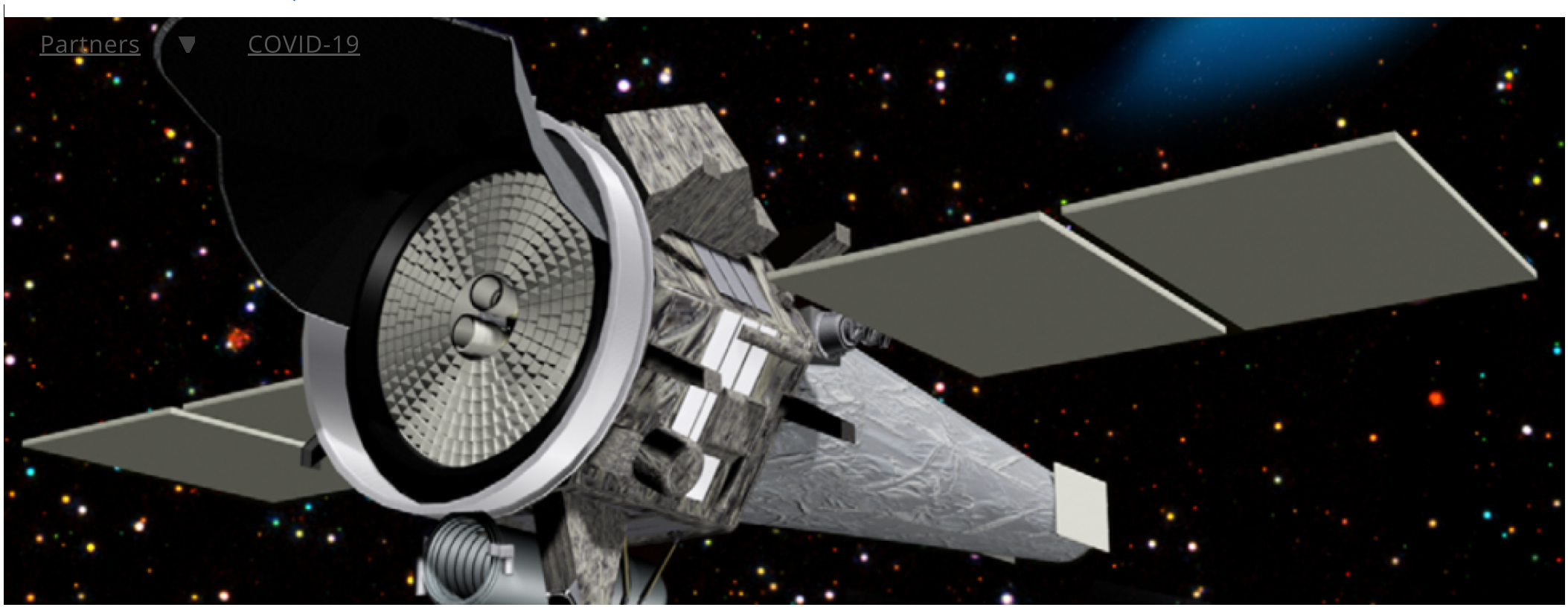

News

NASA selects STAR-X for $3M mission concept study

Penn State astronomer Niel Brandt is part of the mission, which could receive up to $300M for X-ray and ultraviolet studies of exploding stars, growing black holes, and the formation of galaxy clusters in the universe

Sam Sholtis

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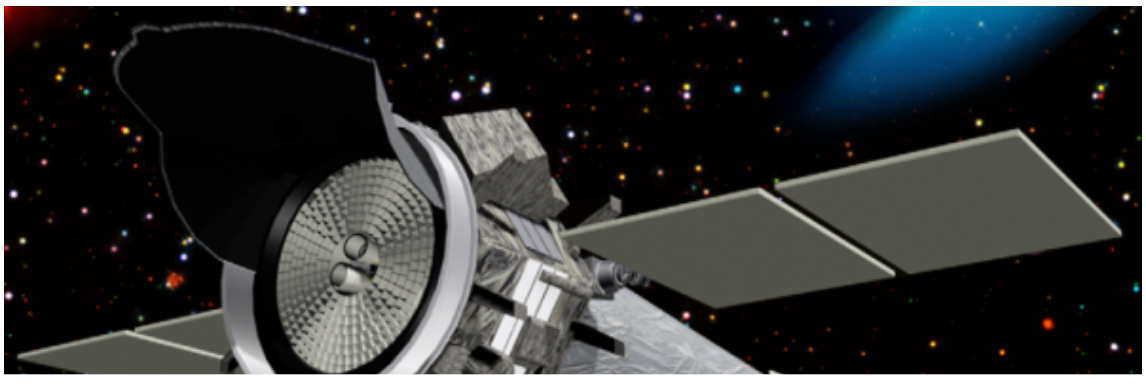
STAR-X, the Survey and Time-domain Astrophysical Research Explorer, a proposed NASA Medium-Class Explorer (MIDEX) mission that includes Penn State astronomer **Niel Brandt**, has been selected by the NASA Explorers Program for further study. STAR-X is one of two proposed MIDEX missions that will receive $3 million for a nine-month detailed study of mission requirements. At the end of this period, one of the proposed missions will be selected for a target launch date in 2027-2028 and be eligible for up to $300 million in additional funding.

Comprised of an X-ray telescope, an ultraviolet (UV) telescope, and a responsive spacecraft, STAR-X is designed to conduct time-domain surveys, which study how astronomical objects change with time, and to respond rapidly to transient cosmic events discovered by other observatories such as LIGO, Rubin LSST, the Roman Space Telescope, and the Square Kilometer Array. The mission is led by Principal Investigator **William Zhang** at NASA's Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. Penn State's Brandt, who is the Verne M. Willaman Professor of Astronomy and Astrophysics and Professor of Physics, is involved in planning the STAR-X cosmic X-ray surveys, active galaxy studies, and fast X-ray transient studies.

"I can't wait to use STAR-X to investigate the first supermassive black holes and understand mysterious, explosive X-ray transient sources," said Brandt. "STAR-X will also provide the essential X-ray and UV follow-up capabilities for remarkable cosmic objects discovered by the Rubin LSST in optical light."



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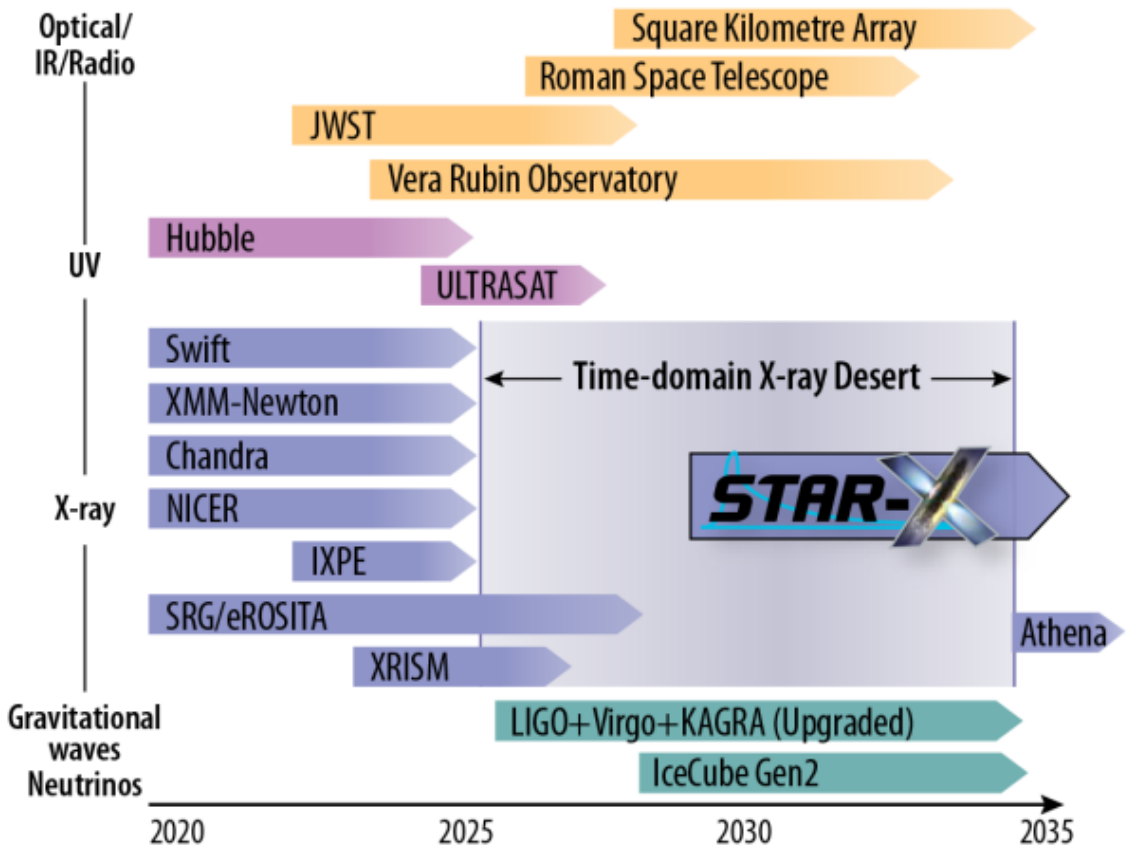
Artist's impression of STAR-X after its launch in 2027-2028. The aperture for the X-ray telescope is the large circular shape toward the left with thermal-baffle "ribbing" structure apparent. The ultraviolet telescope is the "outrigger" tube attached to the observatory's underside. The background shows X-ray imaging of the sky, such as would be obtained by STAR-X. Further technical details about the observatory are available at ***http://star-x.xraydeep.org/observatory/****. Credit: The STAR-X Team and NASA/GSFC.*

The STAR-X spacecraft would be able to turn rapidly to point a sensitive wide-field X-ray telescope and a UV telescope at transient cosmic sources, such as supernova explosions and feeding supermassive black holes. Deep X-ray surveys would map black holes and hot gas trapped in distant clusters of galaxies; combined with infrared observations from NASA's upcoming Roman Space Telescope, these observations would trace how massive clusters of galaxies built up over cosmic history.

STAR-X would provide revolutionary capabilities including unprecedented X-ray and UV volumetric survey speed; a unique combination of large field-of-view, large X-ray collecting area, low background, and excellent imaging; increased sensitivity for characterizing diffuse emissions, and increased speed and sensitivity for the discovery of faint X-ray point sources. It fills the gap in X-ray and UV survey coverage, providing simultaneous X-ray and UV observations, which are among the earliest and most uniquely informative astrophysical signals that probe the inner regions around compact objects like black holes and neutron stars, and it complements optical, infrared, and gravitational wave facilities.

The mission's Deputy Principal Investigator, **Ann Hornschemeier**, who is also Lab Chief for X-ray Astrophysics at GSFC, earned a Ph.D. in Astronomy and Astrophysics at Penn State, mentored by Brandt, in 2002.

"Ann is superb - a bundle of energy, and the right person to push STAR-X to succeed," said Brandt.



Bar chart showing the schedules for astronomical time-domain survey facilities operating or being developed at radio, infrared (IR), optical, ultraviolet (UV), and X-ray wavelengths as well as using gravitational waves and neutrinos - as labeled along the left-hand side. Relevant facilities are labeled including the Square Kilometer Array (operating in the radio), the Roman Space Telescope (infrared), the Vera Rubin Observatory (mainly optical), LIGO (gravitational waves), and IceCube (neutrinos). Note that STAR-X would effectively fill the "time-domain X-ray desert" that will otherwise exist in the late 2020's and 2030's, providing X-ray complementarity with many key facilities. Credit: The STAR-X Team and NASA/GSFC.

NASA Explorer missions conduct focused scientific investigations and develop instruments that fill scientific gaps between the agency's larger space science missions. The proposals were competitively selected based on potential science value and feasibility of development plans. The Explorers Program is the oldest continuous NASA program and is designed to provide frequent, low-cost access to space using principal investigator-led space science investigations relevant to the Science Mission Directorate's astrophysics and heliophysics programs.

"NASA's Explorers Program has a proud tradition of supporting innovative approaches to exceptional science, and these selections hold that same promise," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate at NASA Headquarters in Washington. "From studying the evolution of galaxies to explosive, high-energy events, these proposals are inspiring in their scope and creativity to explore the unknown in our universe."

Since the launch of Explorer 1 in 1958, which discovered the Earth's radiation belts, the Explorers Program has launched more than 90 missions, including the Uhuru and Cosmic Background Explorer (COBE) missions that led to Nobel prizes for their investigators.

The program is managed by NASA Goddard for NASA's Science Mission Directorate in Washington, which conducts a wide variety of research and scientific exploration programs for Earth studies, space weather, the solar system, and the universe. More information can be found at the **Explorers Program website**.

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