20. Marscher, A.P. “Spontaneous Formation of Knots in Relativistic Flows: A Model for Variability in Compact Synchrotron Sources,” 1980, *Astrophysical Journal*, **239**, 296-304.
21. Marscher, A.P., Vestrand, W.T., and Scott, J.S. “Neutrino, Gamma-Ray, Electron, and Positron Production in an Ultrarelativistic Plasma,” 1980, *Astrophysical Journal*, **241**, 1166-1174.
22. Rothschild, R.E., Baity, W.A., Marscher, A.P., and Wheaton, W.A. “Nonthermal Hard X-Ray Emission from the Nucleus of NGC 1275,” 1981, *Astrophysical Journal (Letters)*, **243**, L9-L12.
23. Vestrand, W.T., Scott, J.S., Marscher, A.P., and Christiansen, W.A. “Effects of Gamma-Ray, Neutrino, and Particle Production on the Energetics and Dynamics of Compact Extragalactic Radio Sources,” 1981, *Astrophysical Journal*, **245**, 811-817.
24. Marscher, A.P., and Broderick, J.J. “Distance-Independent Evidence for Relativistic Motion in the Quasar NRAO 140,” 1981, *Astrophysical Journal (Letters)*, **247**, L49-L52.
25. Marscher, A.P., and Broderick, J.J. “X-Ray and VLBI Radio Observations of the Quasars NRAO 140 and NRAO 530,” 1981, *Astrophysical Journal*, **249**, 406-414.
26. Marscher, A.P., and Burbidge, E.M. “Rotating Compact Radio Sources and Angular Momentum Transfer from the Nucleus to Outlying Gas in Active Galaxies,” 1982, *Astrophysical Letters*, **22**, 83-87.
27. Marscher, A.P., and Broderick, J.J. “Apparent Superluminal Motion in the Quasar NRAO 140,” 1982, *Astrophysical Journal (Letters)*, **255**, L11-L15.

28. Junkkarinen, V.T., Marscher, A.P., and Burbidge, E.M. “Einstein X-Ray Observations of QSOs with Absorption-Line Systems,” 1982, *Astronomical Journal*, **87**, 845-848.
29. Marscher, A.P. “Accurate Formula for the Self-Compton X-Ray Flux Density from a Uniform, Spherical, Compact Radio Source,” 1983, *Astrophysical Journal*, **264**, 296-297.
30. Marscher, A.P., and Broderick, J.J. “VLBI Observations of the Quasars CTD20 (0234+285), OJ248 (0827+243), and 4C19.44 (1354+195), and the Millimeter-X-Ray Connection,” 1983, *Astronomical Journal*, **88**, 759-763.
31. Marscher, A.P., Brecher, K., Wheaton, W.A., Ling, J.C., Mahoney, W.A., and Jacobson, A.S. “Search for 511 KeV Electron- Positron Annihilation Radiation from Mildly Active Galaxies Using the HEAO-3 Gamma-Ray Spectrometer,” 1984, *Astrophysical Journal (Letters)*, **281**, 566-569.
32. Marscher, A.P., and Broderick, J.J. “Multifrequency Radio VLBI Observations of the Superluminal, Low-Frequency Variable Quasar NRAO 140.” 1985, *Astrophysical Journal*, **290**, 735-741.
33. Marscher, A.P., and Gear, W.K. “Models for High-Frequency Radio Outbursts in Extragalactic Sources with Application to the Early 1983 Millimeter to Infrared Flare of 3C273,” 1985, *Astrophysical Journal*, **298**, 114-127.
34. Mastichiadis, A., Marscher, A.P., and Brecher, K. “Electron-Positron Pair Production by Ultrarelativistic Electrons in a Soft Photon Field,” 1986, *Astrophysical Journal*, **300**, 178-189.
35. Mastichiadis, A., Brecher, K., and Marscher, A.P. “Electromagnetic Cascades in the Magnetosphere of a Very Young Pulsar: A Model for the Positron Production near the Galactic Center,” 1987, *Astrophysical Journal*, **314**, 88-94.
36. Shaffer, D.B., Marscher, A.P., Marcaide, J.M., and Romney, J.D. “Multi-Epoch VLBI Observations of 4C39.25: Superluminal Motion amid Stationary Structure,” 1987, *Astrophysical Journal (Letters)*, **314**, L1-L5.
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39. Daly, R.A., and Marscher, A.P. “The Gas Dynamics of Compact Relativistic Jets,” 1988, *Astrophysical Journal*, **334**, 539-551.
40. Marscher, A.P. “Contemporaneous X-Ray and VLBI Radio Observations of the Quasar NRAO 140,” 1988, *Astrophysical Journal*, **334**, 552-559.
41. McHardy, I.M., Marscher, A.P., Gear, W.K., Muxlow, T., Lehto, H.J., and Abraham, R.G. “VLBI, MERLIN, and VLA Observations of the Blazar 1156+295,” 1990, *Monthly Notices of the Royal Astronomical Society*, **246**, 305-314.

42. Bloom, S.D., and Marscher, A.P. “Comparison of VLBI Radio Core and X-ray Flux Densities of Extragalactic Radio Sources,” 1991, *Astrophysical Journal*, **366**, 16-21.
43. Marscher, A.P., Zhang, Y.F., Shaffer, D.B., Aller, H.D., and Aller, M.F. “Multifrequency VLA, VLBI, and Single-Dish Observations of the Quasar 4C 39.25,” 1991, *Astrophysical Journal*, **371**, 491-500.
44. Marscher, A.P., Bania, T.M., and Wang, Z. “Detection of Local Interstellar CO Absorption toward BL Lacertae,” 1991, *Astrophysical Journal (Letters)*, **371**, L77-L80.
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47. Marscher, A.P., Moore, E.M., and Bania, T.M. “Detection of AU-Scale Structure in Molecular Clouds,” 1993, *Astrophysical Journal (Letters)*, **419**, L101–L104.
48. Bloom, S.D., Marscher, A.P., Gear, W.K., Teräsranta, H., Valtaoja, E., Aller, H.D., and Aller, M.F. “Radio, Millimeter-Submillimeter, and Infrared Spectra of Flat-Spectrum Extragalactic Radio Sources,” 1994, *Astronomical Journal*, **108**, 398–404.
49. Zhang, Y.F., Marscher, A.P., Aller, H.D., Aller, M.F., Teräsranta, H., and Valtaoja, E. “Radio and X-Ray Observations of the  $\gamma$ -Ray Bright Quasar PKS 0528+134,” 1994, *Astrophysical Journal*, **432**, 91–102.
50. Marscher, A.P., and Stone, A.L. “Simulations of Variations of Absorption Line Profiles in Clumpy Molecular Clouds,” 1994, *Astrophysical Journal*, **433**, 705–711.
51. Gómez, J.L., Alberdi, A., Marcaide, J.M., Marscher, A.P., and Travis, J.P. “Synchrotron Emission from Bent Shocked Relativistic Jets,” 1994, *Astronomy & Astrophysics*, **292**, 33–44.
52. Edelson, R., ..., Marscher, A.P. (37th author), *et al.* “Multi-Wavelength Monitoring of the BL Lacertae Object PKS 2155–304. IV. Multi-Wavelength Analysis,” 1995, *Astrophysical Journal*, **438**, 120.
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55. Moore, E.M., and Marscher, A.P. “Observational Probes of the Small Scale Structure of Molecular Clouds,” 1995, *Astrophysical Journal*, **452**, 671–679.
56. Marscher, A.P. “Probes of the Inner Jets of Blazars,” 1995, *Proc. Nat. Acad. Sci.*, **92**, 11439–11441.



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58. Hartman, R.C., Webb, J.R., Marscher, A.P., *et al.* “Simultaneous Multiwavelength Spectrum and Variability of 3C 279 from  $10^9$  to  $10^{24}$  Hz,” 1996, *Astrophysical Journal*, **461**, 698–712.
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66. von Montigny, C., ..., Marscher, A.P., *et al.* “Multi-wavelength Observations of 3C 273 in 1993–1995,” 1997, *Astrophysical Journal*, **483**, 161–177.
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