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<p>Video Podcast Episode 10: Making the Universe come to life – behind the Hubble images</p> <p>FOR IMMEDIATE RELEASE 18:00 (CET)/12:00 AM EST 08 November, 2007</p>		
<p>00:00 [Visual starts]</p> <p>[Narrator] 00:00 We live in a Universe of unimaginable scale and almost incomprehensible beauty. How is the light from stars, galaxies and nebulae fashioned into the spectacular images that have so inspired us over the years?</p> <p>00:20</p> <p>00:35 [Woman] This is the Hubblecast!</p> <p>News and Images from the NASA/ESA Hubble Space Telescope.</p> <p>Travelling through time and space with our host Doctor J a.k.a. Dr. Joe Liske.</p> <p>00:49 [Dr. J] Welcome to the Hubblecast! Do you ever look at these beautiful Hubble images and wonder how they were made? What exactly happens after the faint light from distant objects is detected by Hubble? How are these cosmic photons captured in space transformed into the glorious colour images down here on your wall or on computer screen?</p> <p>On a clear night when we look up into the heavens we can see the light from thousands of stars. Our eyes are fantastic detectors but are in reality are actually very limited. They aren't sensitive enough to peer out very far into space. Also we can only see visible light, but not ultraviolet or infrared light like Hubble can. That's why for professional astronomers the Hubble Space Telescope is such an exciting tool to probe the</p>		<p>Zoom on several of Hubble's 'best' images.</p> <p>Image explosion</p> <p>Hubblecast Logo + web site</p> <p>Presented by ESA and NASA</p> <p>TITLE Slide: Episode 10: Making the Universe come to life – behind the Hubble images</p> <p>Nametag</p> <p>Virtual studio: Dr J on camera</p> <p>Different images cross fade.</p> <p>Dr. J in front of a night sky twinkling above.</p>

Universe.

01:36

[Narrator]

Sitting at its vantage point 600 km above the Earth, Hubble is a window on the Universe. The journey to make a Hubble image begins when light from a distant object starts on its way towards us. After travelling across the vast distances of space it is captured by Hubble with its 2.4 metre wide mirror. The light is then sent to one of Hubble's several cameras where the photons are turned into an electrical charge by a CCD chip rather similar to the ones in digital cameras.

The Advanced Camera for Surveys (ACS), for example, contains over 16 million picture elements or 'pixels'. These act as miniature 'buckets' to collect the light. The camera then reads how much light has been captured in each bucket (the charge within each of the pixels) and outputs an image. This readout is then beamed back to the Earth as a series of encoded numbers that are stored in archives in the US and Europe.

02:32

[Dr. J]

Hubble's cameras image the Universe with different filters – like this one. These select specific wavelengths of light that are characteristic of different physical processes which may be going on in different parts of distant galaxies and nebulae. Each of the filters results in a single greyscale image which is then assigned a colour. This colour is usually chosen to more or less correspond to the actual colour of the filter, although this is not always true. Anywhere between two and six filtered images are combined to create the final colour image.

Take this view of the colliding Antennae Galaxies. Hubble imaged this colliding pair through red, green and blue filters to reveal the different components inside the galaxies. For example the red light is coming from old stars and glowing hydrogen gas, while the blue light is showing the violent star formation triggered by the cosmic collision. The red, green and blue images are combined to create the final multi-colour image.

03:42

[Narrator]

One of the challenges in making images is that there is a huge range of brightness in nature from faint to bright objects and astronomical images are so rich in information that our eyes and computer screens cannot show their full content. Nature can be difficult to capture in a single photograph and most of us have encountered situations like the following. Imagine you try to take a picture of a landscape. When you do so you can either capture the bright parts of the sky or the darker parts of the vegetation, but rarely both together. The job of the image processing specialists is to compress this range of brightnesses

HST

Graphic of light from a distant galaxy sweeping back across space past galaxies and nebulae to bounce around inside Hubble and (eventually) beamed back as a stream of numbers to Earth.

'Light' falls in buckets that are serially read out.

TDRS animation

Dr J. shows a colour filter

Working with the images full screen on 'virtual lightbox.'

Show image showing outside house...
...Then inside house...
...and then combined image.

together so that we can see all the nuances.

Image experts use the program FITS Liberator, pioneered by ESA, ESO and NASA to produce a magnificent rich image which can be interpreted by our eyes.

05:01

[Dr. J]

But is this what we would see with our eyes if we could look through Hubble? Well not really.

Look at this image of the Cigar Galaxy. This is what Hubble sees in visible light. Our eyes aren't actually sensitive enough to be able to detect the faint light from this distant object even when looking through a telescope. The reason why Hubble's instruments can do it is because they can gather and add up the light over an extended period of time - which is something our eyes can't do.

05:32

[Narrator]

Furthermore some telescopes can 'see' wavelengths that we can't see with our eyes. This multi-wavelength view shows us much more than our eyes, or any one telescope, can see.

Parts of the image were made with the Chandra X-ray Observatory in X-rays and part with the Spitzer Space Telescope in infrared light.

05:52

[Dr. J]

In this episode we have seen how the images that have amazed and intrigued us are created. You too can have a go at making your own images, just Google 'FITS Liberator'.

This is Dr. J signing off for the Hubblecast.

Once again nature has surprised us beyond our wildest imagination ...

06:12

[Outro]

Hubblecast is produced by ESA/Hubble at the European Southern Observatory in Germany. The Hubble mission is a project of international cooperation between NASA and the European Space Agency.

END

FITS Liberator demonstration

Virtual studio: Dr J on camera

Hubble Cigar galaxy image

Composite Spitzer-Hubble-Chandra image

Chandra Cigar galaxy image

Spitzer Cigar galaxy image