CHANDRA X-RAY OBSERVATORY

The Chandra X-ray Observatory is the third in NASA's family of Great Observatories that includes the Hubble Space Telescope and the Compton Gamma Ray Observatory. NASA's Marshall Space Flight Center manages the Chandra program. TRW is the prime contractor for the spacecraft. Key subcontractors include Ball Aerospace & Technologies, Inc., Eastman Kodak Company, and Raytheon Optical Systems, Inc. The scientific instruments were built by teams from MIT, Pennsylvania State University, the Smithsonian Astrophysical Observatory, the Laboratory for Space Research in the Netherlands, and the Max Planck Institute in Germany. The Smithsonian's Chandra X-ray Center controls science and flight operations from Cambridge, MA

Supernova 1987A Press Kit Contents:

I. NASA Press Release - *Impact! Chandra Images a Young Supernova Blast Wave*

II. Contacts
- A. SN 1987A Science Panelists
- B. Chandra Press Contacts

III. Fact Sheets & Biographies
- A. Fact Sheets
  1. Science Background for Supernova 1987A
  2. The Chandra X-ray Observatory
- B. Biographies
  1. A. Bunner
  2. D. Burrows
  3. R. Kirshner
  4. E. Michael

IV. Still Images
- A. SN 1987A Chandra Image
- B. SN 1987A X-ray/Optical Composite

SN 1987A SCIENCE PANELISTS

Dr. Alan N. Bunner
Science Program Director, Structure and Evolution of the Universe
NASA Headquarters, Washington D.C. 20546
Phone: 202.358.0364 Fax: 202.358.3096
alan.bunner@hq.nasa.gov

Professor David Burrows
Penn State University, University Park, PA
Phone: 814.863.2466
burrows@astro.psu.edu

Professor Robert Kirshner
Harvard University, Cambridge, MA
Phone: 617.495.7519
rkirshner@cfa.harvard.edu

Eli Michael
University of Colorado, Boulder, CO
Phone: 303.492.5585
michaele@colorado.edu

CHANDRA PRESS CONTACTS

Dr. Wallace Tucker, Chandra Science Spokesperson.
Smithsonian Astrophysical Observatory, Cambridge, MA
Phone: 617.496.7998 Fax: 617.495.7356
wtucker@cfa.harvard.edu

NASA Contacts

Dolores Beasley, Public Affairs Officer
NASA Headquarters, Washington D.C.
Phone: 202.358.1753
dolores.beasley@hq.nasa.gov

Steve Roy, Media Relations Office
Marshall Space Flight Center, Huntsville, AL
Phone: 256.544.6535
steve.roy@msfc.nasa.gov

ABOUT SUPERNOVA 1987A

Supernova 1987A, the first supernova observed in 1987, was the brightest and nearest supernova to Earth in almost four centuries. Before it exploded, it was a luminous blue giant star that put out 100,000 times as much power as the Sun. After the explosion, the expanding debris glowed in visible light with the power of 100,000,000 suns for four months.

Supernova 1987A is located in a nearby galaxy called the Large Magellanic Cloud. This galaxy is about 160,000 light years from Earth, so when it was first observed by optical telescopes in 1987, the event had actually occurred about 158,013 B.C. We are seeing a delayed-action replay of the actual event. When astronomers say that SN1987A is only 13 years old, they mean that it is has been 13 years since the outburst was observed on Earth.

A supernova explosion is among the most violent events in nature. When the nuclear power source at the center or core of a star is exhausted, the core collapses. In less than a second, a neutron star is formed. As infalling matter crashes down on the neutron star, temperatures rise to many billions of degrees Celsius. Within hours, all but the central neutron star is blown away at speeds in excess of 50 million kilometers per hour. This exploding matter creates a gigantic shock wave that speeds ahead of a shell of gas that has temperatures of millions of degrees.

Over the next few thousand years, the expanding shell of hot gas will glow in X rays. Eventually after rumbling across several thousand light years, the shell will disperse. In this way, the supernova spreads the heavy elements created in the star and possibly triggers the formation of new stars from a cold interstellar cloud.

With Supernova 1987A, scientists have an opportunity to watch the early phases of this action from a close – but not too close – vantage point. They were able to detect energy from the first seconds of the explosion in the form of fundamental particles called neutrinos. For the first 500 days, the visible light was observed to fade gradually, powered by the radioactive decay of cobalt into iron. Gamma rays from the radioactive decay were also observed.

With the Chandra X-ray Observatory and the Hubble Space Telescope astronomers can observe the evolution of the hot gas shell, watch as the shock wave heats surrounding gas, measure the amounts of the various elements ejected in the explosion, and search for the neutron star that should have been formed in the explosion. So far, the neutron star has not been detected.

Present Chandra observations show the hot gas shell sweeping toward a ring of matter ejected by the star thousands of years before it exploded. This ring has been observed by Hubble to brighten during in the past two years, presumably due to the collision of the shock wave with portions of the ring. The full impact of the collision of the shell with the ring will occur in the next few years. Then Supernova 1987A will become a hundred times brighter in X rays, opening up a new act in the majestic drama of cosmic death and renewal that is unfolding under the watchful eyes of the world's most powerful telescopes.

THE CHANDRA X-RAY OBSERVATORY

The Chandra X-Ray Observatory, launched on July 23, 1999, has taken its place with the Hubble Space Telescope and Compton Gamma Ray Observatory in NASA's fleet of Great Observatories. As the world's premier X-ray observatory, Chandra gives astronomers a powerful new tool to investigate the hot regions of the universe where black holes, exploding stars, and colliding galaxies hold sway.

With its combination of four pairs of ultra smooth, high-resolution mirrors and efficient X-ray detectors, Chandra makes images at least thirty times sharper than any previous X-ray telescope. The High Resolution Camera, and the Advanced CCD Imaging Spectrometer record images electronically, and two transmission gratings enable scientists to make precise measurements of the energies of incoming X rays.

The Chandra X-Ray Observatory Center

The Chandra program, managed by NASA's Marshall Space Flight Center in Huntsville, Alabama, is an example of NASA's initiative to streamline the operations of its space science missions. The Smithsonian Astrophysical Observatory's Chandra X-Ray Center (CXC), under the direction of Dr.Harvey Tananbaum, is located at the Harvard-Smithsonian Center for Astrophysics in Cambridge Massachusetts. The CXC is responsible for planning the science observations based on proposals from the scientific community, processing data received from the observatory, and providing technical and scientific support to the scientists who use Chandra. The Center operates the observatory from its Operations & Control facility located at One Hampshire Street in Cambridge, Massachusetts.

The CXC is a collaboration of personnel from the Smithsonian Astrophysical Observatory, the Massachusetts Institute of Technology (MIT), and the Chandra prime contractor, TRW.

The Operations & Control Center (OCC) is staffed by the CXC, with the Flight Operations Team provided by TRW. The OCC has a glass-walled area outside the main control room where visitors and press can watch the Flight Operations Team and mission specialists as they communicate with the observatory and carry out the space flight operations.

Commands for executing the observation plan are transmitted from the OCC to one of three ground stations (in Spain, Australia, or California) that make up NASA's Deep Space Network (DSN). The DSN relays the commands to the orbiting spacecraft. The spacecraft carries out the commands and points the telescope to the specified targets, and moves the science instruments to their appropriate positions.

During routine operations, science data and monitoring data will be sent from the spacecraft to the OCC, via the DSN, approximately every eight hours. Scientists and engineers will use monitoring data to assess Chandra's condition. If the health or safety of the observatory appears to be in danger, the operating mode and the observation plans will be modified.

Data from Chandra observations are processed at the Chandra Center. Observatory calibration data will be made public as soon as possible. The scientific data belonging to guest observers and guaranteed time observers can be held by them for one year to allow time for analysis and publication of scientific results. The data are then placed in the public archive.

Dr. Alan Bunner
Science Program Director, NASA

Dr. Alan Bunner is currently the Science Program Director (Structure & Evolution of the Universe) at NASA Headquarters in Washington, DC. As a member of the Office of Space Science (OSS) Board of Directors, he has responsibility for the science discipline areas of high energy astrophysics, extreme ultraviolet astronomy, submillimeter and radio astronomy, relativistic astrophysics, and general relativity.

Dr. Bunner received his B.A. in Mathematics and Physics from the University of Toronto in 1960 and his Ph.D. in Physics from Cornell University in 1967.

Dr. David Burrows
Professor, Penn State University

Professor David Burrows received a B.A. degree in Physics and Music from Beloit College (Beloit, Wis.) in 1975 and a PhD in Physics from the University of Wisconsin - Madison in 1982. He joined the Penn State faculty in 1983 where he is currently a Senior Scientist & Professor in the Department of Astronomy & Astrophysics.

His research interests include X-ray instrumentation, the interstellar medium, supernova remnants (SNR), and gamma-ray burst afterglows. Dr. Burrows is a Co-Investigator on the Chandra/ACIS instrument and is leading the development of the X-ray Telescope that will be launched in 2003 on the recently selected Swift Gamma-Ray Burst Explorer mission. His research accomplishments include the first all-sky maps in the soft X-ray band (1983), first flight of an X-ray CCD camera (1987), and the discovery of the first X-ray "shadows" (1991). He is leading the ACIS team's SNR observation program.

Dr. Robert Kirshner
Associate Director, Harvard-Smithsonian Center for Astrophysics

Robert Kirshner is Professor of Astronomy at Harvard University and an Associate Director of the Harvard-Smithsonian Center for Astrophysics. He graduated from Harvard College in 1970 and received a Ph.D. in astronomy at Caltech four years later. After a postdoc at Kitt Peak National Observatory in Tucson, he joined the faculty at the University of Michigan for 9 years before moving to the Harvard Astronomy Department in 1986. He served as Chairman of the department from 1990-1997.

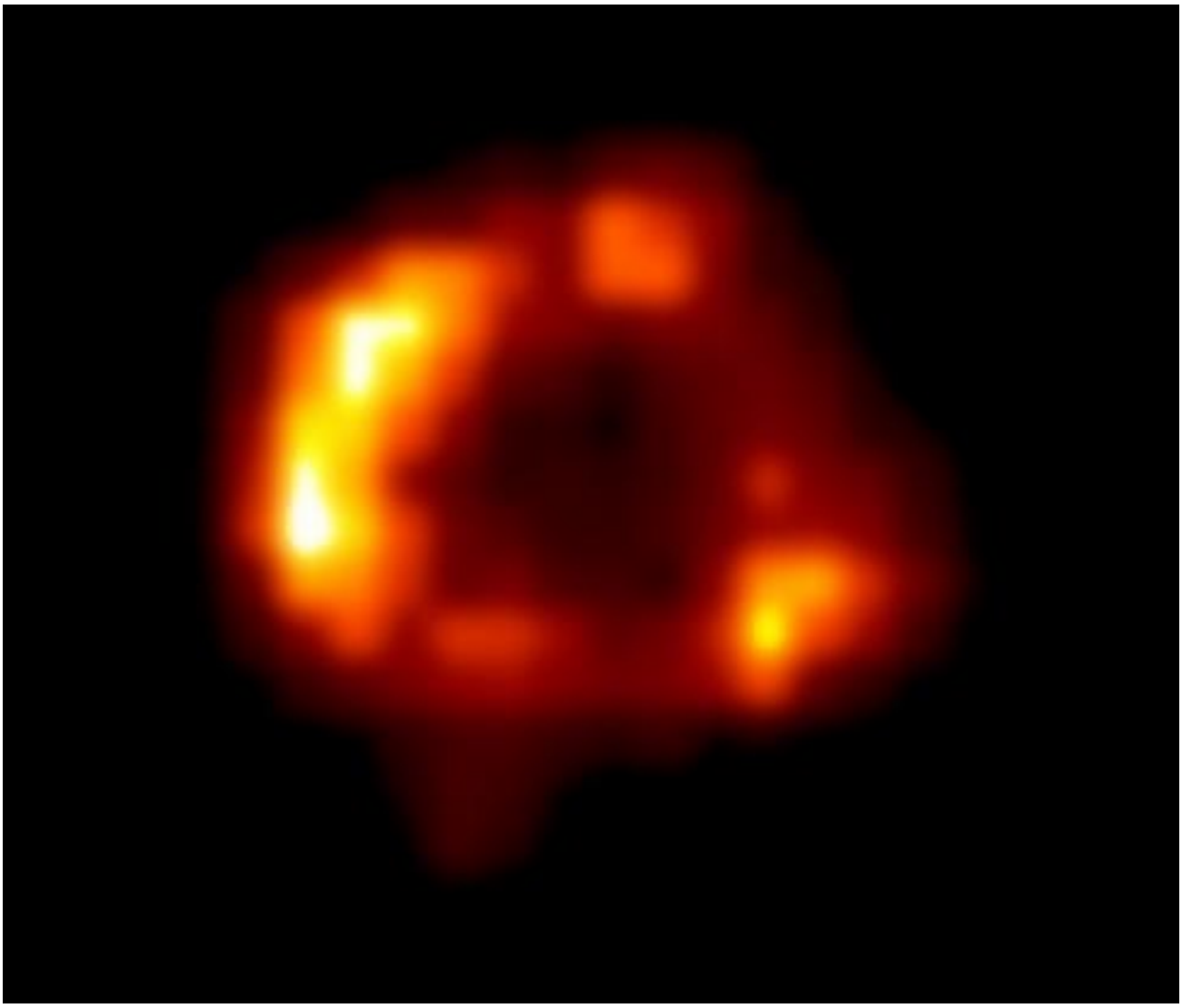
Professor Kirshner is an author of 200 research papers dealing with supernovae, the large-scale distribution of galaxies, and the size and shape of the Universe. His recent work on the acceleration of the Universe was dubbed the "Science Breakthrough of the Year for 1998" by Science Magazine. An article by Kirshner and his collaborators on this topic appears in the January 1999 Scientific American. He was elected to the National Academy of Sciences in 1998.

Kirshner is a frequent public lecturer on science, including the 1997 Princeton University lectures, the 1998 Seyfert Lecture at Vanderbilt University, and a featured talk to the National Science Teachers Association at their national meeting in 1999. He is also the teacher of Science A-35, a core curriculum course for 250 Harvard undergraduates entitled "Matter in the Universe." The vivid (and slightly hazardous) demonstrations in Science A-35 led to Kirshner's being featured in Boston Magazine in their October 1998 article on "Nutty Professors". Kirshner has made a series of video tapes on "Cosmic Questions" which are widely available.

Eli Michael

Eli Michael received a B.A. in Physics and Astronomy from Pomona College (Claremont, CA) in 1996 and a M.S. in Astrophysical and Planetary Sciences from the University of Colorado at Boulder in 1998. He is currently a doctoral candidate at the University of Colorado at Boulder under a NASA Graduate Student Research Fellowship from Goddard Space Flight Center. His doctoral research, which utilizes both the Chandra X-ray Observatory and the Hubble Space Telescope, focuses on understanding the structure and development of the supernova remnant forming from Supernova 1987A.

SUPERNOVA 1987A



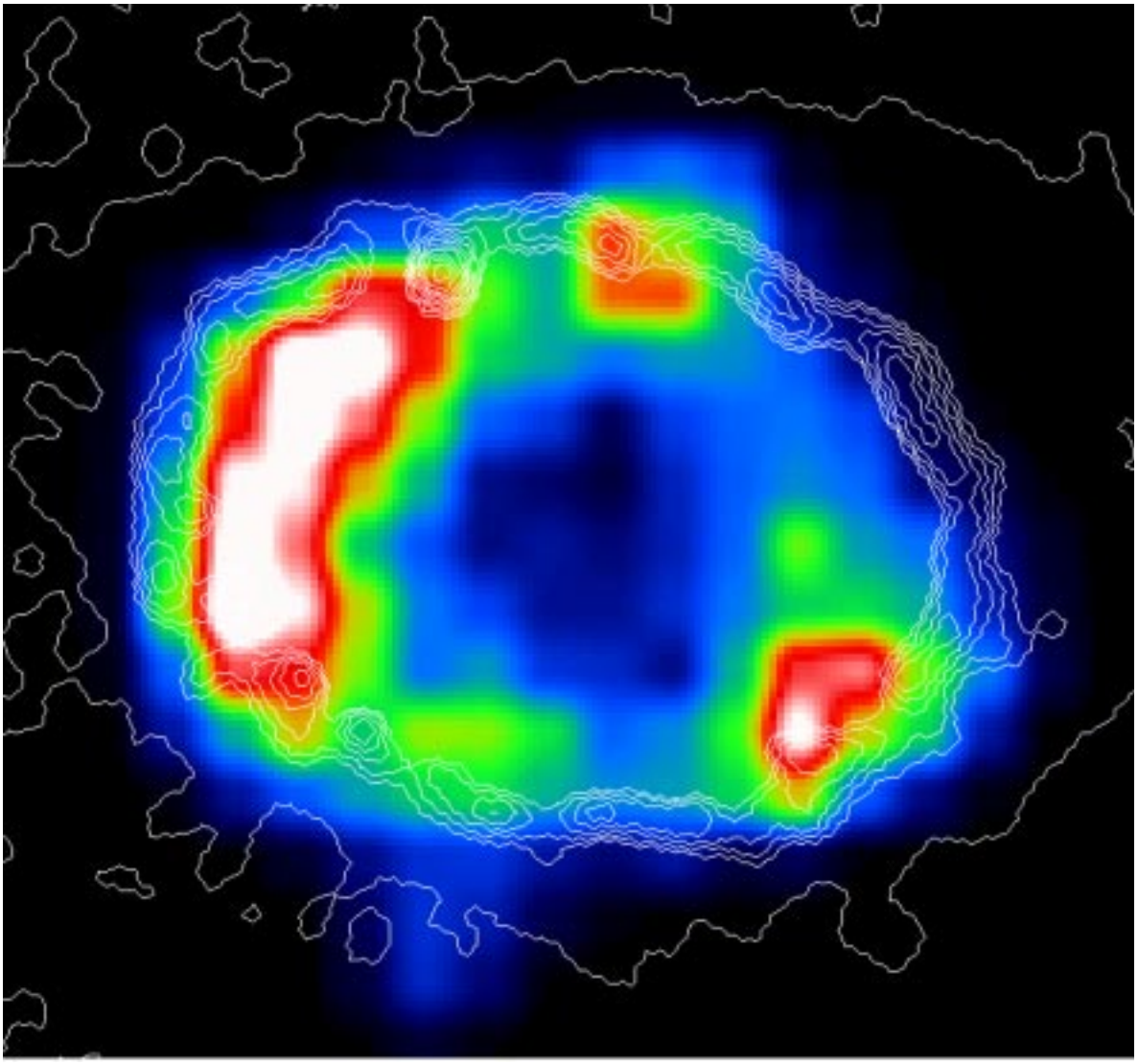
Supernova 1987A in X-rays

Credit: NASA/CXC/SAO/PSU/D. Burrows et al

The Chandra X-ray Observatory image of SN 1987A made in January 2000 shows an expanding shell of hot gas produced by the supernova explosion. The gas in the shell has a temperature of about ten million degrees Celsius, and is visible only with an X-ray telescope. The colors represent different intensities of X-ray emission, with white being the brightest.

Chandra X-ray Observatory ACIS image.
Scale: Field shown is 3 arcsec on a side, corresponding to a size of 2.4 light years.

SUPERNOVA 1987A X-RAY/OPTICAL COMPOSITE



Chandra/Hubble composite image of SN 1987A

Credit: X-ray: NASA/PSU/D.Burrows et al.; Optical: NASA/CfA/P.Challis et al.

This Chandra X-ray image of SN 1987A made in January 2000 shows an expanding shell of hot gas produced by the supernova explosion. The colors represent different intensities of X-ray emission, with white being the brightest. Also shown are the contours from a Hubble Space Telescope optical image taken on 2 February 2000.

Scale: The optical ring is 1.2 x 1.6 arcsec, corresponding to 1.0 x 1.3 light years.