Exploring the Hot Universe with the Coolest Instrument in Orbit

Presented by

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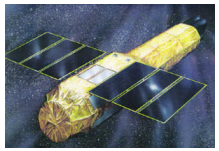
SUZAKU [ASTRO-EII]



The Hot Universe

The Universe is filled with highly energetic phenomena

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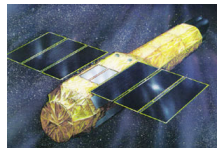
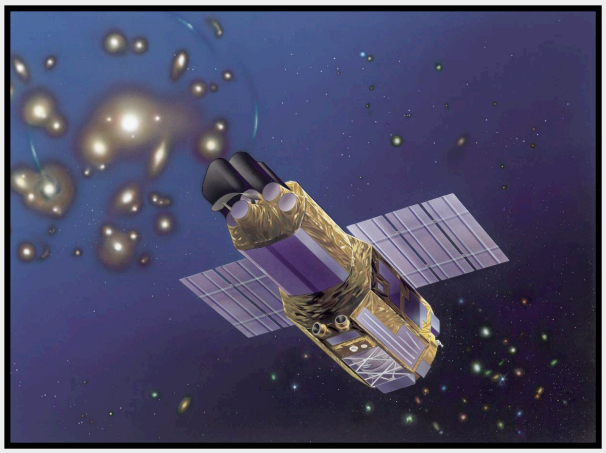


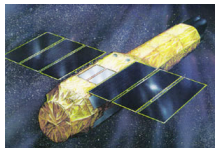
Meet Suzaku!

Suzaku is a brand-new satellite that will explore how stars and galaxies form and evolve. Using X-ray telescopes, it will explore phenomena occurring in extreme environments in the universe.



We'll discuss:

- Science and instruments on Suzaku
- Bringing Suzaku into your classroom



Just the facts…

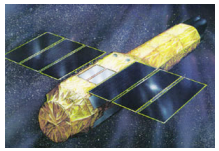
WHO? Suzaku (known pre-launch as Astro-E2)

WHEN? Launched July 10, 2005

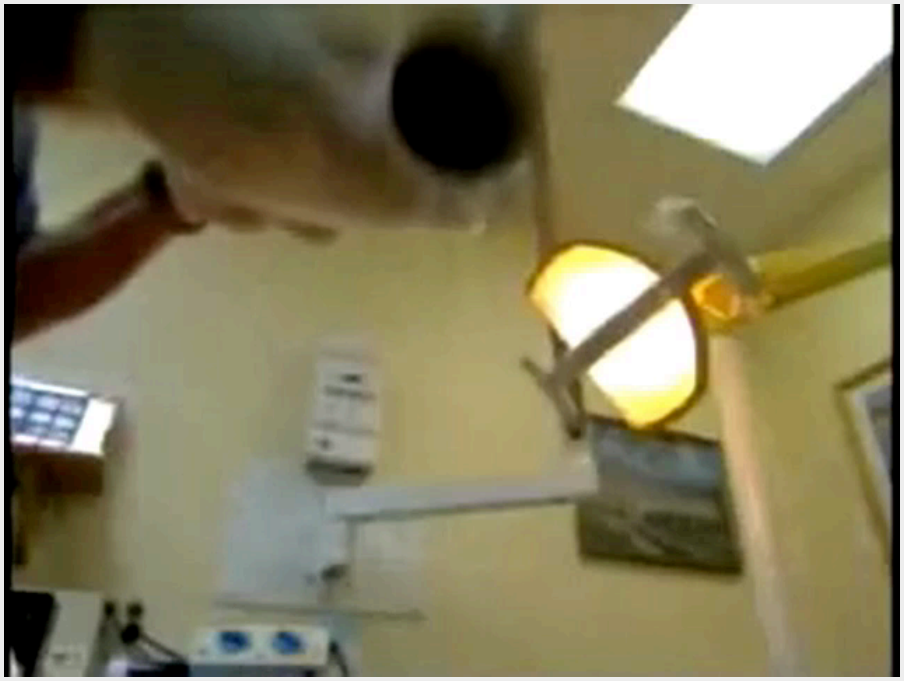
WHERE? Built simultaneously in the US and Japan, and launched from Uchinoura, Japan.

WHY? To detect X-rays from sources in space, such as black holes, galaxies, and stars.

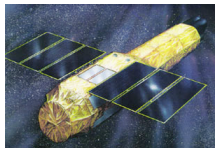
HOW? Well, let's take a look…



Where do we get our X-rays?



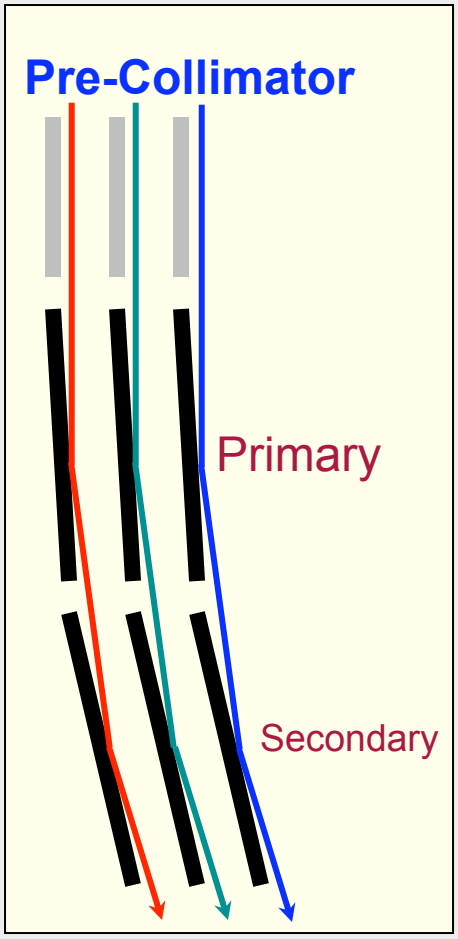
Kim Weaver

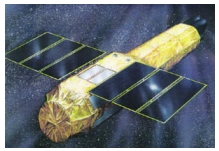


So you want to see X-rays…

Build a Telescope!

- X-rays do not reflect off of normal mirrors.
- But they do reflect at grazing incidences off metal mirrors.
  - Two grazing incidences will bring x-rays into focus.

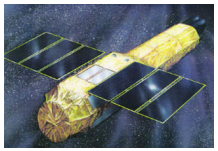




More on Grazing Incidences

Reflecting X-rays is a bit like skimming stones on a lake -- using the best angle will make them bounce (reflect), instead of sink (absorb).

Simple classroom activities about grazing incidences can be kinesthetic or modeled with balls, eggs, and other materials.



Building the Telescopes

Four quadrants (1344 mirrors) are assembled to form a cylindrical stage 40cm in diameter.

Reflecting surfaces are gold.

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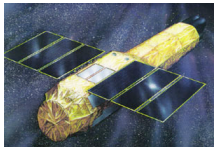
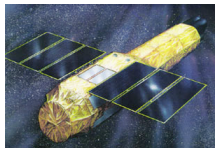


Putting it all together



How We Explore using Spectroscopy

Kevin Boyce and Ilana Harrus

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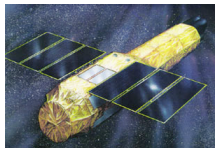

Classroom Spectroscopy

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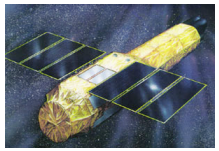

A Day at the Multiwavelength Stadium

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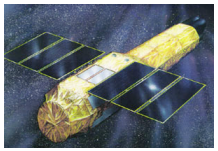
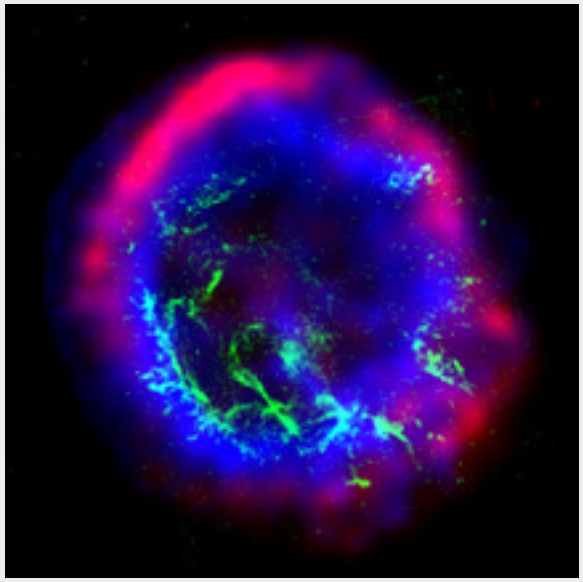
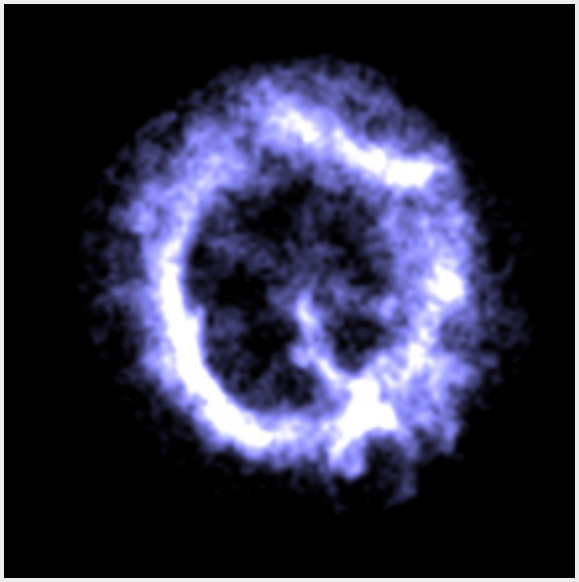


What Do X-rays Reveal?

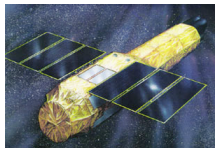
Let's take a look at a supernova remnant!



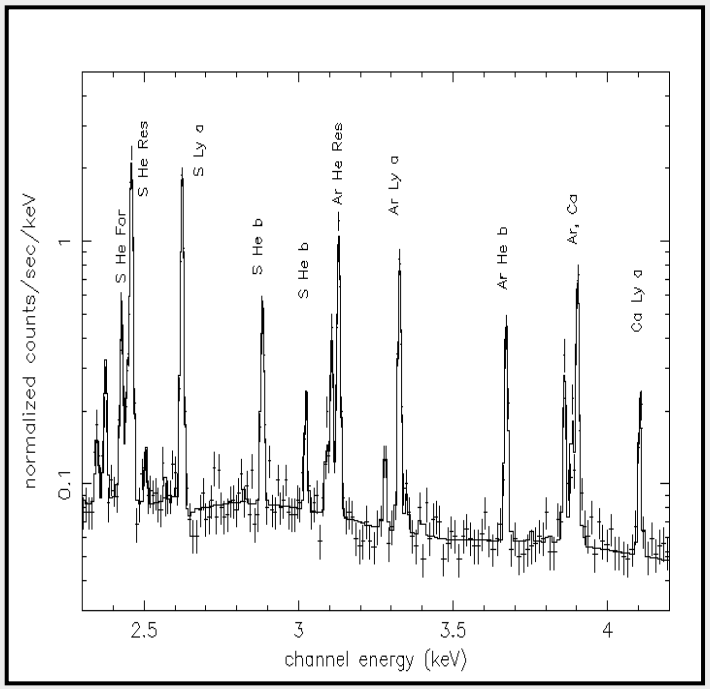
Multiwavelength View

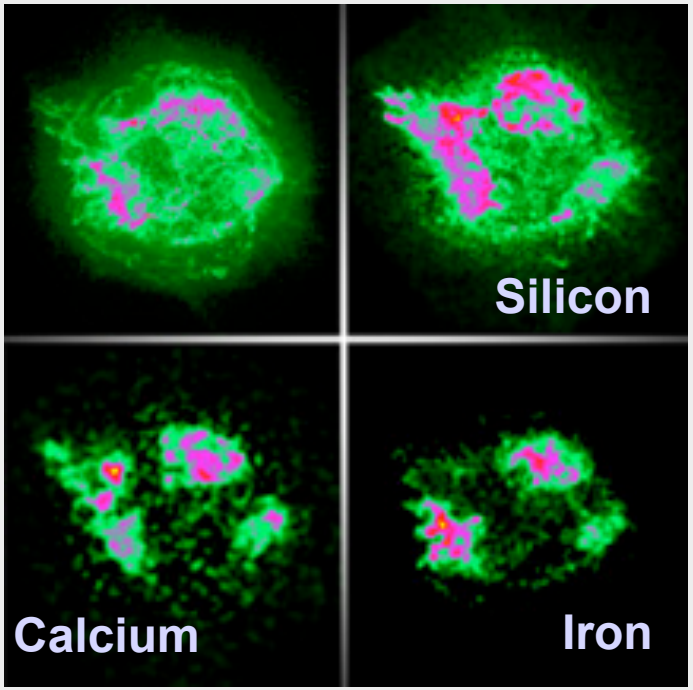


X-ray View



What Can Spectroscopy Tell Us?





The elemental composition of a supernova remnant…

…and exactly where those elements are located.

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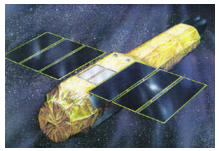

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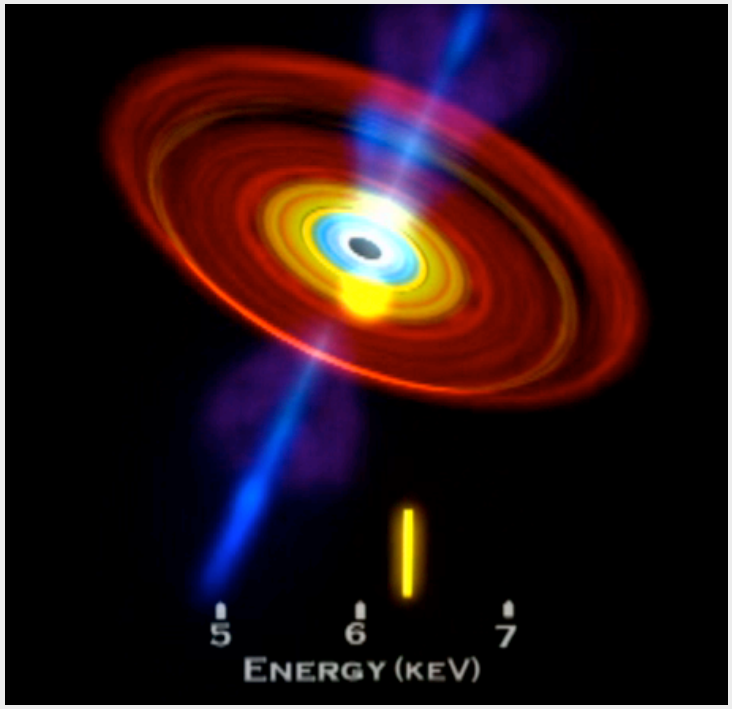
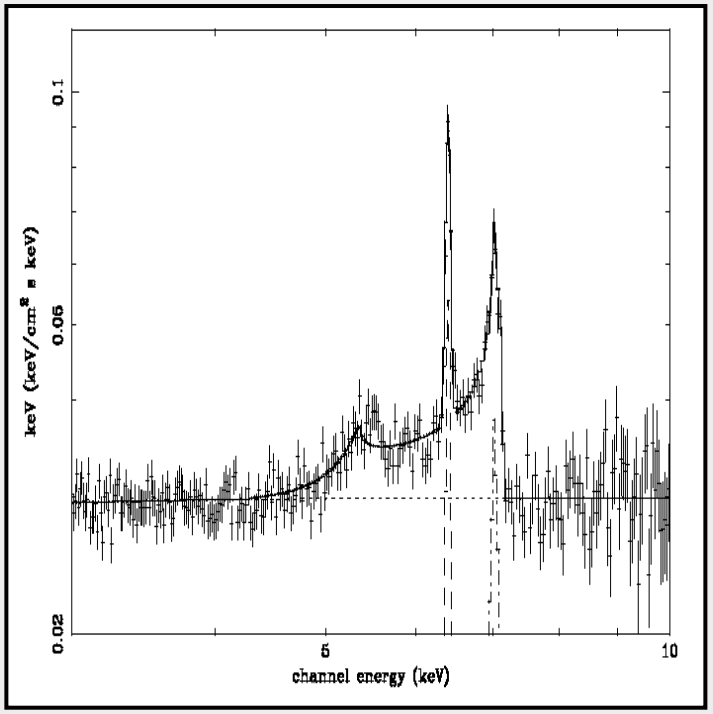
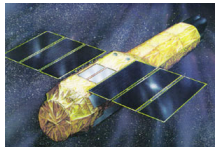




The motion of material swirling around a black hole…

…and relativistic effects that can probe for info like size.



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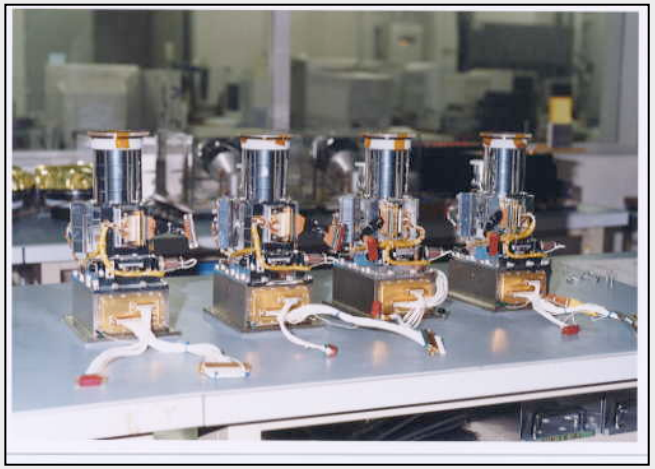
How does Suzaku detect X-rays?

XIS

X-ray Imaging Spectrometers

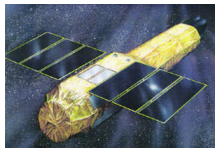
- Four CCDs, each served by its own telescope.
- Detect X-rays with energies between 0.2 - 12 keV.



HXD

Hard X-ray Detector

- Detects higher energy X-rays between 10 to 700 keV.
- The most sensitive detector ever built for this range!



What do scientists hope to learn with Suzaku?

- When and where are the chemical elements created?
- What happens when matter falls onto a black hole?
- How does nature heat gas to X-ray emitting temperatures?

Scientists look for answers to these questions to start to answer much bigger questions about how our Universe formed and evolved.

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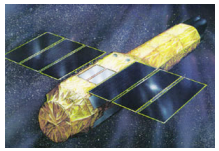
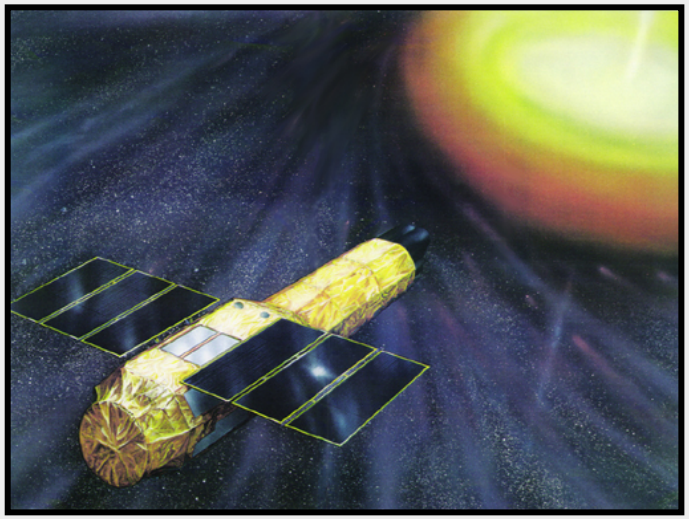


Why “Astro-E2” ?



This continues a collaboration between
NASA and the Japanese in x-ray astronomy.

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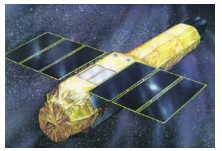
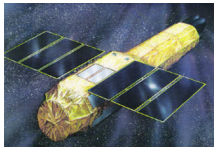


Being Part of an International Team

- What do you think about the fact that the Japanese collaborators had to learn English… but the US collaborators rarely speak any Japanese?
- How do you feel about the Japanese attitude about sweets?
- What are other physical and cultural obstacles involved in an international collaboration?
- What are the opportunities?



A Trip to Space

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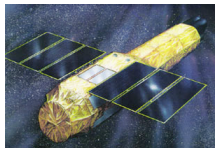
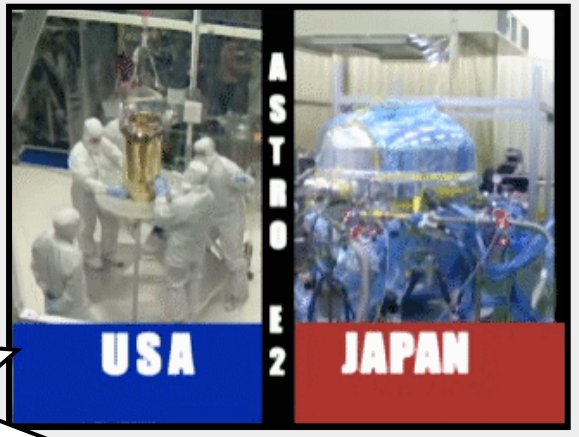
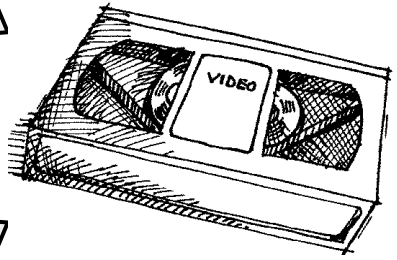
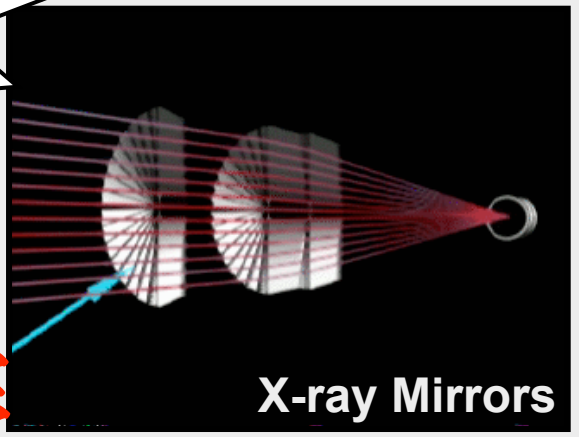


"Building the Coolest X-ray Satellite"





WITH TEACHER GUIDE



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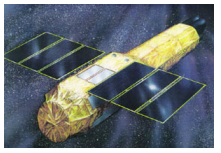

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