

Curriculum Vitae

Alan P. Marscher

Name Alan P. Marscher

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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
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

Member, Electorate Nominating Committee, Section on Astronomy, American Association of Professional Astronomers, 1993-2000
Member, external oversight committee for the VERITAS γ -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
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

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 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)

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 compose pop songs for the course and perform them in my lectures. Recorded versions are available on my website, www.bu.edu/blazars/songs. The CC 105 course has a website at <http://www.bu.edu/core/cc105>.

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 Spitzer Space Telescope (infrared), Chandra X-ray Observatory, and Rossi X-Ray Timing Explorer (RXTE), the Compton Gamma Ray Observatory (CGRO, now defunct), the Lowell Observatory Perkins Telescope, and the James Clerk Maxwell Telescope. We will be very active in the multiwaveband data analysis and interpretation of γ -ray bright blazars observed with NASA's GLAST γ -ray observatory, scheduled for launch in mid-2008.

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, precession?).

An extensive web site 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 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

Book

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.

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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38. Marscher, A.P., Shaffer, D.B., Booth, R.S., and Geldzahler, B.J. “Multifrequency VLBI Observations of 4C39.25: A Superluminal Source without a Well-Defined Core,” 1987, *Astrophysical Journal (Letters)*, **319**, L69-L72.
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.
45. Bania, T.M., Marscher, A.P., and Barvainis, R. “Observations of Local Interstellar CO toward Four Compact Extragalactic Radio Sources,” 1991, *Astronomical Journal*, **101**, 2147-2150.
46. Alberdi, A., Marcaide, J.M., Marscher, A.P., Zhang, Y.F., Elósegui, P., Gómez, J.L., and Shaffer, D.B. “The Parsec-Scale Radio Jet of 4C 39.25,” 1993, *Astrophysical Journal*, **402**, 160–172.
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 γ -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.
53. Gómez, J.L., Martí, J.M., Marscher, A.P., Ibáñez, J.M., and Marcaide, J.M. “Parsec-Scale Synchrotron Emission from Hydrodynamic Relativistic Jets in Active Galactic Nuclei,” 1995, *Astrophysical Journal (Letters)*, **449**, L19–L21 + insert plates L2 and L3.
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56. Marscher, A.P. “Probes of the Inner Jets of Blazars,” 1995, *Proc. Nat. Acad. Sci.*, **92**, 11439–11441.
57. Paglione, T.M., Marscher, A.P., Jackson, J.M., and Bertsch, D.L. “Diffuse Gamma-Ray Emission from the Starburst Galaxy NGC 253,” 1996, *Astrophysical Journal*, **460**, 295–302.

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.
59. Bloom, S.D., and Marscher, A.P. “An Analysis of the Synchrotron Self-Compton Model for the Multiwaveband Spectra of Blazars,” 1996, *Astrophysical Journal*, **461**, 657–663.
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61. Marscher, A.P., and Travis, J.P. “Synchrotron Self-Compton Interpretation of Multiwaveband Observations of Gamma-Ray Bright Blazars,” 1996, *Astr. Ap. Suppl.*, **120**, C537–540.
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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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69. Gómez, J.L., Marscher, A.P., Alberdi, A., Martí, J.M., and Ibáñez, J.M. “Subparsec Polarimetric Radio Observations of 3C 120: A Close-Up Look at Superluminal Motion,” 1998, *Astrophysical Journal*, **499**, 221–226.
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71. Georganopoulos, M., and Marscher, A.P. “Modeling the Variability of the BL Lacertae Object PKS 2155–304,” 1998, *Astrophysical Journal (Letters)*, **506**, L11–L14.
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Scheme for BL Lacertae Objects,” 1998, *Astrophysical Journal*, **506**, 621–636.

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