

Hubble explores a barred spiral galaxy



NASA 2002

The photograph on pages 10-11 shows a barred spiral galaxy, NGC 1672 in the astronomers' New General Catalogue. The image was made by the Hubble Space Telescope (HST), and was released in April 2007.

NGC 1672 is situated 60 million light years away, in the constellation of Dorado. The image is just 75 000 light years wide.

Dr Andrew Levan of Warwick University is part of the team studying this galaxy. He explains why this image was made:

This was part of a programme to understand how star formation works in spiral galaxies. The bright red regions in the spiral arms are where the star formation is happening. Using this data, and some taken in tandem by the Chandra X-ray Observatory (which uses X-rays which can penetrate through dense gas and dust around stars, in the same way they can penetrate our bodies), we can investigate in detail the properties of these regions and how they affect the galaxy as a whole.

How the image was made

To make the image, light from the distant galaxy was recorded four times, through four different filters. Three of these let through blue, green and infrared light, while the fourth transmitted a narrow band of wavelengths around 658 nanometres, corresponding to red light coming from ionised hydrogen gas. (Stars consist largely of hydrogen.)

Total exposure time was 2.7 hours, after which the four images were combined.

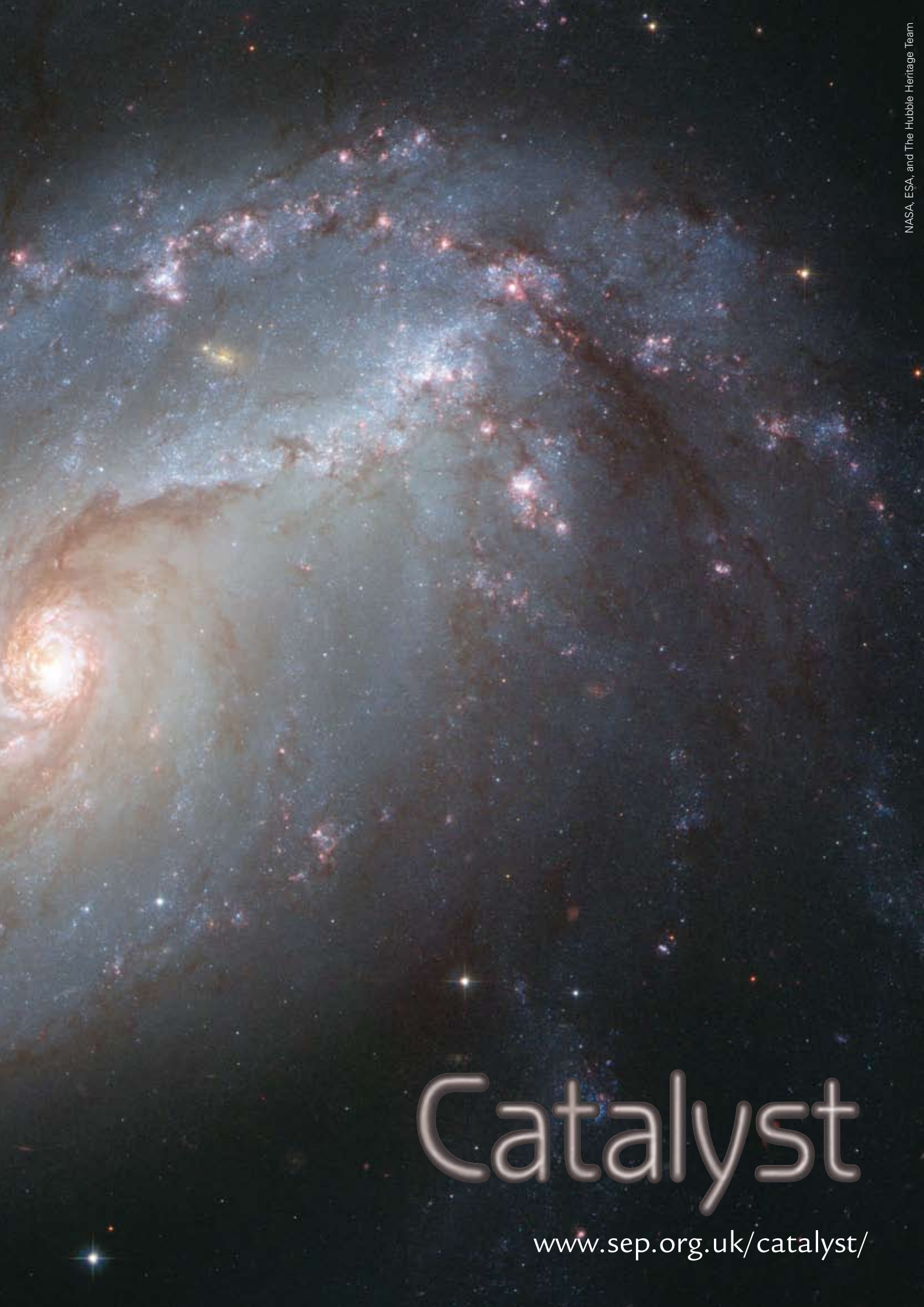
The HST is in orbit at an average height of 600 km above the Earth, where it can get a clear view of objects in space, free from the effects of the Earth's atmosphere.

What to look for:

- spiral arms leading out from a central bar with dust lanes following their inner edges
- clusters of hot, young blue stars which are forming along the spiral arms
- the bright central nucleus glowing brightly; this energy comes from material being dragged into a supermassive black hole at the centre of the galaxy
- other, distant galaxies shining through NGC 1672's dust clouds
- a few bright stars from our own galaxy



Dust, gas and stars make up the barred spiral galaxy NGC 1672 in this image from the Hubble Space Telescope.



Catalyst

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We all live in a barred spiral galaxy

The word galaxy comes from the Greek word *gala*, meaning milk.

Our galaxy is the Milky Way. On a clear night, it appears as a band of stars, straggling across the sky. For a long time, the Milky Way has been recognised to be a spiral galaxy; now we know that it is a barred spiral galaxy, somewhat similar to NGC 1672 (pages 10-11).

How do we know?

We cannot possibly hope to see our galaxy from outside – it is 100 000 light years across. So how did astronomers work out its shape?

It is clear from the fact that stars are clustered in a band across the night sky that our galaxy must be two-dimensional, roughly speaking a flat disc. There is a prominent split in the band, in the constellation of Scorpius.

In 1785, William Herschel, the discoverer of Uranus, counted stars in different directions. He guessed that the galaxy extended furthest in directions where the stars were most numerous. His diagram (figure 1) has the Sun close to the centre of the galaxy, and the Scorpius division on the right.



Figure 1: William Herschel's diagram of a cross-section through the Milky Way

Building the picture

In the second half of the 19th century, astronomers used large telescopes to scan the night sky. They spotted many thousands of 'spiral nebulae' (a nebula is a cloud). Some thought that these were simply clouds of glowing dust and gas; others that they were giant star systems, perhaps even 'island universes'. Today we know that these nebulae are other galaxies, comparable to the Milky Way.

It wasn't until the 1930s that sufficient measurements had been made of stars in the Milky Way to confirm that our galaxy is spiral in form, roughly 100 000 light years across, with a central bulge about 16 000 light years thick.

Today's view

This picture has recently been further refined. Following in Herschel's footsteps, a team of astronomers have measured the distances of 30 million stars. They looked at infrared radiation coming from these stars, as this long-wavelength radiation can pass right through the thickness of the galaxy. To their surprise, their data showed that the Milky Way is more than a simple spiral galaxy; it has an extensive central bar.

The Sun is a star in one of the spiral arms of the galaxy, about one-third of the way in from the edge. The image shown below is an artist's impression of what you would see if you could travel out from the galactic disc and look at it face-on.

The Milky Way – a barred spiral galaxy

