Director’s Report

Quick Status

- Observatory functioning nominally except for recent HRC HV anomaly. Investigation underway.
- Data processing and delivery functioning nominally.
- TOO/DDT support continues on normal pace.
- Cycle 27 Peer Review completed successfully. Continued high oversubscription.
  - New “distributed review” process developed and successfully implemented.
- Improvements in operations approaches have mitigated continued temperature increases.
- Senior Review Report results for Chandra are Very Good/Excellent.
  - Proposed SR operational options contained full funding for GOs.
- NASA direction for FY26 under a Continuing Resolution allocated $63M for Chandra.

DDT Summary: 08 Oct 2024 - 05 Nov 2025

Cycle	Accepted Proposals	Accepted Time (ks)	Rejected Proposals	Rejected Time (ks)
25	7	135	1	40
26	20	518	12	790

Notes:

1: 1 withdrawn Cycle 25 proposal.

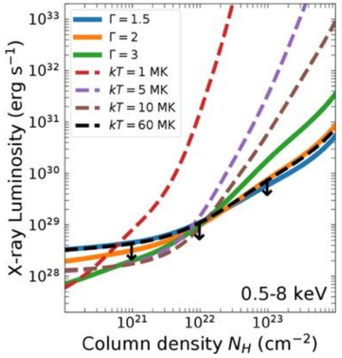
2: Rejected #s do not include informal requests that went untriggered.

3: No non-transient programs were approved since 08 Oct 2024
(out of three requested).

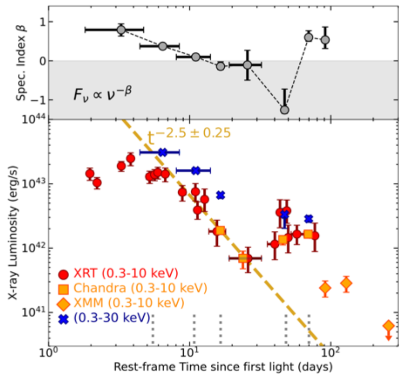
4: Cycle 26 (& 27) are at 50% of normal time allocation due to CLP contributions.

Chandra X-ray Center

DDT Summary: 08 Oct 2024 - 05 Nov 2025



Upper limits robustly exclude accreting WD or NS as Betelgeuse companion.



Observation of most luminous FBOT favors an embedded energetic source shining through expanding ejecta.

Target	Classification	PI	t_r	t_a	SI	GRAT	P
Betelgeuse	STARS AND WDs	O'Grady	50	45	HRC-I	NONE	N
SN2023fyq	SN, SNR AND ISOLATED NS	Dong	20	20	ACIS-S	NONE	N
AT2024wpp	SN, SNR AND ISOLATED NS	Margutti	40	40	ACIS-S	NONE	D
AT2024tvd	NORMAL GALAXIES	Yao	20	20	ACIS-S	NONE	D
EP241021A	STARS AND WDs	Jonker	20	10	ACIS-S	NONE	D
EP250108a	STARS AND WDs	Jonker	40	10	ACIS-S	NONE	D
M84	ACTIVE GALAXIES AND QUASARS	Ford	40	40	ACIS-S	NONE	D
EP250207B	SN, SNR AND ISOLATED NS	Troja	15	25	ACIS-S	NONE	D
EP250302a	BH AND NS BINARIES	O'Connor	20	20	ACIS-S	NONE	D
EP250304a	SN, SNR AND ISOLATED NS	Margutti	20	20	ACIS-S	NONE	N
EP J120944.2+585060	BH AND NS BINARIES	Sun	20	11	HRC-I	NONE	D

t_r = requested (ks)

t_a = approved (ks)

P = proprietary
N=None
D=Default

Cycle 26

Cycle 25

Blue: Student or Postdoc

DDT Summary: 08 Oct 2024 - 05 Nov 2025

Chandra detects off-nucleus source providing evidence for jetted TDE from IMBH.

Chandra position identifies Be star as X-ray counterpart to optical source in WD binary system in outburst.

Target	Classification	PI	t_r	t_a	SI	GRAT	P
GRB 250419A	SN, SNR AND ISOLATED NS	Ho	40	30	ACIS-S	NONE	N
GS 1826-238	BH AND NS BINARY	Kajava	35	40	ACIS-S	HETG	N
EP250702a	ACTIVE GALAXIES & QUASARS	Li	15	15	ACIS-I	NONE	D
EP250702a	BH AND NS BINARY	O'Connor	30	30	ACIS-S	NONE	N
GRB 250702B	BH AND NS BINARY	Pathak	50	20	ACIS-S	NONE	D
EP250630b	WD BINARIES AND CV	Maitra	20	2	HRC-I	NONE	N
GRB 250702B	BH AND NS BINARIES	Eyles-Ferris	30	40	ACIS-S	NONE	N
NEXUS	ACTIVE GALAXIES & QUASARS	Zhao	40	40	ACIS-I	NONE	N
AT 2025vjw	NORMAL GALAXIES	Somalwar	20	20	ACIS-S	NONE	N
CHIME J1634+44	WD BINARIES AND CV	Ng	10	10	ACIS-S	NONE	D

t_r = requested (ks)

t_a = approved (ks)

P = proprietary
N=None
D=Default

Cycle 25

Cycle 24

DDT Summary: 08 Oct 2024 - 05 Nov 2025

Target	Classification	PI	t_r	t_a	SI	GRAT	P
GRB 251016A	SN, SNR AND ISOLATED NS	Troja	20	20	ACIS-S	NONE	D
V1935 Cen	WD BINARIES AND CV	Drake	50	50*	HRC-S	LETG	N
AT2025aarm	NORMAL GALAXIES	Somalwar	25	25	ACIS-S	NONE	N
GRB 251013C	SN, SNR AND ISOED NS	Martin-Carrillo	40	40	ACIS-S	NONE	N

*No data obtained due to HRC-S HV anomaly.

t_r = requested (ks)

t_a = approved (ks)

P = proprietary
N=None
D=Default

Cycle 25

Cycle 24

Community TOO Programs

- We have received a request to consider Large TOO programs, perhaps submitted by a representative group of the time-domain community.
  - The aim would be a larger and more “open” set of time/triggers to be used for a range of target types.
  - Part of the rationale is that it is difficult to propose for individual TOOs without being very specific about trigger criteria, and then some sources of interest don’t end up meeting all of those criteria.
- At present, Chandra evaluates ~45-70 TOO/DDT triggers/request per Cycle (actually more, since some some DDTs are discussed and turned down before submission) with ~30-55 approved programs (and more individual observations). TOO programs can be submitted as Large Proposals at present.
  - TOO/DDT observations compete with non-transient Chandra science. A balance has always been maintained. Is it time to re-evaluate?
- Note current “Call for Suggestions for Community Target-of-Opportunity Programs with Hubble and Webb”
  - Should Chandra be carrying out a similar investigation? (Note impacts of future staffing reductions.)

Senior Review Results

Individual SR evaluation for Chandra was very positive:

Factor A (Scientific Merit): **E**

Factor B (Relevance to APD Objectives): **E**

Factor C (Technical Capability & Mngmt): **VG**

Overall: E/VG

(E: Excellent; VG: Very Good, G: Good, F: Fair, P: Poor)

Factor A: Strengths

o The Chandra mission is expected to return compelling and impactful science of great breadth and depth.

o Chandra's exquisite angular resolution is unrivalled by current or planned missions; enables unique science.

o The significant synergy with NASA's fleet and ground-based facilities is a key strength of Chandra's science.

o Chandra is highly productive & in high demand.

o Chandra offers long temporal baseline for variable sources and proper motion studies.

o Chandra is indispensable for studies of rare, faint, and fading X-ray transients.

o High quality data products of the mature Chandra mission are rapidly made available in a user-friendly and accessible public data archive.

o Analysis software sets standard of accessibility and state-of-the-art data science for X-ray observatories for observers at all career stages.

Factor A Weaknesses: NONE

Factor B: Strengths

o Chandra robustly addresses the overarching questions of the Science Mission Directorate's (SMD's) science plan.

o Chandra mission makes crucial contributions to all three thematic areas highlighted in the 2020 Astrophysics Decadal Survey.

o Chandra addresses key questions and areas for discovery that are identified by Science Panels of the 2020 Astrophysics Decadal Survey in order to guide the advancement of astronomy and astrophysics during the next decade.

o The 2020 Astrophysics Decadal Survey recommended maturation studies for the Lynx mission, which is a next-generation platform for X-ray science that could greatly benefit from knowledge transfer from Chandra.

Factor B Weaknesses: NONE

Factor C: Strengths

o Chandra Mission has excellent cost efficiency, while fulfilling high expectations of a NASA flagship.

o Funding to support GOs for observations, theory, and archival research has been a central contributor to Chandra's scientific success.

o The Chandra operating model is excellent.

o Chandra team has demonstrated resilience and adaptability in face of unexpected pressures to drastically reduce costs or even cease operations.

o Current health of Observatory is excellent thanks to proactive measures taken by the team.

o The governance, science team, and observatory all look robust for another five-to-10 years.

Factor C: Minor Weaknesses

o Molecular contamination on ACIS optical blocking filter has significantly diminished A_{eff} below ~1.5 keV.

o Spacecraft showing significant signs of aging.

Senior Review Results

- Overall report for <u>all missions</u> was also positive for Chandra, but in a more limited sense:

  "For this Senior Review, the in-guide budget for Chandra was set at the level of the Fiscal Year 2025 (FY25) President's Budget Request, which was intended as a close-out budget. The Chandra team was asked to provide a minimum-cost mission, although the cost was expected to exceed the in-guide budget; **<u>the Panel was directed to evaluate that minimum-cost mission in place of the in-guide close-out plan.</u>**"

- In reality, the SR considered the Chandra Minimal-Cost Mission along with the <u>over-guide requests</u> from other missions. It was listed in Tier 1 along with other top non-Chandra over-guide requests.

  - The **top Tier 2 recommendation was for restoring HRC science**.
  - The full "Chandra for the Future" mission was in Tier 3 over-guides (which were listed in no particular order).

- Direction following the SR and subsequent PPBE budgeting meeting was to continue to execute to current FY25 budget with further guidance to follow.

Recognizing Chandra Science

SAVE CHANDRA
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June 25, 2025

The Honorable Jerry Moran
Chair
Appropriations Subcommittee on Commerce,
Justice, Science, and Related Agencies
U.S. Senate
Washington, D.C. 20510

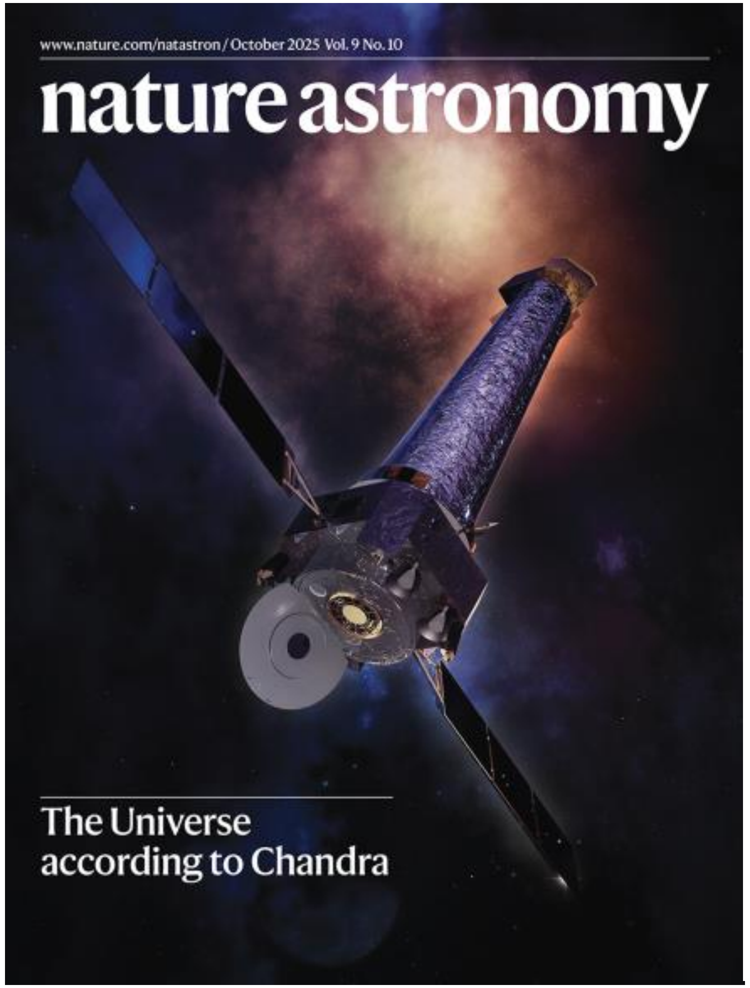
The Honorable Chris Van Hollen
Ranking Member
Appropriations Subcommittee on Commerce,
Justice, Science, and Related Agencies
U.S. Senate
Washington, D.C. 20510

Dear Chair Moran, Ranking Member Van Hollen, and Distinguished Members of the Committee:

We are the American Astronauts who proudly deployed NASA's *Chandra X-ray Observatory* from the Space Shuttle *Columbia*'s payload bay in 1999. Since that time, *Chandra* has revolutionized our understanding of the Universe, and humanity's place within it. We write today alongside a community of more than 10,000 people across our nation to ask that your committee continue to protect *Chandra* from premature and needless cancellation, as proposed in the Fiscal Year 2026 President's Budget Request for NASA.

Chandra — the most powerful X-ray Observatory in history — has been the vanguard of U.S. leadership in high energy astrophysics, a Nobel-prize winning field that began in and has been led by the United States since 1962. As the crew of STS-93, we had the honor of deploying the *Chandra* X-ray Observatory — an extraordinary example of American scientific achievement. Even after 25 years in orbit without servicing, *Chandra* remains the most powerful X-ray telescope ever built, with unrivaled X-ray detection sensitivity and imaging precision. Its longevity and continued cutting-edge scientific output reflect not only outstanding engineering but also the essential role *Chandra* plays in global astronomy. *Chandra* enhances nearly every major telescope around the world through its unique multiwavelength synergy, making it a force multiplier for discovery — a point emphasized in the report from NASA's most recent Congressionally-mandated Senior Review (NASA's "highest form of peer review"), which states: "*Now is arguably the most compelling time for Chandra to operate, joining the Hubble Space Telescope and JWST to enable sub-arcsecond observations across the electromagnetic spectrum from mid-infrared to X-rays. This set of three flagship observatories is a powerhouse that will provide unparalleled scientific potential that will not be superseded for many years.*"

Terminating *Chandra* now would not only undermine decades of American investment, but leave a critical gap in our national space capabilities. Nothing close to a replacement exists, and restoring this level of X-ray observatory capacity could take well over a decade — at many times the current operating cost. Meanwhile, China is actively expanding its own high-energy astrophysics program, positioning itself to assume global leadership in a field the United States pioneered.



nature astronomy

Review article
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25 years of groundbreaking discoveries with Chandra

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Check for updates

Patrick Slane[1], Ákos Bogdán[1] & David Pooley[2,3]

The Chandra X-ray Observatory is a mainstay of modern observational astrophysics. With the highest angular resolution of any X-ray facility, its imaging and spectral capabilities in the 0.5–10 keV band have led to both unique and complementary breakthroughs in nearly all areas of the field. Now, more than a quarter of a century into its mission, Chandra continues to provide invaluable information on the contributions of compact objects to the evolution of galaxies, the nature of supernova explosions, the impact of energetic jets from supermassive black holes on their host environments and the fate of exoplanet atmospheres in systems rich with stellar flares. Here we provide a summary of Chandra results—one that is embarrassingly incomplete, but representative of both the exquisite past and promising future of Chandra's contributions to high-energy astrophysics and all of mainstream astronomy.

As recently as 50 years ago—a blink of an eye in the history of astronomy—our knowledge of the high-energy Universe was confined to a small catalogue of discrete sources accompanied by apparently diffuse X-ray emission filling the sky. Today, this hazy X-ray background has been resolved into a speckled array dominated primarily by black holes, and we recognize a sky teeming with X-ray emission produced by objects from within our own Solar System to the very edge of the known Universe. This revolution has been brought about, largely, through the development of telescopes with mirrors capable of producing images of the X-ray sky.

The Chandra X-ray Observatory (Chandra) represents the current pinnacle of such facilities. With mirrors capable of resolving sources separated by less than 1″, the observatory can distinguish discrete sources from diffuse emission, image extremely small structures and measure proper motions and expansions of objects over time periods of years to decades. With a typical total background of two counts per million-second integration within a resolution element of $\lesssim 1''$ radius, Chandra is able to detect exceedingly faint objects—both very-low-luminosity nearby sources and luminous sources at high redshift. These capabilities open unique avenues of study that have resolved the diffuse X-ray background into point sources, separated emission from discrete sources in external galaxies to reveal the intervening interstellar medium (ISM), identified neutron stars and clumps of metal-rich ejecta in supernova remnants (SNRs) and resolved shocks in merging galaxy clusters.

Chandra's high-resolution mirrors are accompanied by two detectors, each capable of detecting individual X-ray photons: a CCD (charge-coupled device) camera that offers both imaging and moderate spectral resolution spectroscopy, and a microchannel device that provides slightly higher-resolution imaging along with fast timing capabilities. Each camera has both imaging and spectroscopy arrays, the latter used to read out X-rays dispersed through one of two transmission grating spectrometers that can be inserted into the beam to provide spectra with a resolving power of ~100–1,000 over the 0.25–10 keV bandpass. This powerful combination has been used to push the forefront of high-energy astrophysics, breaking completely new ground and establishing X-ray observations as a crucial component of mainstream astronomical investigations.

Here we present an overview of highlights from the first quarter century of studies with Chandra. A complete summary is far beyond the scope of this Review, but the reader is referred to ref. 1 for a more expansive treatment. This overview is organized around contributions to three fundamental questions of modern astrophysics: how did we get here, how does the Universe work and are we alone?

Key insights on our origins

Throughout a star's birth, life and death, whether on its own or with a partner in a binary, there are key high-energy processes that provide unique information on how the stars, planets and elements in our Galaxy came to exist in their present form and distribution. Stars, their

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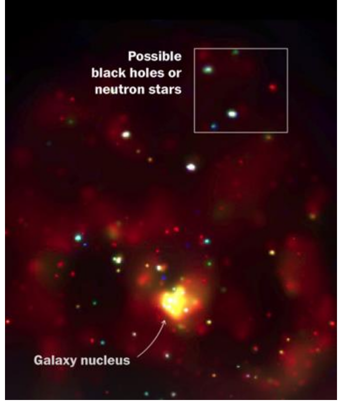
The Washington Post
Opinion | These scientific advances were 'Made in the U.S.A.' Will they continue?
America has long led in research. Budget cuts could jeopardize that dominance. (216 kB)

- We know neutron stars — stars so dense that a speck the size of a sesame seed would weigh more than a few thousand elephants — are common. The X-ray image below was made by NASA's Chandra mission. The numerous colorful dots are possible neutron stars or black holes located in a distant galaxy like our own.



Additional Budget Actions

- Reminder: President's Budget Request (PBR) contained drastic cuts to all of science, including NASA, and stated "NASA will initiate closeout of the Chandra mission."

- As part of post-SR actions, all operating missions were requested to prepare a 6-month close-out plan, with estimated costs, risks, and lists of tasks that would be reduced or eliminated.

  - Subsequently, a 3-month close-out plan was requested.

- Meanwhile, efforts by broad community crystalized support for Chandra in Congress.

  - Both Senate and House Appropriations bills provide support for Chandra – a huge milestone.

  - NASA was actively looking for ways to support Chandra throughout the complicated budget process.

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Astrophysics.—The Committee recommendation for Astrophysics includes not less than $98,300,000 for the Hubble Space Telescope, restoring grant funding for investigators and maintaining current public outreach activities; not less than $63,000,000 for the Chandra X-ray Observatory; and $80,500,000 for NASA's contribution to the Laser Interferometer Space Antenna [LISA].

The Committee recognizes that both Hubble and Chandra continue to make transformative discoveries and provide key capabili-

119TH CONGRESS 1st Session | HOUSE OF REPRESENTATIVES | REPORT 119–272

Astrophysics.—The recommendation includes $1,485,000,000 for Astrophysics.

Chandra X–Ray Observatory.—The Committee supports continued funding for the Chandra X–Ray Observatory, which continues to deliver discoveries addressing a wide range of questions across astrophysics.

FY26 Budget Direction

- All SR options were presented to the annual Planning, Programming, Budgeting, and Execution (PPBE) process.
  - In addition, an unsolicited Appendix was added with costs to restore HRC to Minimal Cost Mission (MCM).
- FY26 guidance received for operation under Continuing Resolution: $63M
  - This is above MCM budget but slightly below MCM option with HRC restored.
- Guidance is taken as MCM+HRC, with some savings required for HRC.
  - With existing reserves, this will allow us to complete FY26 without reductions (and with full GO funding restored for Cycle 27).
  - Assuming same budget for FY27 would require ramping down to MCM in 2027.
- Operation under a new federal budget unknown until such budget is developed and passed.
  - Encouraging outlook barring more significant NASA reductions.

Table 4.1: Reductions to Reach Minimal-Cost Mission
• ~~Remove HRC from use. Grating use available only with ACIS.~~
• Reduce rapid return-to-science support following anomalies.
• No *Chandra* conferences or newsletters.
• Reduce HelpDesk to minimal levels.
• Eliminate bibliography and other mission statistics tracking.
• No funding for archive or theory proposals.
• No new operating configurations for ACIS.
• Freeze HRC/LETG/HETG calibration.
• Minimize ACIS calibration.
• Minimize monitoring and trending of instruments.
• Eliminate Uplink Support for observations.
• Minimize Validation & Verification (V&V) and special processing efforts.
• Halt any further work on CSC and TGCAT.
• No new updates/algorithms/functionality to analysis software (CIAO, Sherpa, DS9, MARX, ChaRT, SAOTrace).
• Eliminate CIAO/Sherpa training workshops.
• Minimize new documentation/threads.
• No new updates to Data System software beyond mission-critical needs.

Questions