

Craig L. Sarazin

Biographical Data

BORN: August 11, 1950; Milwaukee, Wisconsin USA

CHILDREN: Stephen Neil, February 7, 1976
Andrew Thomas, November 9, 1978

OFFICE ADDRESS: Department of Astronomy
University of Virginia
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EDUCATION: Ph.D. Physics, Princeton University, Princeton, NJ, 1975
M.A. Physics, Princeton University, Princeton, NJ, 1973
B.S. Physics, California Institute of Technology, Pasadena,
CA, 1972
Ph.D. thesis, *The Role of Dust in H II Regions*, John N.
Bahcall, supervisor.

EDUCATIONAL AWARDS
AND HONORS: Haren Lee Fisher Physics Prize, California Institute of Tech-
nology, 1971.
National Science Foundation Graduate Fellow, 1972–1975.
National Merit Scholar, 1968–1972.

PROFESSIONAL SOCIETIES: American Astronomical Society
High Energy Astrophysics Division, AAS
International Astronomical Union
Commission 28: Galaxies, IAU
Commission 34: Interstellar Medium, IAU
Astronomical Society of the Pacific, University Liaison
COSPAR Associate, Member of Scientific Commission E

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Professional Experience

- CURRENT POSITION: W. H. Vanderbilt Professor of Astronomy, University of Virginia, Charlottesville, VA, 1997–.
- LONG TERM POSITIONS: Chairman of the Department of Astronomy, Director of McCormick Observatories, and Director of the Virginia Institute of Theoretical Astronomy, University of Virginia, Charlottesville, VA, 1992–1995.
- Professor of Astronomy, University of Virginia, Charlottesville, VA, 1987–1996.
- Associate Professor of Astronomy, University of Virginia, Charlottesville, VA, 1980–1987.
- Assistant Professor of Astronomy, University of Virginia, Charlottesville, VA, 1977–1980.
- Member, School of Natural Science, Institute for Advanced Study, Princeton, NJ, 1975–1977.
- VISITING POSITIONS: Visiting Scientist, Inter-University Centre for Astronomy and Astrophysics, Pune, India, 1995
- Visiting Scientist, Space Telescope Science Institute, Baltimore, MD, 1993–1995.
- Visiting Professor, Physics Department, Scuola Normale, Pisa, Italy, 1992.
- Visiting Fellow, Institute of Astronomy, Cambridge University, Cambridge, UK, 1987.
- Visiting Fellow, Joint Institute for Laboratory Astrophysics, University of Colorado and the National Bureau of Standards, Boulder, CO 1985–1986.
- Visiting Professor of Physics, School of Natural Science, Institute for Advanced Study, Princeton, NJ, 1981–1982.
- Visiting Associate Scientist, National Radio Astronomy Observatory, Charlottesville, VA, summers 1979–1981.
- Visiting Member, School of Natural Science, Institute for Advanced Study, Princeton, NJ, 1980.
- Visiting Assistant Professor of Astronomy, University of California, Berkeley, CA 1979.

Visiting Assistant Scientist, National Radio Astronomy Observatory, Charlottesville, VA, summers 1977–1978.

Visiting Fellow, Institute of Astronomy, Cambridge University, Cambridge, UK, 1976.

Robert Millikan Fellow, Physics Department, California Institute of Technology, summer 1975.

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Committees: Professional

- Chair, Astronomy and Space Physics Science Council, Universities Space Research Association, 2004–
- Member, National Research Council, Beyond Einstein Program Assessment Committee, 2006–
- Member, Astronomy and Space Physics Science Council, Universities Space Research Association, 2000–
- Member, Scientific Organizing Committee, meeting on “Heating vs. Cooling in Galaxies and Clusters of Galaxies,” Garching, Germany, 2005–2006
- Member, Clusters Proposal Review Panel, Chandra Cycle 8, 2006
- Member, Extragalactic Proposal Review Panel, Hubble Space Telescope Cycle 13, 2004
- Member, Scientific Organizing Committee, meeting on “A Pan-Chromatic View of Clusters of Galaxies and the Large-Scale Structure,” Tonantzintla, Mexico, 2005
- Member, Scientific Organizing Committee, meeting on “Galaxies Viewed with Chandra,” Cambridge, MA, 2004
- Member, Scientific Organizing Committee, meeting on “Cosmic Rays and Magnetic Fields in Large Scale Structure,” Busan, Korea, 2004.
- Member, Review Panel for XMM/Newton Cycle 3 Proposals, 2003
- Member, Scientific Organizing Committee, meeting on “The Riddle of Cooling Flows,” Charlottesville, Va., 2002–2003
- Member, Scientific Organizing Committee, Soft X-ray Emission from Clusters of Galaxies and Related Phenomena, Huntsville, AL, 2002
- Member, Scientific Organizing Committee, meeting of the Southeastern Section of the American Physical Society, Auburn, AL, 2002
- Member, Scientific Organizing Committee, The Future of Extreme Ultraviolet Astronomy, Albuquerque, NM, 2002
- Member, NASA Chandra Cycle-3 Final Proposal Review Panel, 2001
- Chair, NASA Chandra Users Committee, 1997–2001
- Member, NASA Chandra Users Committee, 1993–2001
- Member, Scientific Organizing Committee, The High Energy Universe at Sharp Focus: Chandra Science, Minnesota, 2000–2001
- Member, Scientific Organizing Committee, IAP 2000 Conference on Constructing the Universe with Clusters of Galaxies, Paris, France, 2000
- Member, NASA Astro-E Users Committee, 1999–2000
- Internal Referee, Report of Astronomy and Astrophysics Survey Committee, National Research Council 1999–2000
- Member, High Energy Astrophysics from Space Panel, Astronomy and Astrophysics Survey Committee, National Research Council 1998–2000
- Member, NASA ASCA Users Committee, 1995–2000
- Member, NASA Working Group on X-ray Astronomy, 1989–1999
- Member, Heineman Prize Committee, American Astronomical Society, 1995–1998
- Member, Scientific Organizing Committee, Ringberg Workshop on “Diffuse Thermal and Relativistic Plasma in Galaxy Clusters,” Ringberg, Germany, 1997–1999
- Member, Scientific Organizing Committee, ASCA “Cherry Blossom” US-Japanese Conference on X-ray Astronomy, Washington, DC, 1997
- Member, Review Panel on a New Science Strategy for Space Astronomy and Astrophysics, Space Studies Board, National Academy of Sciences, 1996–1997
- Member, Scientific Organizing Committee, Conference on X-ray Imaging and Spectroscopy of Cosmic Hot Plasmas, Tokyo, 1996

Member, Scientific Organizing Committee, Conference on Cluster Cooling Flows, Israel, 1996

Member, Time Allocation Committee, Kitt Peak National Observatory, 1995

Member, NASA Long Term Space Astrophysics Review Panel, 1994

Member, Scientific Organizing Committee, Aspen Astrophysics Workshop on the Physics of Clusters of Galaxies, 1994.

Member, Scientific Organizing Committee, Moriond Astrophysics Conference on Clusters of Galaxies, 1994.

Chairman, NASA ASCA Extragalactic Review Panel, 1993.

Member, External Visiting Committee for Astronomy, University of Maryland, 1992.

Member, NASA ROSAT Review Panel, 1992.

Member, NASA Review Panel on High Energy Astrophysics Theory, 1991.

Member, Scientific Organizing Committee, NATO Advanced Study Workshop on Clusters and Superclusters of Galaxies, 1990–1991.

Chairman, Proposal Review Panel on Clusters of Galaxies for ROSAT, NASA, 1989.

Chairman, Scientific Organizing Committee, meeting on “Dark Matter in the Universe,” Southeastern Section, American Physical Society, 1989

Member, Committee on Space Astronomy and Astrophysics, Space Science Board, National Academy of Sciences, 1984–1988

Member, Scientific Organizing Committee, IAU. Colloquium 115 on High Resolution X-ray Spectroscopy of Cosmic Plasmas, 1988

Member, Scientific Organizing Committee, NATO Advanced Study Workshop on Cooling Flows in Galaxies and Clusters, 1987

Chairman, Scientific Organizing Committee, Institute for Advanced Study Workshop on X-ray Emission from Clusters of Galaxies, 1981

Committees: University

Member, Review Panel for FEST proposals, 2002

Member, Faculty Senate, University of Virginia, 1997–2001

Member, Promotions and Tenure Committee, College of Arts and Sciences, 1998–1999, 2000–2001

Member, Committee on Research and Scholarship, Faculty Senate, University of Virginia, 1997–1999

Chair, Ad Hoc Committee to Recommend Chair of Astronomy Department, College of Arts and Sciences, 1998

Member, Ad Hoc Subcommittee on a Faculty Center, Faculty Senate, University of Virginia, 1997–1998

Member, Ad Hoc Committee to Recommend Chair of Physics Department, College of Arts and Sciences, 1996

Member, Computing Committee, College of Arts and Sciences, 1992–1995

Member, Executive Committee, Faculty Forum for Scientific Research, 1991–1992

Member, Academic Computing Subcommittee, Committee on Information Technology and Communications, 1991–1992

Member, Faculty Forum for Scientific Research, 1988–1992

Member, Ad Hoc Subcommittee on Relocation of the Academic Computing Center, Committee on Information Technology and Communications, 1991–1992

Member, Academic Advisory Committee, College of Arts and Sciences, 1987–1992

Member, Advisory Committee, Institute of Nuclear and Particle Physics, Associate Provost for Research, 1987–1992

Member, University Computer Policy Committee, Associate Provost for Research, 1989–1991

Member, Selection Committee, Academic Computing Center Unix Computer Systems, Associate Provost for Research, 1990
Member, Ad Hoc Committee on a Faculty Grievance, College of Arts and Sciences, 1989–1990
Member, Subcommittee on Advanced Computing Resources, Computer Policy Committee, 1988–89
Member, ROTC Advisory Committee, 1978–79

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Grants as PI or Co-PI

Present

- National Aeronautics and Space Administration, Chandra Cycle 4, *Low Mass X-ray Binaries and Globular Clusters in Virgo Early-Type Galaxies*, CXC GO3-4099X (U.Va. 118198-101-GG10505-31671), November 2002 – November 2005, \$40,513, PI.
- National Aeronautics and Space Administration, Chandra Cycle 4 E/PO, *Black Holes, Seeing the Unseeable: A Planetarium Show at the Science Museum of Virginia*, an E/PO grant associated with *Low Mass X-ray Binaries and Globular Clusters in Virgo Early-Type Galaxies*, CXC GO3-4099X (U.Va. 118198-101-GG10505-31671), November 2002 – November 2005, \$14,995, PI.
- National Aeronautics and Space Administration, XMM Cycle 2, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, NAG5-13645 (U.Va. 119815-101-GP10075-31671), September 2003 – September 2005, \$38,000, PI.
- National Aeronautics and Space Administration, XMM Cycle 2, *Radio Halos and Relics and Merger Shocks in Clusters of Galaxies*, NAG5-13737 (U.Va. 119932-101-GP10077-31671), September 2003 – September 2005, \$36,000, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *Using the Chandra Archive To Study Low Mass X-ray Binaries & Globular Clusters in Virgo & Non-Virgo Early-Type Galaxies*, AR4-5008X (U.Va. 120344-101-GG10591-31671), January 2004 – January 2006, \$30,520, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *Deep Chandra and Hubble Observations NGC 4697, the Nearest Optically Luminous, X-ray Faint Elliptical Galaxy*, GO4-5093X (U.Va. 120375-101-GG10593-31671), January 2004 – January 2006, \$74,399, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *What Bends the Lobes of WAT Radio Sources in Isolated Environments - Are They in Fossil Groups?*, GO4-5150X (U.Va. 120345-101-GG10592-31671), January 2004 – January 2006, \$49,470, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *The HIFLUGCS Cluster Survey: A Cornerstone for Cosmology*, GO4-5132X (U.Va. 120417-101-GG10596-31671), January 2004 – January 2006, \$50,744, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *Probing the Complex Structure in the Core of Abell 2029*, GO4-5149X (U.Va. 120424-101-GG10597-31671), January 2004 – January 2006, \$42,199, PI.
- National Aeronautics and Space Administration, Hubble Cycle 12, *Deep Chandra and Hubble Observations NGC 4697, the Nearest Optically Luminous, X-ray Faint Elliptical Galaxy*, HST-GO-10003.01-A (U.Va. 120552-101-GG10606-31671), February 2004 – January 2007, \$8,959, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *Chandra Observations of Galaxy Clusters with Large cD Galaxy Peculiar Velocities*, GO4-5137X (U.Va. 121007-101-GG10616-31671), May 2004 – May 2006, \$47,567, PI.
- National Aeronautics and Space Administration, Chandra X-ray Center, *Formation, Evolution, and Dynamics of Compact Objects in the Galaxy: Chandra Postdoctoral Fellowship for Dr. Eric D. Pfahl*, CXC PF4-50024 (U.Va. 121370-101-GG10635-31671), August 2004 - July 2005, \$101,693, PI.
- Virginia Space Grant Consortium, *Chandra X-ray Observations X-ray Binaries in Elliptical Galaxies: Graduate Fellowship for Greg Sivakoff*, (U.Va. 121318-101-GG10630-31670), August 2004 – May 2006, \$10,000, PI.
- National Aeronautics and Space Administration, XMM Cycle 3, *X-Ray Emission from Fila-*

- mentary Radio Relics & Mergers in Clusters of Galaxies*, NNG04GO34G (U.Va. 121658-101-GP10085-31671), August 2004 – August 2006, \$8,400, PI.
- National Aeronautics and Space Administration, XMM Cycle 3, *The Physics of Cooling Flow Clusters with Central Radio Sources*, NNG04GO80G (U.Va. 121695-101-GP10086-31671), August 2004 – August 2006, \$38,300, PI.
- National Aeronautics and Space Administration, XMM Cycle 3, *The Complex Dynamics of the Thermal and Nonthermal Intracluster Gas*, NNG04GP46G (U.Va. 121776-101-GP10087-31671), September 2004 – August 2006, \$41,600, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *Filamentary Radio Relics in Clusters of Galaxies: Radio Bubbles or Merger Shocks?*, GO4-5133X (U.Va. 122091-101-GG10663-31671), September 2004 – September 2006, \$43,450, PI.
- National Aeronautics and Space Administration, XMM Cycle 3, *Abell 520: A Complex Merging Cluster with an Unusual Radio Halo*, NNG05GA34G (U.Va. 122124-101-GP10090-31671) September 2004 – September 2006, \$44,000, PI.
- National Aeronautics and Space Administration, Chandra Cycle 6 EPO, *Stellar Evolution Planetarium Show at the Science Museum of Virginia*, an E/PO grant associated with *Low Mass X-ray Binaries and Globular Clusters in the Early-Type Galaxy NGC 4365*, CXC GO5-6086X (U.Va. 122627-101-GG10021-31671), January 2005 – December 2006, \$26,155, PI.
- National Aeronautics and Space Administration, Chandra Cycle 6, *The Interaction between Cluster Central Radio Sources and Cooling Flows*, CXC GO5-6126X (U.Va. 123008-101-GG10302-31671), March 2005 – March 2007, \$31,899, PI.
- National Aeronautics and Space Administration, Chandra Cycle 6, *Stellar Mass Loss Versus External Accretion in the X-ray Bright Elliptical NGC 5813*, CXC GO5-6081X, (U.Va. 123075-101-GG10275-31671), April 2005 – April 2007, \$33,940, PI.
- National Aeronautics and Space Administration, Chandra Cycle 6, *Low Mass X-ray Binaries and Globular Clusters in the Early-Type Galaxy NGC 4365*, CXC GO5-6086X (U.Va. 122627-101-GG10021-31671), May 2005 – May 2007, \$71,179, PI.
- National Aeronautics and Space Administration, XMM Cycle 4, *The Local Galaxy Cluster Mass Function of the Brightest Clusters in the Sky*, NNG05GO50G (U.Va. 124073-101-GP10103-31671), August 2005 – August 2007, \$36,800, PI.
- National Aeronautics and Space Administration, Hubble Cycle 14, *Resolving the Connection Between Globular Clusters and Low-Mass X-ray Binaries*, HST-GO-10597.03 (U.Va. 124340-101-GG10759-31671), November 2005 – October 2007, \$10,292, PI.
- National Aeronautics and Space Administration, Hubble Cycle 14, *Probing The Galaxy-wide Globular Cluster — Low Mass X-ray Binary Connection in Early-type Galaxies*, HST-GO-10582.02 (U.Va. 124877-101-GG10782-31671), December 2005 – November 2007, \$47,946, PI.
- National Aeronautics and Space Administration, XMM Cycle 4, *The Physics of Cooling Flow Clusters with Central Radio Sources*, NNG06GD54G (U.Va. 124992-101-GP10110-31671), February 2006 – February 2007, \$43,400, PI.
- National Aeronautics and Space Administration, XMM Cycle 5, *Understanding Gas Interactions in Groups: NGC 1600*, NNX06AE78G (U.Va. 126314-101-GP10115-31671). August 2006 – July 2007, \$64,366, PI.
- National Aeronautics and Space Administration, Suzaku Cycle 1, *Nailing Down the Hard X-ray Inverse Compton Emission from the Radio Halo in the Coma Cluster*, NNX06AI44G, September 2006 – September 2007, \$51,401, PI.
- National Aeronautics and Space Administration, Suzaku Cycle 1, *Hard X-ray Inverse Compton Emission and a Merger Shock Associated with the Brightest Known Radio Relic in Abell 3667*, NNX06AI37G, September 2006 – September 2007, \$42,560, PI.

Approved But No Funds Yet Received

- National Aeronautics and Space Administration, Chandra Cycle 7, *A High Resolution Study of Interstellar Absorption*, May 2006 – May 2007, \$61,107, PI.
- National Aeronautics and Space Administration, XMM Cycle 5, *Mass Constraints on High Redshift Clusters of Galaxies with XMM-Newton*, August 2006 – August 2007, \$55,418, PI.
- National Aeronautics and Space Administration, XMM Cycle 5, *The Local Galaxy Cluster Mass Function of the Brightest Clusters in the Sky - I*, August 2006 – August 2007, \$40,044, PI.
- National Aeronautics and Space Administration, Hubble Cycle 15, *Probing the Globular Cluster / Low Mass X-ray Binary Connection in Early-type Galaxies at Low X-ray Luminosities*, August 2006 – August 2008, \$39,951 PI.

Past

- National Aeronautics and Space Administration, Chandra Cycle 4, *The HIFLUGCS Cluster Survey: A Cornerstone for Cosmology*, GO3-4160X (U.Va. 118642-101-GG10523-31671), March 2003 – March 2005, \$97,279, PI.
- National Aeronautics and Space Administration, Chandra Cycle 4, *A High Redshift ($z = 0.95$) Cluster Revealed by a FIRST Bent-Double Radio Source*, GO3-4155X (U.Va. 118727-101-GG10525-31671), March 2003 – March 2005, \$28,515, PI.
- National Aeronautics and Space Administration, XMM Cycle 2, *The Origin of the Disturbed Cool Core and Filamentary Radio Source in Abell 133*, NAG5-13088 (U.Va. 118567-101-GP10068-31671), March 2003 – March 2005, \$38,000, PI.
- National Aeronautics and Space Administration, XMM Cycle 2, *The Physics of Cooling Flow Clusters with Central Radio Sources*, NAG5-13089 (U.Va. 118570-101-GP10069-31671), March 2003 – March 2005, \$38,000, PI.
- National Aeronautics and Space Administration, Chandra Cycle 3, *The Interaction Between Cluster Central Radio Sources and Cooling Flows*, GO2-3160X (U.Va. 118403-101-GG10515-31671), February 2003 – February 2005, \$29,064, PI.
- National Aeronautics and Space Administration, Chandra Cycle 3 E/PO, *The Largest Structures in the Universe: Exhibits for the McCormick Observatory E/PO Program*, an E/PO grant associated with *The Interaction Between Cluster Central Radio Sources and Cooling Flows*, GO2-3160X (U.Va. 118403-101-GG10516-31671), February 2003 – February 2005, \$9,995, PI.
- National Aeronautics and Space Administration, Chandra Cycle 4, *The HIFLUGCS / Chandra Archive Cluster Survey: A Cornerstone for Cosmology*, CXC AR3-4014X (U.Va. 118245-101-GG10510-31671), December 2002 – December 2004, \$28,000, PI.
- National Aeronautics and Space Administration, Chandra Cycle 4, *Low Mass X-ray Binaries and Globular Clusters in Virgo and Non-Virgo Early-Type Galaxies from the Chandra Archive*, CXC AR3-4005X (U.Va. 118256-101-GG10511-31671), December 2002 – December 2004, \$38,000, PI.
- National Aeronautics and Space Administration, Chandra Cycle 3, *Resolving the X-Ray Binary Population in Early-Type Galaxies*, CXC GO2-3099X (U.Va. 118034-101-GG10498-31671), November 2002 – November 2004, \$34,200, PI.
- National Aeronautics and Space Administration, Chandra Cycle 3, *Merger Shocks in Clusters of Galaxies*, CXC GO2-3159X (U.Va. 117485-101-GG10480-31671), August 2002 – August 2004, \$40,305, PI.
- National Aeronautics and Space Administration, Chandra Cycle 3 EPO, *Space Travels: A New Component on X-ray Astronomy for the Science Museum of Virginia's Traveling Exhibition and Program for Schools and Communities*, an E/PO grant associated with

- Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, CXC GO2-3100X (U.Va. 117269-101-GG10483-31671), August 2002 – August 2004, \$9,995, PI.
- National Aeronautics and Space Administration, Chandra Cycle 3, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, CXC GO2-3100X (U.Va. 117269-101-GG10473-31671), August 2002 – August 2004, \$66,068, PI.
- National Aeronautics and Space Administration, Chandra Cycle 5, *The Formation of Wide-Angle Tailed Radio Sources: Interaction Between the Radio Lobes and the Intracluster Medium*, March 2004 – August 2004, \$37,417, PI, transferred to Dr. Elizabeth Blanton at Boston University when she left U.Va.
- National Aeronautics and Space Administration, Chandra X-ray Center, *The Interactions between Radio Lobes and X-ray Gas in Clusters and Groups: Chandra Postdoctoral Fellowship for Dr. Elizabeth L. Blanton*, CXC PF1-20017 (U.Va. 114060-101-GG10355-89898) August 2001 - July 2004, \$229,282, PI.
- Virginia Space Grant Consortium, *X-ray Observations of Elliptical Galaxies: Graduate Fellowship for Scott Randall*, (U.Va. 116869-101-GG10454-3167), June 2002 – May 2004, \$10,000, PI.
- National Aeronautics and Space Administration, XMM Cycle 1, *Merger Shocks in Clusters of Galaxies*, NAG5-10075 (U.Va. 5-28810) November 2000 – November 2003, \$38,700, PI.
- National Aeronautics and Space Administration, XMM Cycle 1, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, NAG5-10074 (U.Va. 5-28811), November 2000 – November 2003, \$40,000, PI.
- National Aeronautics and Space Administration, Chandra Cycle 2, *The Interaction between Cluster Central Radio Sources and Cooling Flows*, CXC GO1-2133X (U.Va. 5-28846), May 2001 – May 2003, \$59,501, PI.
- National Aeronautics and Space Administration, Chandra Cycle 2, *Merger Shocks in Clusters of Galaxies*, CXC GO1-2123X (U.Va. 5-28845), May 2001 – May 2003, \$59,885, PI.
- National Aeronautics and Space Administration, Chandra Cycle 2, *Resolving the X-ray Binary Population in Early-Type Galaxies*, CXC GO1-2078X (U.Va. 5-28847), June 2001 – June 2003, \$54,700, PI.
- National Aeronautics and Space Administration, Chandra Cycle 2, *Filamentary Radio Relics and Mergers in Clusters of Galaxies*, CXC GO1-2122X (U.Va. 5-28819), October 2000 – October 2001, \$52,987, PI.
- National Aeronautics and Space Administration, Chandra Cycle 1, *The Interaction Between Cluster Central Radio Sources and Cooling Flows*, CXC GO0-1158X (U.Va. 5-28821), September 2000 – September 2001, \$45,835, PI.
- National Aeronautics and Space Administration, Chandra Cycle 1, *Subcluster Mergers, Radio Relics, and the Cooling Flow in Abell 85*, CXC GO0-1173X (U.Va. 5-28807), August 2000 – August 2001, \$47,480, PI.
- National Aeronautics and Space Administration, Applied Information Systems (subcontract through NCSU), *Nonequilibrium Effects and Shock Models*, NAG5-9490 (U.Va. 5-28779), July 2000 – July 2001, \$19,381
- National Aeronautics and Space Administration, Chandra Cycle 1, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, CXC GO0-1141X (U.Va. 5-28781) May 2000 – May 2001, \$45,064, PI.
- National Aeronautics and Space Administration, Chandra Cycle 1, *Resolving the Mystery of X-Ray Faint Elliptical Galaxies*, CXC GO0-1019X (U.Va. 5-28764), March 2000 – March 2001, \$59,841, PI.
- National Aeronautics and Space Administration, ADP, *Cooling Gas, Cold Gas, and the Dynamical History of Clusters of Galaxies*, NAG 5-8390 (U.Va. 5-28717), March 1999 – March 2000, \$19,927, PI.

- National Aeronautics and Space Administration, ATP, *Dynamics and Emission of Hot Astrophysical Plasmas*, NAG 5-3057, September 1995 – September 1999, \$288,000, PI.
- National Aeronautics and Space Administration, ASCA, *Cluster Dark Matter Density Profiles at Very Large Radii, X-Ray Spectra of Cluster Cooling Flows: Spectral Evidence for Cooling and Cold Gas*, and *An ASCA Observation of the Rich cD Cluster A2107 in the Center of the Hercules Supercluster*, NAG 5-4516, September 1997 – August 1999, \$48,300, PI.
- National Aeronautics and Space Administration, ASCA, *X-Ray Spectra of Cluster Cooling Flows with Excess Absorption: Spectral Diagnostics for Cooling and Cold Gas, X-Ray Spectra of Elliptical Galaxies: Gas Dynamics, Chemical Evolution, and Missing Mass, The X-Ray Spectrum of Triangulum Australis: Probing the High Luminosity Tail of X-Ray Clusters, Mapping the Temperature Structure of Almost Relaxed Clusters, X-Ray Spectra of the Hercules Cluster – The Interaction of Intracluster Gas, Gas Stripping, and Radio Plasma*, and *B2 1028+313 and Abell 1030: A Quasar in the Center of a Cluster Cooling Flow*, NAG 5-2526, March 1994 – March 1998, \$243,689, PI.
- National Aeronautics and Space Administration, ROSAT, *Twilight of the Gods: The Massive, Long Period, Accreting Binary VV Cephei Enters Eclipse*, NAG 5-4787, July 1997 – June 1998, \$6,400, PI.
- National Aeronautics and Space Administration, ROSAT, *B2 1028+313 and Abell 1030: A Quasar in the Center of a Cluster Cooling Flow*, NAG 5-3308, August 1996 – January 1998, \$7,600, PI.
- National Aeronautics and Space Administration, ROSAT, *Cooling Flow Clusters with Evidence for Star Formation and/or Cool Gas, The Nature of the X-Ray Filaments in Cluster Cooling Flows, A High Resolution Study of X-ray Emission from Bright Elliptical Galaxies, NGC 7144: A Non-Cluster Elliptical with a Massive Dark Halo?, Filaments and Cool Gas in Cluster Cooling Flows*, and *Aligned Radio, Optical, and X-ray Structures in Clusters of Galaxies*, NAG 5-1891, February 1992 – August 1996, \$128,000, PI.
- National Aeronautics and Space Administration, ATP, *Emission Processes and Dynamics of Hot Gases in Astrophysics*, NAGW-2376, February 1991 – July 1996, \$587,500, Co-PI.
- National Aeronautics and Space Administration, ROSAT, *Cooling Flow Clusters with Evidence for Star Formation and/or Cool Gas*, and *A Detailed Study of the X-ray Emission from Bright Elliptical Galaxies*, NAG 5-1577, January 1991 – November 1992, \$83,000, PI.
- National Aeronautics and Space Administration, *Emission Processes and Dynamics of Hot Gases in Astrophysics*, NAGW-764, March 1988 – February 1991, \$555,000, Co-PI.
- National Aeronautics and Space Administration, *Emission Processes and Dynamics of Hot Gases in Astrophysics*, NAGW-764, July 1985 – February 1988, \$480,000, Co-PI.
- National Science Foundation, *Emission from Plasmas in Supernovae, Quasars, and Clusters of Galaxies*, AST 81-20260, July 1984 – January 1987, \$69,954, PI.
- National Science Foundation, *Ionized Gas in Galaxies and Clusters of Galaxies*, AST 81-20260, May 1982 – October 1984, \$42,000, PI.
- National Aeronautics and Space Administration, *X-ray Observations of Southern High Redshift Clusters*, NAG-8308, February 1980 – February 1982, \$3,398, PI.
- National Aeronautics and Space Administration, *X-ray Observations of M51 and M81 – the Dynamics of Spiral Galaxies*, NAS8-33348, May 1979 – October 1981, \$2,000, PI.

Pending

- National Aeronautics and Space Administration, Chandra Cycle 8, *The Halo Structure of RCS2–2327.4–0204*, July 2006 – July 2008, \$22,999, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *Abell 119: Cluster Mergers and the Origin of Narrow-Angle-Tail Radio Galaxies*, November 2006 – November

- 2007, \$36,200, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *Deep Chandra and Hubble Observations of NGC 1023: Testing the Origin of Low-Mass X-ray Binaries in a Lenticular Galaxy*, November 2006 – November 2007, \$108,000, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *The Galactic Generation-X: The First Study of the X-ray Properties of Massive E+A Galaxies*, November 2006 – November 2007, \$41,272, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *Solving the Cooling Flow Mystery: Understanding Variations in Star Formation Efficiency Using the Chandra Archive*, November 2006 – November 2007, \$65,000, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *Generating a Homogeneous Library of Isolated Binary Galaxy Cluster Mergers — Applications to Dark Energy Surveys*, November 2006 – November 2007, \$44,000, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *A High Resolution Model of Interstellar Absorption*, November 2006 – November 2007, \$30,541, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Chandra Cycle 8, *Jets, Bubbles, Binaries, and Hot Gas: A Deep Observation of Centaurus A*, November 2006 – November 2007, \$20,000, PI, proposal approved but budget uncertain.
- National Aeronautics and Space Administration, Hubble Cycle 15, *Deep Chandra and Hubble Observations of NGC 1023: Testing the Origin of Low-Mass X-ray Binaries in a Lenticular Galaxy*, November 2006 – November 2007, \$20,000, PI, proposal approved but budget uncertain.
- National Science Foundation, *Long Wavelength Array (LWA) — Research and Development*, May 2006 – December 2008, \$5.2 million, PI P. Henning, UNM, Sarazin Co-I (see below)
- National Science Foundation, *Long Wavelength Array (LWA) — Research and Development at the University of Virginia*, May 2006 – December 2008, \$300,000, PI of this subcontract

Approved Grants but Funds Withdrawn due to Satellite Failure

- National Aeronautics and Space Administration, Astro-E2 Cycle 1, *Properties of the Merger and Radio Source Interaction in the Cygnus A Cluster*, January 2006 – January 2008, \$37,841, PI.
- National Aeronautics and Space Administration, Astro-E2 Cycle 1, *Resolving the Iron Absorption Lines in the X-ray Dipper 4U 1916–05*, January 2006 – January 2008, \$33,852, PI.
- National Aeronautics and Space Administration, Astro-E Cycle 1, *Subcluster Mergers, Radio Relics, and the Cooling Flow in Abell 85*, June 1999 – June 2001, \$62,194, PI.
- National Aeronautics and Space Administration, Astro-E Cycle 1, *High Resolution X-Ray Spectra of Cluster Cooling Flows: Spectral Evidence for Cooling and Cold Gas*, June 1999 – June 2001, \$38,484, PI.
- National Aeronautics and Space Administration, Astro-E Cycle 1, *Properties of the Merger and Cooling Flow in the Cygnus A Cluster*, June 1999 – June 2001, \$67,691, PI.

Allocated Observing Time as PI

- Chandra X-ray Observatory Cycle 8, *Abell 119: Cluster Mergers and the Origin of Narrow-Angle-Tail Radio Galaxies*, 2006, 49,000 seconds, PI.

- Chandra X-ray Observatory Cycle 8, *Deep Chandra and Hubble Observations of NGC 1023: Testing the Origin of Low-Mass X-ray Binaries in a Lenticular Galaxy*, 2006, 192,000 seconds, PI.
- Chandra X-ray Observatory Cycle 8, *The Galactic Generation-X: The First Study of the X-ray Properties of Massive E+A Galaxies*, 2006, 50,000 seconds, PI.
- Hubble Space Telescope Cycle 15, *Deep Chandra and Hubble Observations of NGC 1023: Testing the Origin of Low-Mass X-ray Binaries in a Lenticular Galaxy*, 2006, 5 orbits, PI.
- Hubble Space Telescope Cycle 15, *Probing the Globular Cluster / Low Mass X-ray Binary Connection in Early-type Galaxies at Low X-ray Luminosities*, 2006, 10 orbits, PI.
- Suzaku X-ray Observatory Cycle 1, *Nailing Down the Hard X-ray Inverse Compton Emission from the Radio Halo in the Coma Cluster*, 2006, 180,000 seconds, PI
- Suzaku X-ray Observatory Cycle 1, *Hard X-ray Inverse Compton Emission and a Merger Shock Associated with the Brightest Known Radio Relic in Abell 3667*, 2006, 135,000 seconds, PI.
- XMM/Newton X-ray Observatory, ESA, Cycle 5, *Understanding Gas Interactions in Groups: NGC 1600*, 2006, 85,300 seconds, PI.
- Chandra X-ray Observatory Cycle 7, *A High Resolution Study of Interstellar Absorption*, 2005, 100,000 seconds, PI
- Astro-E2 X-ray Observatory Cycle 1, *Properties of the Merger and Radio Source Interaction in the Cygnus A Cluster*, 2005, 100,000 seconds, PI
- Astro-E2 X-ray Observatory Cycle 1, *Resolving the Iron Absorption Lines in the X-ray Dipper 4U 1916–05*, 2005, 50,000 seconds, PI
- Hubble Space Telescope Cycle 14, *Probing The Galaxy-wide Globular Cluster — Low Mass X-ray Binary Connection in Early-type Galaxies*, 2005, 12 orbits, PI
- Hubble Space Telescope Cycle 14, *Resolving the Connection Between Globular Clusters and Low- Mass X-ray Binaries*, 2005, 9 orbits, PI
- XMM/Newton X-ray Observatory, ESA, Cycle 4 *The Local Galaxy Cluster Mass Function of the Brightest Clusters in the Sky*, 2005, 227,700 seconds, PI.
- XMM/Newton X-ray Observatory, ESA, Cycle 4 *The Physics of Cooling Flow Clusters with Central Radio Sources*, 2005, 22,600 seconds, PI.
- Chandra X-ray Observatory Cycle 6, *Low Mass X-ray Binaries and Globular Clusters in the Early-Type Galaxy NGC 4365*, 2004, 160,300 seconds, PI.
- Chandra X-ray Observatory Cycle 6, *Stellar Mass Loss Versus External Accretion in the X-ray Bright Elliptical NGC 5813*, 2004, 49,000 seconds, PI.
- Chandra X-ray Observatory Cycle 6, *The Interaction between Cluster Central Radio Sources and Cooling Flows*, 2004, 41,000 seconds, PI.
- XMM/Newton X-ray Observatory, ESA, Cycle 3 *The Physics of Cooling Flow Clusters with Central Radio Sources*, 2003, 103,300 seconds, PI.
- XMM/Newton X-ray Observatory, ESA, Cycle 3 *The Complex Dynamics of the Thermal and Nonthermal Intracluster Gas*, 2003, 88,700 seconds, PI.
- Chandra X-ray Observatory Cycle 5 and Hubble Space Telescope Cycle 12, *Deep Chandra and Hubble Observations NGC 4697, the Nearest Optically Luminous, X-ray Faint Elliptical Galaxy*, 2003, 160,000 seconds on Chandra, one orbit on Hubble, PI.
- Chandra X-ray Observatory Cycle 5, *Filamentary Radio Relics in Clusters of Galaxies: Radio Bubbles or Merger Shocks?*, 2003, 53,000 seconds, PI.
- Chandra X-ray Observatory Cycle 5, *Chandra Observations of Galaxy Clusters with Large cD Galaxy Peculiar Velocities*, 2003, 77,000 seconds, PI.
- Chandra X-ray Observatory Cycle 5, *The HIFLUGCS Cluster Survey: A Cornerstone for Cosmology*, 2003, 83,000 seconds, PI.
- XMM/Newton X-ray Observatory, ESA, Cycle 2 *Radio Halos and Relics and Merger Shocks in Clusters of Galaxies*, 2002, 122,000 seconds, PI.

XMM/Newton X-ray Observatory, ESA, Cycle 2 *The Origin of the Disturbed Cool Core and Filamentary Radio Source in Abell 133*, 2002, 35,000 seconds, PI.

XMM/Newton X-ray Observatory, ESA, Cycle 2 *The Physics of Cooling Flow Clusters with Central Radio Sources*, 2002, 63,000 seconds, PI.

XMM/Newton X-ray Observatory, ESA, Cycle 2 *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, 2002, 89,000 seconds, PI.

XMM/Newton X-ray Observatory, ESA, Cycle 2 National Aeronautics and Space Administration, XMM Cycle 2, *A High-Redshift ($z = 0.95$) Cluster Revealed by a FIRST Bent-Double Radio Source*, 2002, 38,000 seconds, PI.

Chandra X-ray Observatory Cycle 4, *Low Mass X-ray Binaries and Globular Clusters in Virgo Early-Type Galaxies*, 2002, 44,000 seconds, PI.

Chandra X-ray Observatory Cycle 4, *A High Redshift ($z = 0.95$) Cluster Revealed by a FIRST Bent-Double Radio Source*, 2002, 20,000 seconds, PI.

Chandra X-ray Observatory Cycle 4, *The HIFLUGCS Cluster Survey: A Cornerstone for Cosmology*, 2002, 120,000 seconds, PI.

Chandra X-ray Observatory Cycle 3, *The Interaction Between Cluster Central Radio Sources and Cooling Flows*, 2002, 26,000 seconds, PI.

Chandra X-ray Observatory Cycle 3, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, 2002, 95,000 seconds, PI.

Chandra X-ray Observatory Cycle 3, *Resolving the X-Ray Binary Population in Early-Type Galaxies*, 2002, 36,000 seconds, PI.

Chandra X-ray Observatory Cycle 3, *Merger Shocks in Clusters of Galaxies*, 2002, 50,000 seconds, PI.

Chandra X-ray Observatory Cycle 2, *Filamentary Radio Relics and Mergers in Clusters of Galaxies*, 2001, 36,000 seconds, PI.

Chandra X-ray Observatory Cycle 2, *The Interaction between Cluster Central Radio Sources and Cooling Flows*, 2001, 53,000 seconds, PI.

Chandra X-ray Observatory Cycle 2, *Resolving the X-ray Binary Population in Early-Type Galaxies*, 2001, 84,000 seconds, PI.

Chandra X-ray Observatory Cycle 2, *Merger Shocks in Clusters of Galaxies*, 2001, 56,000 seconds, PI.

XMM/Newton X-ray Observatory, ESA, Cycle 1, *Merger Shocks in Clusters of Galaxies*, 2000, 63,000 seconds, PI.

XMM/Newton X-ray Observatory, ESA, Cycle 1, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, 2000, 82,000 seconds, PI.

Astro-E X-ray Observatory, *Properties of the Merger and Cooling Flow in the Cygnus A Cluster*, 2000, 140,000 seconds, PI.

Astro-E X-ray Observatory, *Subcluster Mergers, Radio Relics, and the Cooling Flow in Abell 85*, 2000, 108,000 seconds, PI.

Astro-E X-ray Observatory, *High Resolution X-ray Spectra of Cluster Cooling Flows: Spectral Evidence for Cooling and Cold Gas*, 2000, 39,000 seconds, PI.

Chandra X-ray Observatory Cycle 1, *Subcluster Mergers, Radio Relics, and the Cooling Flow in Abell 85*, 2000, 40,000 seconds, PI.

Chandra X-ray Observatory Cycle 1, *The Interaction Between Cluster Central Radio Sources and Cooling Flows*, 2000, 37,000 seconds, PI.

Chandra X-ray Observatory Cycle 1, *Stellar Mass Loss Versus External Accretion in X-ray Bright Ellipticals*, 2000, 40,000 seconds, PI.

Chandra X-ray Observatory Cycle 1, *Resolving the Mystery of X-Ray Faint Elliptical Galaxies*, 2000, 70,000 seconds, PI.

ASCA X-ray Observatory, *Cooling Gas, Cold Gas, and the Dynamical History of Clusters of Galaxies*, 1999, 100,000 seconds, PI.

ROSAT X-ray Observatory, *Cluster Environment Surrounding the Giant FR II, NVSS 2146+82*, 1999, 40,000 second, administrative PI.

ASCA X-ray Observatory, *X-Ray Spectra of Cluster Cooling Flows with Excess Absorption: Spectral Diagnostics for Cooling and Cold Gas*, 1994-1998, 429,000 seconds, PI.

ROSAT X-ray Observatory, *Low Luminosity X-ray Sources and UV Bright Stars in Globular Clusters*, 1997-1998, 223,000 seconds, PI.

ROSAT X-ray Observatory, *Twilight of the Gods: The Massive, Long Period, Accreting Binary VV Cephei Enters Eclipse*, 1996-1997, 20,000 seconds, PI.

ASCA X-ray Observatory, *An ASCA Observation of a Rich cD Cluster A2107 in the Center of the Hercules Supercluster*, 1997-1998, 30,000 seconds, PI.

ASCA X-ray Observatory, *Cluster Dark Matter Density Profiles at Very Large Radii*, 1997-1998, 50,000 seconds, PI.

ASCA X-ray Observatory, *B2 1028+313 and Abell 1030: A Quasar in the Center of a Cluster Cooling Flow*, 1995, 40,000 sec, PI.

ASCA X-ray Observatory, *X-Ray Spectra of Elliptical Galaxies: Gas Dynamics, Chemical Evolution, and Missing Mass*, 1995-1997, 80,000 sec, PI.

ASCA X-ray Observatory, *Mapping the Temperature Structure of Almost Relaxed Clusters*, 1996-1997, 110,000 seconds, PI.

ASCA X-ray Observatory, *Searching for Two Component Emission from X-Ray FAINT Early-Type Galaxies: NGC 3115 and NGC 3379*, 1996, 40,000 seconds, PI.

ASCA X-ray Observatory, *The X-Ray Spectrum of Triangulum Australis: Probing the High Luminosity Tail of X-Ray Clusters*, 1995, 20,000 sec, PI.

ASCA X-ray Observatory, *X-Ray Spectra of the Hercules Cluster – The Interaction of Intracluster Gas, Gas Stripping, and Radio Plasma*, 1995, 20,000 sec, PI.

ROSAT X-ray Observatory, *B2 1028+313 and Abell 1030: A Quasar in the Center of a Cluster Cooling Flow*, 1996, 40,000 sec, PI.

ROSAT X-Ray Observatory, *Filaments and Cool Gas in Cluster Cooling Flows*, 1991-1994, 186,600 seconds, PI.

ROSAT X-Ray Observatory, *Aligned Radio, Optical, and X-ray Structures in Clusters of Galaxies*, 1994, 13,100 seconds, PI.

ROSAT X-Ray Observatory, *NGC7144: A Non-Cluster Elliptical with a Massive Dark Halo?*, 1993, 28,200 seconds, PI.

ROSAT X-ray Observatory, *A High Resolution Study of X-ray Emission from Bright Elliptical Galaxies*, 1991-1993, 164,000 seconds, PI.

Very Large Array Radio Observatory, *Radio Imaging of the Complex X-ray Source 2A0335+096*, 1992, 6 hours in C array, 7 hours in D array, PI.

Einstein X-ray Observatory, *X-ray Observations of Southern High Redshift Clusters*, 12,000 seconds, PI.

Einstein X-ray Observatory, *X-ray Observations of M51 and M81 – the Dynamics of Spiral Galaxies*, 20,000 seconds, PI.

Allocated Super-Computing Time as PI

National Science Foundation, Pittsburgh Supercomputing Center, *Hydrodynamical Simulations of the Shaping of Supernovae and Planetary Nebulae*, PSC 89-0313P, June 1990 – June 1991, 50 hours, PI.

National Science Foundation, Pittsburgh Supercomputing Center, *Hydrodynamic Simulations of the Formation and Evolution of Early-Type Galactic Systems*, June 1989 – June 1990, 5 hours, PI.

National Science Foundation, Pittsburgh Supercomputing Center, *Propagation of Jets through Cooling Flows in Galaxies*, PSCA-121, January 1987 – January 1988, 50 hours, PI.