

Charles C. Kankelborg

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Education

Ph.D., September 1996 Department of physics, Stanford University, Stanford, CA. Dissertation: "Multispectral observations of coronal X-ray bright points"

B.S. (summa cum laude, Phi Beta Kappa, Sigma Pi Sigma, Phi Kappa Phi), June 1989
Department of Physics, University of Puget Sound, Tacoma, WA. Honors thesis: "Instabilities of turbulent vortex wakes"

Research Interests

Solar magnetic activity; Coronal loops; X-ray bright points; Image analysis; EUV optics and space instrumentation; Numerical modeling.

Research Experience

2007 - present: Associate Professor, Department of Physics, Montana State University, Bozeman, MT.

2001 - 2007: Assistant Professor, Department of Physics, Montana State University, Bozeman, MT.

April 2001 - August 2001: Research Scientist, Department of Physics, Montana State University, Bozeman, MT. Principal Investigator: "MOSES: A Slitless Multi-Order Solar Extreme Ultraviolet Spectrograph for Fast Imaging Spectroscopy of the Solar Chromosphere and Corona." sounding rocket payload funded for three years by NASA.

August 1996 - April 2001: Postdoctoral Scholar, Department of Physics, Montana State University, Bozeman, MT. Transition Region And Coronal Explorer satellite environmental testing, science operations, observing sequences, automatic exposure control, and data analysis.

Dec 1998 - Dec 1999: Principal Investigator, "Application of three-dimensional, time dependent modeling to a survey of X-ray bright points", NASA SEC Guest Investigator Program.

Jan 1990 - July 1996: Stanford University. Graduate research assistant for Prof. A. B. C. Walker; Multi-Spectral Solar Telescope Array rocket payload. Participated in two successful rocket flights, including calibration of EUV and FUV telescopes, flight software, integration and testing of flight hardware, recovery, and data analysis.

Sep - Dec 1990: Stanford University. Research assistant for Prof. Blas Cabrera. Designed hardware for low temperature physics experiments.

Jun 1988 - Dec 1989: Flow Research, Inc., Kent, WA. DOT Tip Vortex project; performed laboratory simulations of aircraft vortex wakes. Assisted in laser doppler velocimetry experiments.

Summer 1988: University of Puget Sound. Designed and built computer controlled single-vortex dynamics experiment. Isolated self-induction effects and bursting instability previously observed only in twin-vortex systems.

Summer 1987: University of Puget Sound. Independent study and research in fluid mechanics with Prof. A. S. Thorndike. Designed and built gas viscometer; made measurements of atmospheric viscosity.

Professional Societies

Member, American Geophysical Union

Associate Member, Solar Physics Division of the American Astronomical Society

Member, American Scientific Affiliation

Service

I have served on several NASA review panels, including SR& T, Suborbital, MIDEX science review, and TMC reviews for major space missions (2). Referee for The Astrophysical Journal, Solar Physics, and others. Chaired sessions at AAS/SPD meetings.

Public Outreach

I enjoy sharing the exciting results of space science research with the general public. I am a regular volunteer for “Dr. SOHO”, answering solar physics questions posed by visitors to the SOHO web pages. I have given public presentations on science for local church youth gatherings and for the Southwest Montana Astronomical Society. I was privileged to contribute editorial suggestions and a short interview for “Here Comes the Sun”, a planetarium show produced in 2000 by James Manning at the Museum of the Rockies.

Peer Reviewed Publications

1. “Structure of a Transition Region Explosive Event Observed in He II: Transition Region Imaging-Spectroscopy with MOSES”, J. L. Fox, C. C. Kankelborg, and R. J. Thomas, *ApJL*, (2008 in preparation).
2. “Coronal Tomography”, C. C. Kankelborg, *ApJL*, (2008 in preparation).
3. “Fluxon modeling of low-beta plasmas”, C. E. Deforest and C. C. Kankelborg, *Journal of Atmospheric and Terrestrial Physics*, **69**, 116-128, (2007).
4. “An imager with added value for the Solar Orbiter mission”, L. K. Harra, C. C. Kankelborg, R. J. Thomas, J. L. Fox, and B. Winter, *Advances in Space Research*, **36**, 1422-1425, (2005).

5. “SADE: The starspot and dynamo explorer”, P. C. H. Martens, L. W. A. Acton, D. Klumpar, C. Kankelborg, R. A. Stern, G. Peres, and J. L. Culhane, *Advances in Space Research*, **32**, 1123-1124, (2003).
6. “The Relationship Between X-Ray Radiance and Magnetic Flux”, A. A. Pevtsov, G. H. Fisher, L. W. Acton, D. W. Longcope, C. M. Johns-Krull, C. C. Kankelborg, and T. R. Metcalf, *ApJ*, **598**, 1387-1391, (2003).
7. “Topology is destiny: Reconnection energetics in the corona”, D. W. Longcope and C. C. Kankelborg, *Earth, Planets, and Space*, **53**, 571-576, (2001).
8. “Evidence of Separator Reconnection in a Survey of X-Ray Bright Points”, D. W. Longcope, C. C. Kankelborg, J. L. Nelson, and A. A. Pevtsov, *ApJ*, **553**, 429-439, (2001).
9. “High resolution imaging with multilayer telescopes: resolution performance of the MSSTA II Telescopes”, D. S. Martinez-Galarce, A. B. Walker, D. B. Gore, C. C. Kankelborg, R. B. Hoover, T. W. Barbee, and P. F. Boerner, *Optical Engineering*, **39**, 1063-1079, (2000).
10. “On the Nature of the “Moss” Observed by TRACE”, P. C. H. Martens, C. C. Kankelborg, and T. E. Berger, *ApJ*, **537**, 471-480, (2000).
11. “Time Variability of the “Quiet” Sun Observed with TRACE. II. Physical Parameters, Temperature Evolution, and Energetics of Extreme-Ultraviolet Nanoflares”, M. J. Aschwanden, T. D. Tarbell, R. W. Nightingale, C. J. Schrijver, A. Title, C. C. Kankelborg, P. Martens, and H. P. Warren, *ApJ*, **535**, 1047-1065, (2000).
12. “Forward modeling of the coronal response to reconnection in an X-ray bright point”, C. Kankelborg and D. Longcope, *Sol. Phys.*, **190**, 59-77, (1999).
13. “A new view of the solar outer atmosphere by the Transition Region and Coronal Explorer”, C. J. Schrijver, A. M. Title, T. E. Berger, L. Fletcher, N. E. Hurlburt, R. W. Nightingale, R. A. Shine, T. D. Tarbell, J. Wolfson, L. Golub, J. A. Bookbinder, E. E. Deluca, R. A. McMullen, H. P. Warren, C. C. Kankelborg, B. N. Handy, and B. de Pontieu, *Sol. Phys.*, **187**, 261-302, (1999).
14. “The transition region and coronal explorer”, B. N. Handy, L. W. Acton, C. C. Kankelborg, C. J. Wolfson, D. J. Akin, M. E. Bruner, R. Carvalho, R. C. Catura, R. Chevalier, D. W. Duncan, C. G. Edwards, C. N. Feinstein, S. L. Freeland, F. M. Friedlaender, C. H. Hoffmann, N. E. Hurlburt, B. K. Jurcevich, N. L. Katz, G. A. Kelly, J. R. Lemen, M. Levay, R. W. Lindgren, D. P. Mathur, S. B. Meyer, S. J. Morrison, M. D. Morrison, R. W. Nightingale, T. P. Pope, R. A. Rehse, C. J. Schrijver, R. A. Shine, L. Shing, K. T. Strong, T. D. Tarbell, A. M. Title, D. D. Torgerson, L. Golub, J. A. Bookbinder, D. Caldwell, P. N. Cheimets, W. N. Davis, E. E. Deluca, R. A. McMullen, H. P. Warren, D. Amato, R. Fisher, H. Maldonado, and C. Parkinson, *Sol. Phys.*, **187**, 229-260, (1999).

15. “A new view of the solar corona from the transition region and coronal explorer (TRACE)”, L. Golub, J. Bookbinder, E. Deluca, M. Karovska, H. Warren, C. J. Schrijver, R. Shine, T. Tarbell, A. Title, J. Wolfson, B. Handy, and C. Kankelborg, *Physics of Plasmas*, **6**, 2205–2216, (1999).
16. “Coronal Heating by Collision and Cancellation of Magnetic Elements”, D. W. Longcope and C. C. Kankelborg, *ApJ*, **524**, 483–495, (1999).
17. “Observation and Modeling of Soft X-Ray Bright Points. II. Determination of Temperature and Energy Balance”, C. C. Kankelborg, A. B. C. Walker, and R. B. Hoover, *ApJ*, **491**, 952+, (1997).
18. “Observation and Modeling of Soft X-Ray Bright Points. I. Initial Results”, C. C. Kankelborg, A. B. C. Walker, R. B. Hoover, and T. W. Barbee, *ApJ*, **466**, 529+, (1996).
19. “Multi-Spectral Solar Telescope Array. V - Temperature diagnostic response to the optically thin solar plasma”, C. E. Deforest, C. C. Kankelborg, M. J. Allen, E. S. Paris, T. D. Willis, J. F. Lindblom, R. H. O’Neal, A. B. C. Walker, T. W. Barbee, and R. B. Hoover, *Optical Engineering*, **30**, 1125–1133, (1991).
20. “Multi-Spectral Solar Telescope Array. II - Soft X-ray/EUV reflectivity of the multilayer mirrors”, T. W. Barbee, J. W. Weed, R. B. Hoover, M. J. Allen, J. F. Lindblom, R. H. O’Neal, C. C. Kankelborg, C. E. Deforest, E. S. Paris, and A. B. C. Walker, *Optical Engineering*, **30**, 1067–1075, (1991).

Other Publications

1. “Ni/Mg multilayer mirror for 30.4 nm light”, T. Naibert and C. Kankelborg, *Physics of X-Ray Multilayer Structures meeting*, (2008).
2. “The effect of reconnection on a confined flux rope”, L. A. Rachmeler, C. E. Deforest, and C. C. Kankelborg, *AGU Fall Meeting Abstracts*, , A233+, (2007).
3. “Three Dimensional Structure and Time Evolution of a Transition Region Explosive Event Observed in He II”, J. L. Fox, C. C. Kankelborg, R. J. Thomas, and D. Longcope, *AGU Fall Meeting Abstracts*, , A840+, (2007).
4. “Three Dimensional Structure Of A Complex Bipolar Jet: Transition Region Imaging-spectroscopy With MOSES”, L. Fox, C. C. Kankelborg, and D. Longcope, In *American Astronomical Society Meeting Abstracts*, volume 210 of *American Astronomical Society Meeting Abstracts*, pages 95.01–+, (2007).
5. “Fluxon Modeling of Eruptive Events With and Without Reconnection”, C. DeForest, L. Rachmeler, A. Davey, and C. Kankelborg, In *American Astronomical Society Meeting Abstracts*, volume 210 of *American Astronomical Society Meeting Abstracts*, pages 53.05–+, (2007).

6. “Low Cost X-ray Optics for Studying StellarDynamo Cycles”, T. Rust, L. Acton, C. Kankelborg, and P. Martens, In *American Astronomical Society Meeting Abstracts*, volume 210 of *American Astronomical Society Meeting Abstracts*, pages 23.02–+, (2007).
7. “The Sensitivity of Hybrid Differential Stereoscopy for Spectral Imaging”, C. E. DeForest and C. C. Kankelborg, *ArXiv e-prints*, **704**, (2007).
8. “Fluxon Modeling of Active Region Evolution”, C. E. DeForest, C. C. Kankelborg, A. R. Davey, and L. Rachmeler, *AGU Fall Meeting Abstracts*, , B7+, (2006).
9. “Fluxon Modeling of Low-Beta Plasmas”, C. E. DeForest and C. C. Kankelborg, *ArXiv Astrophysics e-prints*, (2006).
10. “First Results From the MOSES Rocket Flight”, C. Kankelborg, J. L. Fox, and R. J. Thomas, In *AAS/Solar Physics Division Meeting*, pages 37.04–+, (2006).
11. “Quantifying The Relationship Between Reconnection Rate And Energy Release In A Survey Of Coronal Bright Points”, A. V. Malanushenko, D. Longcope, E. Aver, and C. Kankelborg, In *AAS/Solar Physics Division Meeting*, pages 10.01–+, (2006).
- 12.
13. “The Hi-C Sounding Rocket Experiment”, L. Golub, J. Cirtain, E. DeLuca, G. Nystrom, C. Kankelborg, D. Klumpar, D. Longcope, and P. Martens, In *AAS/Solar Physics Division Meeting*, pages 06.05–+, (2006).
14. “Narrow-band EUV multilayer coating for the MOSES sounding rocket”, S. M. Owens, J. S. Gum, C. Tarrío, S. Grantham, J. Dvorak, B. Kjornrattanawanich, R. Keski-Kuha, R. J. Thomas, and C. C. Kankelborg, In *Optics for EUV, X-Ray, and Gamma-Ray Astronomy II. Edited by Citterio, Oberto; O’Dell, Stephen L. Proceedings of the SPIE, Volume 5900, pp. 5-13 (2005).*, pages 5–13, (2005).
15. “Fast Inversion of MOSES Data”, C. C. Kankelborg and J. L. Fox, *American Astronomical Society Meeting Abstracts*, **204**, 69.01, (2004).
16. “An imager with added value for the Solar Orbiter mission”, L. Harra, C. Kankelborg, R. Thomas, J. Fox, and B. Winter, In *35th COSPAR Scientific Assembly*, page 1120, (2004).
17. “Data inversion for the Multi-Order Solar Extreme-Ultraviolet Spectrograph”, J. L. Fox, C. C. Kankelborg, and T. R. Metcalf, In *Optical Spectroscopic Techniques and Instrumentation for Atmospheric and Space Research V., Larar, Allen M.; Shaw, Joseph A.; Sun, Zhaobo., eds. Proc. SPIE*, volume 5157, pages 124–132, (2003).
18. “A Fluxon Model for the Behavior of Solar Force-Free Magnetic Fields”, S. Blane McCracken and C. Kankelborg, *APS Meeting Abstracts*, , J6+, (2003).

19. “Measuring EUV Doppler Shifts and Line Widths With the *MOSES* Slitless Spectrograph”, C. C. Kankelborg and J. L. Fox, *American Astronomical Society Meeting*, (2003).
20. “Numerical Modeling of “Velocity Redistribution” in the Solar Transition Region”, J. L. Fox and C. C. Kankelborg, *American Astronomical Society Meeting*, (2003).
21. “Fast EUV Imaging and Spectroscopy”, C. C. Kankelborg, *OpTeC Meeting, Museum of the Rockies, Bozeman, MT*, (2002).
22. “A Parametric Inversion Technique for MOSES Data”, J. L. Fox and C. C. Kankelborg, *American Astronomical Society Meeting*, **200**, (2002).
23. “Forward Modeling of MOSES Response to the Solar Atmosphere”, M. J. S. Cirtain, C. C. Kankelborg, and M. Reiser, *American Astronomical Society Meeting*, **200**, (2002).
24. “The Importance of Plasma Viscosity in Narrow Band Bright Point Observations”, R. A. McMullen, D. W. Longcope, and C. C. Kankelborg, *American Astronomical Society Meeting*, **200**, (2002).
25. “Sensitivity of MOSES to Chromospheric Spectral Line Profiles”, C. C. Kankelborg, *American Astronomical Society Meeting*, **200**, (2002).
26. “Nanoflare Modeling of an X-Ray Bright Point Coronal Loop”, R. A. McMullen, D. W. Longcope, and C. C. Kankelborg, In *Multi-Wavelength Observations of Coronal Structure and Dynamics*, page 95, (2002).
27. “Simulations of an X-Ray Bright Point’s Evolution”, R. A. McMullen, D. W. Longcope, D. E. McKenzie, and C. K. Kankelborg, *AGU Fall Meeting Abstracts*, , C726+, (2001).
28. “Optical Design of the MOSES Sounding Rocket Experiment”, R. J. Thomas and C. C. Kankelborg, *American Astronomical Society Meeting*, **199**, (2001).
29. “Fluxon Modeling of Force Free Magnetic Fields: Voronoi Method”, C. E. DeForest, C. C. Kankelborg, and D. W. Longcope, *AGU Spring Meeting Abstracts*, , 41, (2001).
30. “Lagrangian Modeling of Force Free Fields and Current Sheets: Fluxon representation and the Kernel Method”, C. C. Kankelborg, D. W. Longcope, and C. E. DeForest, *AGU Spring Meeting Abstracts*, , 41, (2001).
31. “Modeling the Coronal Loop of an X-ray Bright Point”, R. A. McMullen, C. C. Kankelborg, and D. W. Longcope, *AGU Spring Meeting Abstracts*, , 41, (2001).
32. “A Reflight of the Explorer-1 Science Mission: The Montana EaRth Orbiting Pico Explorer (MEROPE)”, D. M. Klumpar, M. Omland, G. Hunyadi, S. Jepsen, B. Larsen, C. Kankelborg, and W. Hiscock, *AGU Spring Meeting Abstracts*, , 52, (2001).

33. “The Montana State University NASA Space Grant Explorer-1 Science Reflight Commemorative Mission”, M. Obland, G. Hunyadi, S. Jepsen, B. Larsen, D. M. Klumpar, C. Kankelborg, and W. A. Hiscock, In *Proc. Fifteenth Annual AIAA/USU Conference on Small Satellites*, (2001).
34. “Simultaneous imaging and spectroscopy of the solar atmosphere: advantages and challenges of a 3-order slitless spectrograph”, C. C. Kankelborg and R. J. Thomas, In *Visible Space Instrumentation for Astronomy and Solar Physics*, Oswald H. Siegmund; Silvano Fineschi; Mark A. Gummin; Eds., *Proc. SPIE*, volume 4498, pages 16–26, (2001).
35. “Simultaneous Imaging and Spectroscopy”, Charles C. Kankelborg, Petrus C. Martens, and Roger J. Thomas, In *Solar Encounter: Proc. 1st Solar Orbiter Workshop*, pages 257–260, (2001).
36. “Scientific Objectives of the EUV Spectral Imager for Solar Orbiter”, Petrus C. Martens and Charles C. Kankelborg, In *Solar Encounter: Proc. 1st Solar Orbiter Workshop*, pages 293–296, (2001).
37. “Solar Plumbing? Constraints on the 3D geometry of constant-width coronal loops.”, P. C. H. Martens and C. C. Kankelborg, *AAS/Solar Physics Division Meeting*, **32**, (2000).
38. “Solar Public Outreach on a Shoestring Budget: A Community Approach”, M. B. Larson, C. K. Kankelborg, and D. W. Longcope, *AAS/Solar Physics Division Meeting*, **32**, (2000).
39. “Having Our Cake and Eating it, Too: Fast Imaging Spectroscopy With a Multi-Order Slitless Spectrograph”, C. C. Kankelborg, D. W. Longcope, and P. C. H. Martens, *AAS/Solar Physics Division Meeting*, **32**, (2000).
40. “X-ray bright points: A case study in solar reconnection”, D. Longcope and C. Kankelborg, *Bulletin of the American Astronomical Society*, **32**, 845, (2000).
41. “VLA Decimetric Observations of EUV Transient Events Detected by SOHO and TRACE”, R. F. Willson and C. Kankelborg, In *ESA SP-446: 8th SOHO Workshop: Plasma Dynamics and Diagnostics in the Solar Transition Region and Corona*, J.-C. Vial and B. Kaldeich-Schü, editors, page 715, (1999).
42. “On the Nature of the “Moss” Observed by TRACE”, P. C. H. Martens and C. C. Kankelborg, *Bulletin of the American Astronomical Society*, **31**, 963, (1999).
43. “Heating from X-ray Bright Points in the Quiet Sun Corona: A Quantitative Model”, D. W. Longcope and C. C. Kankelborg, *Bulletin of the American Astronomical Society*, **31**, 849, (1999).
44. “A Survey of X-ray Bright Points: Implications for a Reconnection Model”, C. C. Kankelborg, J. Nelson, D. W. Longcope, and A. A. Pevtsov, *Bulletin of the American Astronomical Society*, **31**, 849, (1999).

45. “High-resolution imaging with multilayer telescopes: resolution performance of the MSSTA II telescopes”, D. S. Martinez-Galarce, A. B. Walker, D. B. Gore, C. C. Kankelborg, R. B. Hoover, T. W. Barbee, and P. F. Boerner, In *X-Ray Optics, Instruments, and Missions II*, Richard B. Hoover; Arthur B. Walker; Eds., *Proc. SPIE*, volume 3766, pages 275–298, (1999).
46. “The TRACE Mission: Initial Scientific Results”, A. M. Title, T. D. Tarbell, J. Wolfson, K. Schrijver, R. R. Fisher, T. Gang, L. Golub, R. A. McMullen, C. Kankelborg, and TRACE Collaboration, *Bulletin of the American Astronomical Society*, **30**, 1398, (1998).
47. “The TRACE Mission”, J. Wolfson, M. Bruner, B. Jurcevich, J. Lemen, K. Schrijver, R. Shine, K. Strong, T. Tarbell, A. Title, L. Golub, J. Bookbinder, E. Deluca, L. Acton, B. Handy, C. Kankelborg, and R. Fisher, *Bulletin of the American Astronomical Society*, **29**, 887, (1997).
48. “Observation and Modeling of Soft X-ray Bright Points. II. Determination of Temperature and Energy Balance”, C. C. Kankelborg, A. B. C. Walker, II, and R. B. Hoover, *Bulletin of the American Astronomical Society*, **29**, 885, (1997).
49. “Multispectral Observations of Coronal X-Ray Bright Points”, C. C. Kankelborg, *Ph.D. Thesis*, (1996).
50. “Design and performance of thin foil XUV filters for the Multi-Spectral Solar Telescope Array II”, J. E. Plummer, C. E. DeForest, D. S. Martinez-Galarce, C. C. Kankelborg, D. B. Gore, R. H. O’Neal, A. B. Walker, F. R. Powell, R. B. Hoover, T. W. Barbee, and J. W. Weed, In *Proc. SPIE Vol. 2515, p. 565-575, X-Ray and Extreme Ultraviolet Optics*, Richard B. Hoover; Arthur B. Walker; Eds., volume 2515, pages 565–575, (1995).
51. “Optical focusing and alignment of the Multi-Spectral Solar Telescope Array II payload”, D. B. Gore, J. B. Hadaway, R. B. Hoover, A. B. Walker, and C. C. Kankelborg, In *Proc. SPIE Vol. 2515, p. 532-543, X-Ray and Extreme Ultraviolet Optics*, Richard B. Hoover; Arthur B. Walker; Eds., volume 2515, pages 532–543, (1995).
52. “Calibration of multilayer mirrors for the Multi-Spectral Solar Telescope Array II”, C. C. Kankelborg, J. E. Plummer, D. S. Martinez-Galarce, R. H. O’Neal, C. E. DeForest, A. B. Walker, T. W. Barbee, J. W. Weed, R. B. Hoover, and F. R. Powell, In *Proc. SPIE Vol. 2515, p. 436-444, X-Ray and Extreme Ultraviolet Optics*, Richard B. Hoover; Arthur B. Walker; Eds., volume 2515, pages 436–444, (1995).
53. “Multi-Spectral Solar Telescope Array VIII: the second flight”, A. B. Walker, M. J. Allen, C. E. DeForest, C. C. Kankelborg, D. S. Martinez-Galarce, J. E. Plummer, R. B. Hoover, T. W. Barbee, and D. B. Gore, In *Proc. SPIE Vol. 2515, p. 182-193, X-Ray and Extreme Ultraviolet Optics*, Richard B. Hoover; Arthur B. Walker; Eds., volume 2515, pages 182–193, (1995).

54. "Observation and Modeling of Soft X-Ray Bright Points in the Solar Corona", C. C. Kankelborg, A. B. C. Walker, Jr., R. B. Hoover, and T. W. Barbee, Jr., *Bulletin of the American Astronomical Society*, **27**, 964, (1995).
55. "Performance of the multilayer-coated mirrors for the MultiSpectral Solar Telescope Array", M. J. Allen, T. D. Willis, C. C. Kankelborg, R. H. O'Neal, D. S. Martinez-Galarce, C. E. Deforest, L. R. Jackson, J. D. Plummer, A. B. Walker, T. W. Barbee, J. W. Weed, and R. B. Hoover, In *Proc. SPIE Vol. 2011, p. 381-390, Multilayer and Grazing Incidence X-Ray/EUV Optics II, Richard B. Hoover; Arthur B. Walker; Eds.*, volume 2011, pages 381–390, (1994).
56. "Calibration of the Multi-Spectral Solar Telescope Array multilayer mirrors and XUV filters", M. J. Allen, T. D. Willis, C. C. Kankelborg, R. H. O'Neal, D. S. Martinez-Galarce, C. E. Deforest, L. Jackson, J. Lindblom, A. B. C. Walker, and T. W. Barbee, In *Multilayer and grazing incidence X-ray/EUV optics for astronomy and projection lithography; Proceedings of the Meeting, San Diego, CA, July 19-22, 1992 (A93-39601 15-74)*, volume 1742, pages 562–574, (1993).
57. "Narrow band solar images in the soft X-ray regime with multilayer optics", A. B. C. Walker, C. C. Kankelborg, R. B. Hoover, T. W. Barbee, and P. C. Baker, In *Multilayer and grazing incidence X-ray/EUV optics; Proceedings of the Meeting, San Diego, CA, July 22-24, 1991 (A93-39658 15-74)*, pages 345–352, (1992).
58. "The Multi-Spectral Solar Telescope Array. II - Soft X-ray/EUV reflectivity of the multilayer mirrors", T. W. Barbee, J. W. Weed, R. B. C. Hoover, M. J. Allen, J. F. Lindblom, R. H. O'Neal, C. C. Kankelborg, C. E. Deforest, E. S. Paris, and A. B. C. Walker, In *Multilayer and grazing incidence X-ray/EUV optics; Proceedings of the Meeting, San Diego, CA, July 22-24, 1991 (A93-39658 15-74)*, volume 1546, pages 432–445, (1992).
59. "Narrow band solar images in the soft X-ray regime with multilayer optics", A. B. C. Walker, C. C. Kankelborg, R. B. Hoover, T. W. Barbee, and P. C. Baker, In *Multilayer and grazing incidence X-ray/EUV optics; Proceedings of the Meeting, San Diego, CA, July 22-24, 1991 (A93-39658 15-74)*, volume 1546, pages 345–352, (1992).
60. "Performance of the Multi-Spectral Solar Telescope Array V: temperature diagnostic response to the optically thin solar plasma", C. E. Deforest, C. C. Kankelborg, M. J. Allen, E. S. Paris, T. D. Willis, J. F. Lindblom, R. H. O'Neal, A. B. Walker, T. W. Barbee, R. B. Hoover, T. W. Barbee, and E. S. Gluskin, In *Proc. SPIE, X-Ray/EUV Optics for Astronomy, Microscopy, Polarimetry, and Projection Lithography, Richard B. Hoover; Arthur B. Walker; Eds.*, volume 1343, pages 404–414, (1991).
61. "The Ultra High Resolution XUV Spectroheliograph. II - Predicted performance", A. B. C. Walker, J. F. Lindblom, J. G. Timothy, M. J. Allen, C. E. Deforest, C. Kankelborg, R. H. O'Neal, E. S. Paris, T. Willis, and T. W. Barbee, In *X-ray/EUV optics for astronomy, microscopy, polarimetry, and projection lithography; Proceedings of the*

Meeting, San Diego, CA, July 9-13, 1990 (A92-25201 09-74). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, volume 1343, pages 319–333, (1991).

62. “Multi-Spectral Solar Telescope Array”, A. B. C. Walker, M. J. Allen, C. Deforest, C. Kankelborg, J. F. Lindblom, R. H. O’Neal, E. Paris, R. B. Hoover, and T. W. Barbee, *BAAS*, **22**, 808, (1990).
63. “Performance of compact multilayer coated telescopes at soft x-ray/EUV and far-ultraviolet wavelengths I”, R. B. Hoover, T. W. Barbee, P. C. Baker, J. F. Lindblom, M. J. Allen, C. E. Deforest, C. C. Kankelborg, R. H. O’Neal, E. S. Paris, and A. B. Walker, In *Proc. SPIE Vol. 1235, p. 821-832, Instrumentation in Astronomy VII, David L. Crawford; Ed.*, volume 1235, pages 821–832, (1990).