



NASA's Chandra X-Ray Observatory

# Virtual Field Trip Teacher Guide

with NASA's Universe of Learning

## About the field trip:

As NASA's premier X-ray telescope, Chandra gives us a powerful tool to investigate hot regions of the Universe. Get a backstage pass to Chandra's Operations Control Center, learn how coding languages help run Chandra, hear about different kinds of light, different space careers, and take a (virtual) journey with us to some exploding stars and colliding galaxies. This virtual field trip is part of the Code.org CS Journeys.

## Logistics:

The field trip is offered in webinar format on Zoom. Students do not need to log in individually; identities are protected in webinar format. Video recordings of the event may be found at <https://chandra.si.edu/fieldtrip/recording.html>. Live transcripts will be enabled. For sign language accommodations, please email us with your needs 2 weeks prior to the field trip date. Most suitable for students in grades 5 and higher. Note: we are adding 2 special sessions this fall for children in grades K-4. See schedule here: <https://chandra.si.edu/fieldtrip/>

Out of the 60 minute session, 20 minutes of Q&A will be provided, so feel free to have students come prepared with questions on coding, software, careers, stars, black holes or just the Universe. A brief hands-on activity is held towards the end of the field trip on binary code, where students write their initials in binary code (no supplies needed though a pencil or laptop to write the binary code characters is helpful): <http://chandra.si.edu/code>

## Send us feedback

Please let us know if you find the experience useful, and help us improve by answering a few short questions after the field trip: [https://studio.code.org/form/csjourneys\\_fall2022](https://studio.code.org/form/csjourneys_fall2022) (no identifying information will be collected)

## Free related activities & resources we offer:

<http://chandra.si.edu/binary>

*Learn the basics of binary code with interactive and at-home activities.*

<http://chandra.si.edu/code>

*Using data from the Chandra X-ray Observatory and other satellites on exploded stars, star-forming regions, and black holes, you'll learn basic coding.*

<http://chandra.si.edu/3dprint>

*Learn to create objects in our Universe through 3D printing.*

<http://chandra.si.edu/tinkercad>

*This activity series will take you through the basics of 3D modeling in astronomy using the free browser-based software Tinkercad.*

<http://chandra.si.edu/vr>

*A three-dimensional virtual reality (VR) with augmented reality (AR) version of 3D data allows you to walk inside the debris from a massive stellar explosion, as well as other astronomical objects.*

<http://chandra.si.edu/women/ar>

*A free augmented reality app that highlights women who have had an impact on STEM fields.*

<http://chandra.si.edu/sound>

*This sonification project allows listeners to hear translations of space data into sound.*

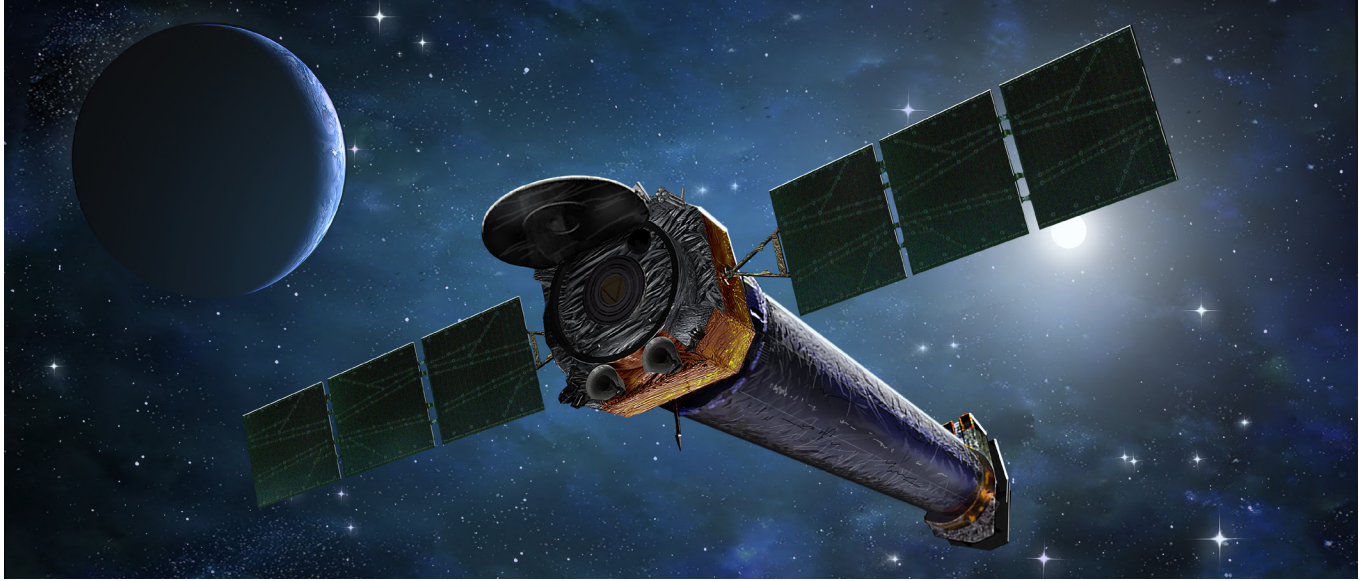
<http://chandra.si.edu/make>

*This site houses hands-on activities that can be done without a computer using mostly paper materials.*

## Virtual tours:

Chandra Control Center VR tour: <https://www.cfa.harvard.edu/news/behind-scenes-tour-chandra-operations-control-center-now-available>

Chandra Spacecraft VR tour: [https://chandra.si.edu/vr/chandra\\_vr/](https://chandra.si.edu/vr/chandra_vr/)



### What is Chandra?

NASA's Chandra X-ray Observatory was launched by the Space Shuttle on July 23, 1999. Chandra is a telescope specially designed to detect X-ray emission from very energetic regions of the Universe such as exploded stars, clusters of galaxies, and black holes. <https://chandra.si.edu/about/>

### Who is Chandra named for?

in honor of the late Indian-American Nobel laureate, Subrahmanyan Chandrasekhar (pronounced: su/bra/mon'yon chandra/say/kar). Known to the world as Chandra (which means "moon" or "luminous" in Sanskrit), he was widely regarded as one of the foremost astrophysicists of the twentieth century. <https://chandra.si.edu/about/chandra.html>

### What is light and the Electromagnetic Spectrum?

The word light usually makes one think of the colors of the rainbow or light from the Sun or a lamp. This light, however, is only one type of electromagnetic radiation. Electromagnetic radiation comes in a range of energies, known as the electromagnetic spectrum. The spectrum consists of radiation such as gamma rays, x-rays, ultraviolet, visible, infrared and radio. [https://chandra.si.edu/resources/em\\_radiation.html](https://chandra.si.edu/resources/em_radiation.html)

### Jobs at Chandra that involve coding and/or software development:

Flight engineer, systems engineer, astrophysicist/astronomer, software developer/engineer, application developer, web developer, 3D modeler, animator, visualization scientist, image processor, technical assistant, computer engineer, computer specialist, system administrator, data specialist, and more!

**Downloadable STEM career chart:** [https://chandra.si.edu/women/images/Poster\\_for\\_classroom.pdf](https://chandra.si.edu/women/images/Poster_for_classroom.pdf)

### Vocabulary

**black hole** A dense, compact object whose gravitational pull is so strong that — within a certain distance of it — nothing can escape, not even light. Black holes are thought to result from the collapse of certain very massive stars at the ends of their evolution.

**light year** The distance that light, moving at a constant speed of 300,000km/s, travels in one year. One light year is about 10 trillion kilometers.

**supernova** Explosive death of a star, caused by the sudden onset of nuclear burning in a white dwarf star (Type Ia), or gravitational collapse of the core of massive star followed by a shock wave that disrupts the star (Type II, Type Ib, Ic). A supernova is one of the most energetic events of the universe and may temporarily outshine the rest of the galaxy in which it resides.

**galaxy** A gravitationally-bound system of stars, gas, dust and dark matter.

**X-ray** Region of the electromagnetic spectrum corresponding to radiation of high frequency and short wavelengths, far outside the visible spectrum.

### For more terms visit our glossary:

<https://chandra.si.edu/resources/glossaryA.html>

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