

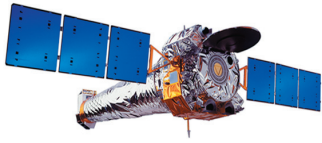
---

## 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.

### Crab Nebula Press Kit Contents:

- I. NASA Press Release
  - II. Press Guide to Science Contacts
  - III. Fact Sheets & Biographies
    - A. Fact Sheet
      - 1. The Chandra X-Ray Observatory
    - B. Biographies
      - 1. Jeff Hester
      - 2. David Burrows
      - 3. Vicky Kaspi
      - 4. Robert Kirshner
  - IV. Still Images
    - A. Collage of Chandra's Observations of the Crab Nebula
    - B. Chandra/Hubble Composite
    - C. Chandra/Hubble Side-by-Side
-



---

## PRESS GUIDE TO SCIENCE CONTACTS

### **CXC Contact**

Megan Watzke, Chandra X-Ray Center  
Smithsonian Astrophysical Observatory, Cambridge, MA  
Phone: 617.496.7998 Fax: 617.495.7356  
cxcpress@cfa.harvard.edu

### **Science Panelists**

Prof. John Jeffrey Hester  
Arizona State University  
Phone: 480-965-0741  
jhester@asu.edu

Prof. David N. Burrows, Sr.  
Penn State University  
Phone: 814-863-2466  
burrows@astro.psu.edu

Prof. Robert P. Kirshner  
Harvard University & Harvard-Smithsonian Center for Astrophysics  
Phone: 617-495-7519  
rkirshner@cfa.harvard.edu

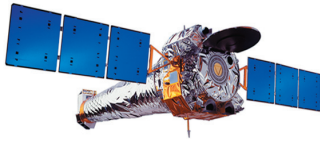
Prof. Victoria M. Kaspi  
McGill University  
Phone: 514-398-6412  
Email: vkaspi@physics.mcgill.ca

### **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

---



## 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.

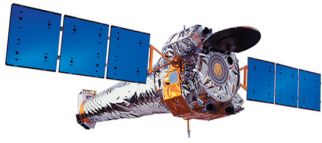
The Operations & Control Center (OCC) is staffed by the CXC, with the Flight Operations Team provided by TRW. The OCC has a glass-walled area outside the main control room where visitors and press can watch the Flight Operations Team and mission specialists as they communicate with the observatory and 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 are sent from the spacecraft to the OCC, via the DSN, approximately every eight hours. Scientists and engineers 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 are modified.

Data from Chandra observations are processed at the Chandra Center. Observatory calibration data are 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. Jeff Hester**  
**Professor of Physics & Astronomy, Arizona State University**

Following completion of his PhD from Rice University in 1985, Dr. Jeff Hester joined the Hubble Space Telescope Wide Field and Planetary Camera science team first as a postdoctoral assistant, and later as an associate member of that team. In 1990, he joined the science team responsible for the second generation WFPC2, which restored Hubble's imaging capability in late 1993.

Dr. Hester, who joined the faculty at Arizona State University in 1991, is known for his work on the interstellar medium. His credits include HST observations of regions of star formation, such as the Eagle Nebula, as well as HST observations of both the energetic pulsar wind and the expanding cloud of ejecta in the Crab Nebula.



---

**Dr. David Burrows**  
**Professor, Penn State University**

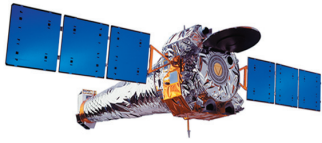
David N. Burrows is a Senior Scientist and Professor of Astronomy and Astrophysics at Penn State University, and is a member of the science team responsible for building the Chandra ACIS instrument used to collect these X-ray images of the Crab. His research interests include X-ray instrumentation, supernova remnants, and the hot interstellar medium. He leads the instrument team for the X-Ray Telescope on NASA's Swift Gamma-Burst Explorer spacecraft.



Burrows was an undergraduate at Beloit College and obtained a doctorate in physics at the University of Wisconsin-Madison in 1982. He has been on the Penn State faculty since 1983, working on the development of X-ray CCD cameras like ACIS, on observations of X-ray "shadows" from cold clouds in the interstellar medium, and on observations of supernova remnants. His first observation of the X-ray Crab nebula, performed in 1976 as a young graduate student, had no spatial resolution, and he is delighted to be working now with a telescope capable of observing the fascinating and dynamic fine details of this object.

---





---

**Dr. Vicky Kaspi**  
**Associate Professor, McGill University**

Vicky Kaspi is an Associate Professor in the Physics Department of McGill University. She received a B.Sc. in physics from McGill University in 1989, and an M.A. and Ph.D. in Physics from Princeton University in 1991 and 1993 respectively. Prior to joining the McGill faculty in 1999, Dr. Kaspi was an Assistant Professor of Physics at the Massachusetts Institute of Technology where she also held a Hubble Postdoctoral Fellowship at the Center for Space Research. From 1994-96, she was both a Hubble Postdoctoral Fellow in the Jet Propulsion Laboratory and a Visiting Associate at the California Institute of Technology.



Dr. Kaspi has been the recipient of numerous awards, including the Canadian Institute for Advanced Research's Young Explorer Prize in 2002, a Canada Research Chair in Physics in 2001, and an Alfred P. Sloan Research Fellowship and Annie Jump Cannon Prize in Astronomy, both in 1998.

Her research focuses on neutron stars, rapidly rotating, ultradense stars that are close cousin to black holes. Among the specific questions she is hoping to answer are: how neutron stars are formed, how fast they can rotate, what are they made of, and what sort of magnetic fields can they harbor. These questions ultimately constrain fundamental issues such as the equation of state of dense matter, and the physics of supernova explosions, the source of the matter out of which we are made.

---

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

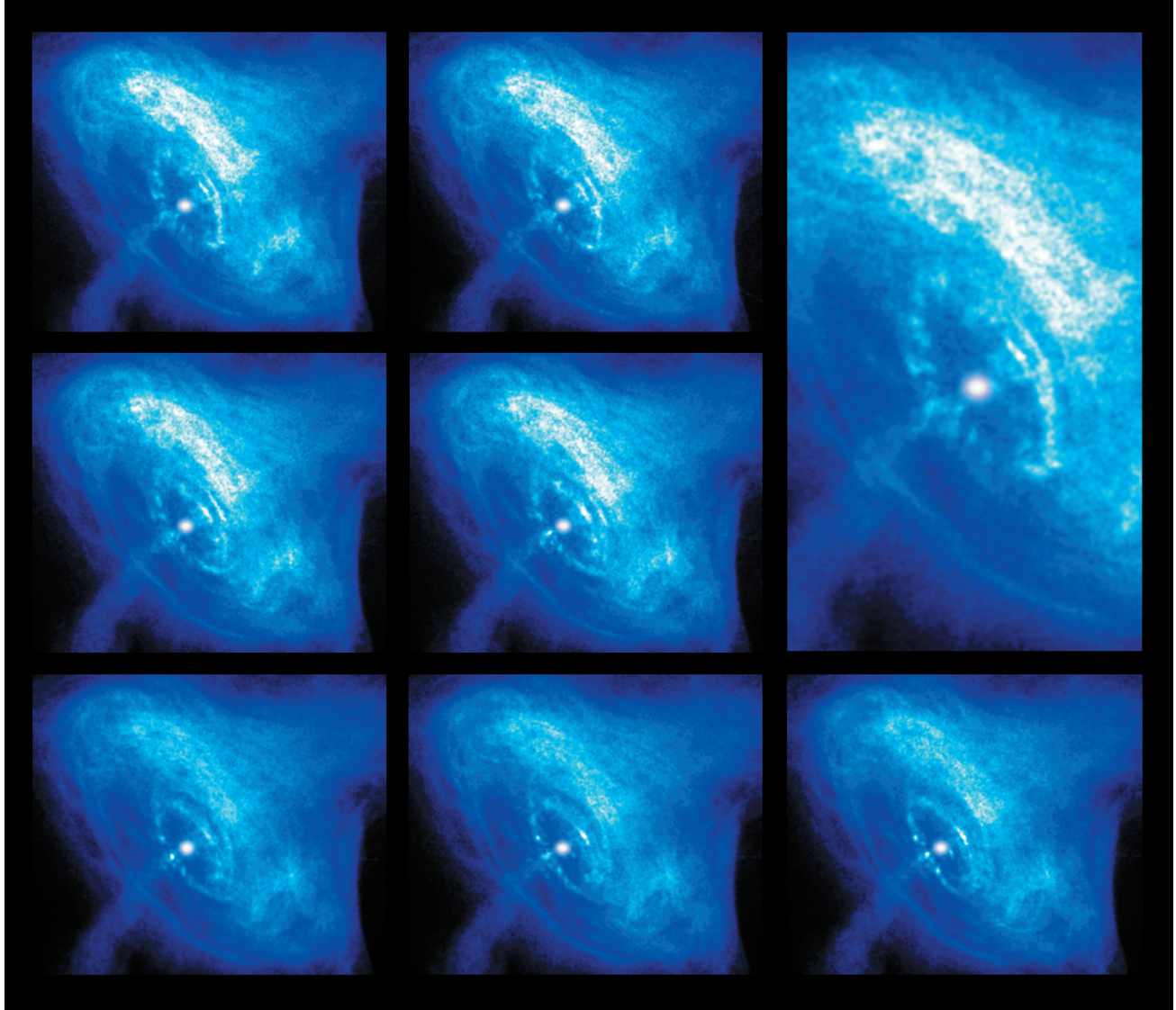
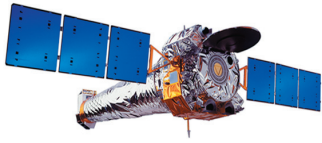


Robert Kirshner is Professor of Astronomy at Harvard University and an Associate Director of the Harvard-Smithsonian Center for Astrophysics. He graduated from Harvard College in 1970 and received a Ph.D. in astronomy at Caltech four years later. After a postdoc at Kitt Peak National Observatory in Tucson, 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" for The Teaching Company which are widely available.

---



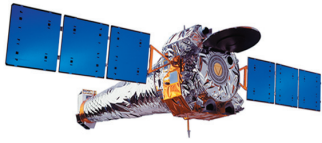
## COLLAGE OF CHANDRA'S CRAB NEBULA OBSERVATIONS

### Image Caption

The Chandra images in this collage were made over a span of several months (ordered left to right, except for the close-up). They provide a stunning view of the activity in the inner region around the Crab Nebula pulsar, a rapidly rotating neutron star seen as a bright white dot near the center of the images.

**Credit:** NASA/CXC/ASU/J.Hester et al.



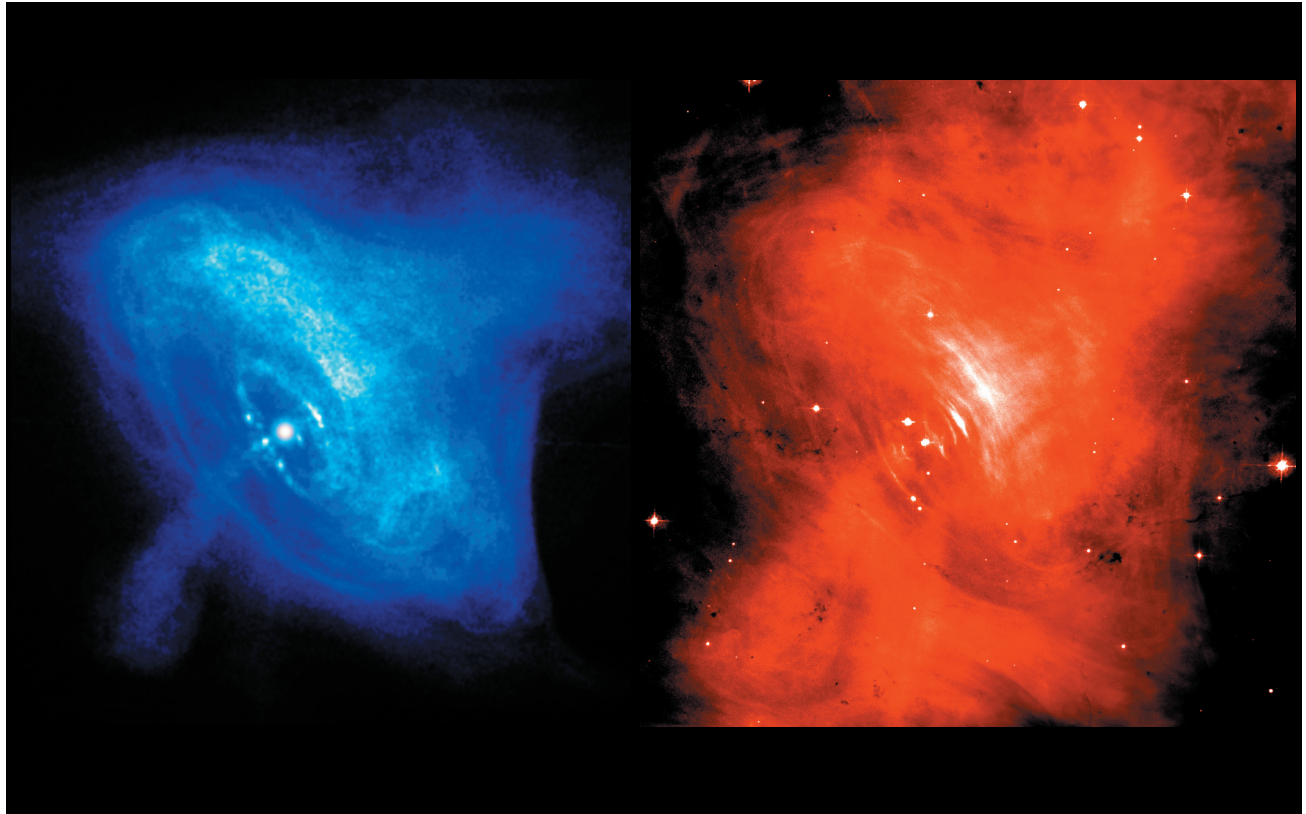
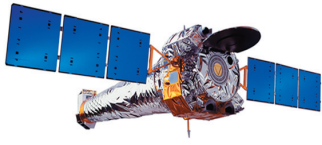


## CHANDRA/HUBBLE COMPOSITE OF CRAB NEBULA

### Image Caption

A composite image of the Crab Nebula showing the X-ray (blue), and optical (red) images superimposed. The size of the X-ray image is smaller because the higher energy X-ray emitting electrons radiate away their energy more quickly than the lower energy optically emitting electrons as they move.

**Credit:** X-ray: NASA/CXC/ASU/J. Hester et al.  
Optical: NASA/HST/ASU/J. Hester et al.



## CHANDRA/HUBBLE SIDE-BY-SIDE COMPARISON OF CRAB NEBULA

### Image Caption

These side-by-side images represent a snapshot from a movie that shows dynamic rings, wisps and jets of matter and antimatter around the pulsar in the Crab Nebula as observed in X-ray light by Chandra (left, blue) and optical light by Hubble (right, red).

**Credit:** X-ray: NASA/CXC/ASU/J. Hester et al.

Optical: NASA/HST/ASU/J. Hester et al.