



Hubble Facts

Launch Date: 24 April, 1990

Orbital altitude: 593 km

Orbital time: 96 minutes

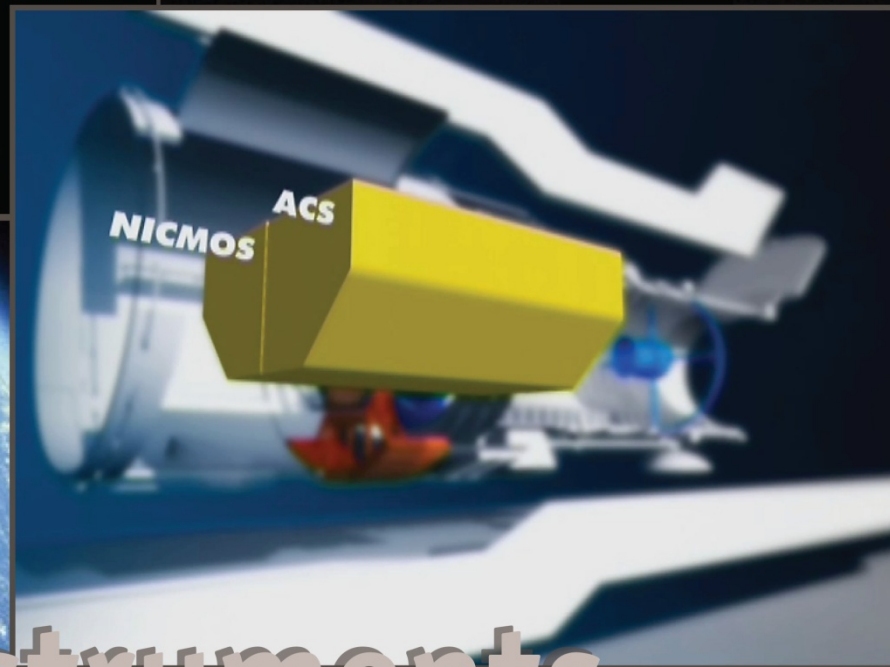
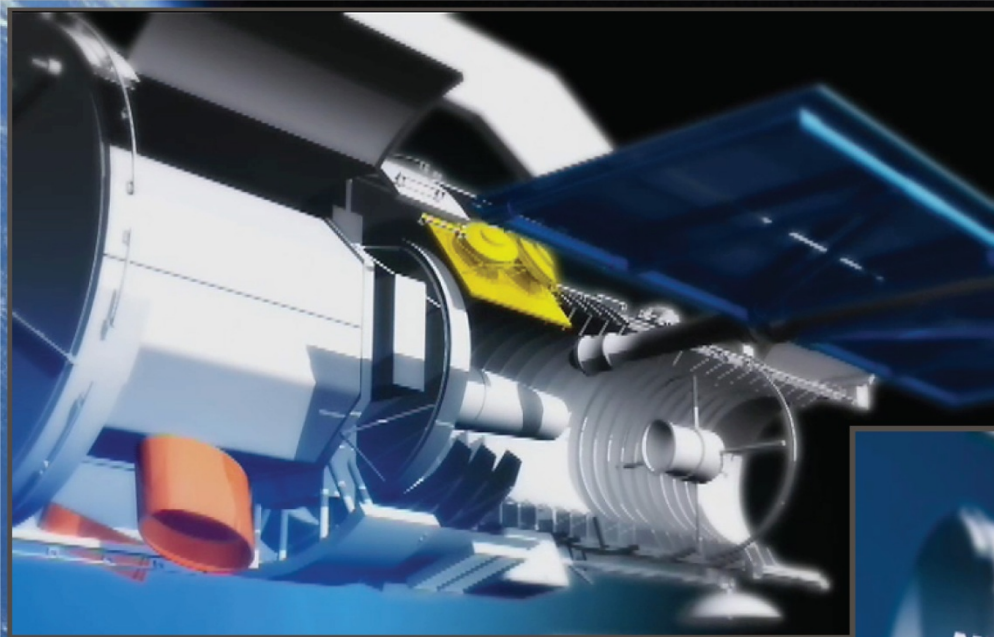
Length: 13.2 m

Diameter: 4.2 m

Primary Mirror: 2.4 m

Mass: 11,110 kg

Pointing stability: Hubble moves less than 0.007 arc-seconds for 24 hours

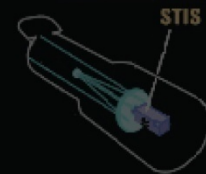
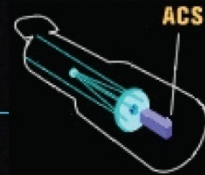


HUBBLE Instruments

ADVANCED CAMERA FOR SURVEYS

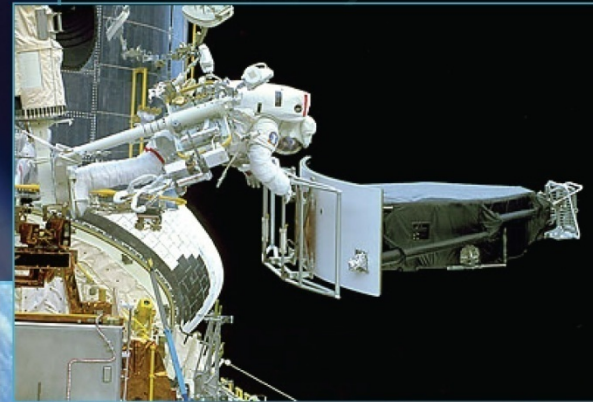
ACS is a so-called third generation Hubble instrument. Its wide field of view is nearly twice that of Hubble's previous workhorse camera, WFPC2. The name, Advanced Camera for Surveys, comes from its particular ability to map relatively large areas of the sky in great detail.

Galaxy M82 as pictured by ACS

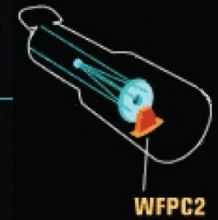
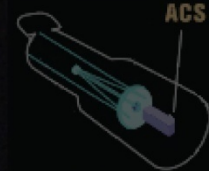


WIDE FIELD and PLANETARY CAMERA 2

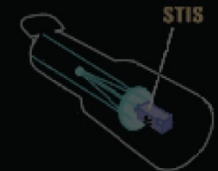
WFPC2 was Hubble's workhorse camera up to the installation of ACS. It records excellent quality images through a selection of 48 colour filters covering a spectral range from far-ultraviolet to visible and near-infrared wavelengths. WFPC2 has produced many of the stunning pictures that have been released as public outreach images over the years.



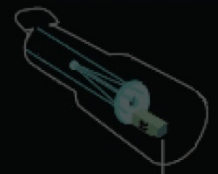
A typical image taken with the WFPC2 camera onboard Hubble. The four CCD chips are so close that the seams between them are difficult to see. They are all 800x800 pixels - also the smaller PC (Planetary Camera chip in the upper left corner).



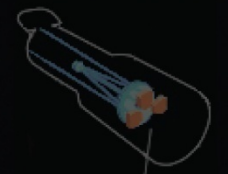
WFPC2



STIS



NICMOS

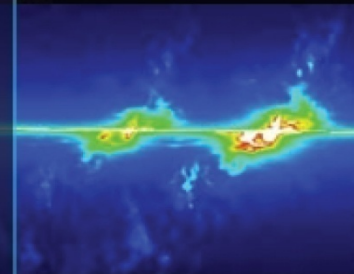


3 FGSs

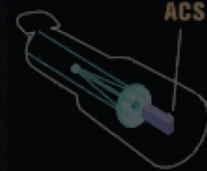
SPACE TELESCOPE IMAGING SPECTROGRAPH



The Space Telescope Imaging Spectrograph (STIS) is a versatile multi-purpose instrument taking full advantage of modern technology. It combines a camera with a spectrograph and covers a wide range of wavelengths from the near-infrared region into the ultraviolet.



A STIS spectrum of the galaxy NGC 4151 revealing that gas is flowing out of a black hole in its centre.

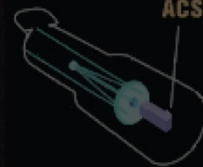


NEAR INFRARED CAMERA AND MULTI-OBJECT SPECTROMETER

The Near Infrared Camera and Multi-Object Spectrometer (NICMOS) is an instrument for near infrared imaging and spectroscopic observations of astronomical targets. NICMOS detects light with wavelengths between 8000 to 25000 Ångstroms.

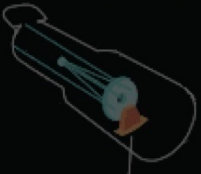
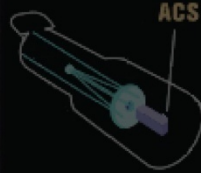


Typical image taken with NICMOS. It shows a gigantic star cluster in the centre of our Milky Way. NICMOS is the only Hubble instrument which – due to its infrared capabilities – is able to look through the heavy clouds of dust and gas in these central regions.

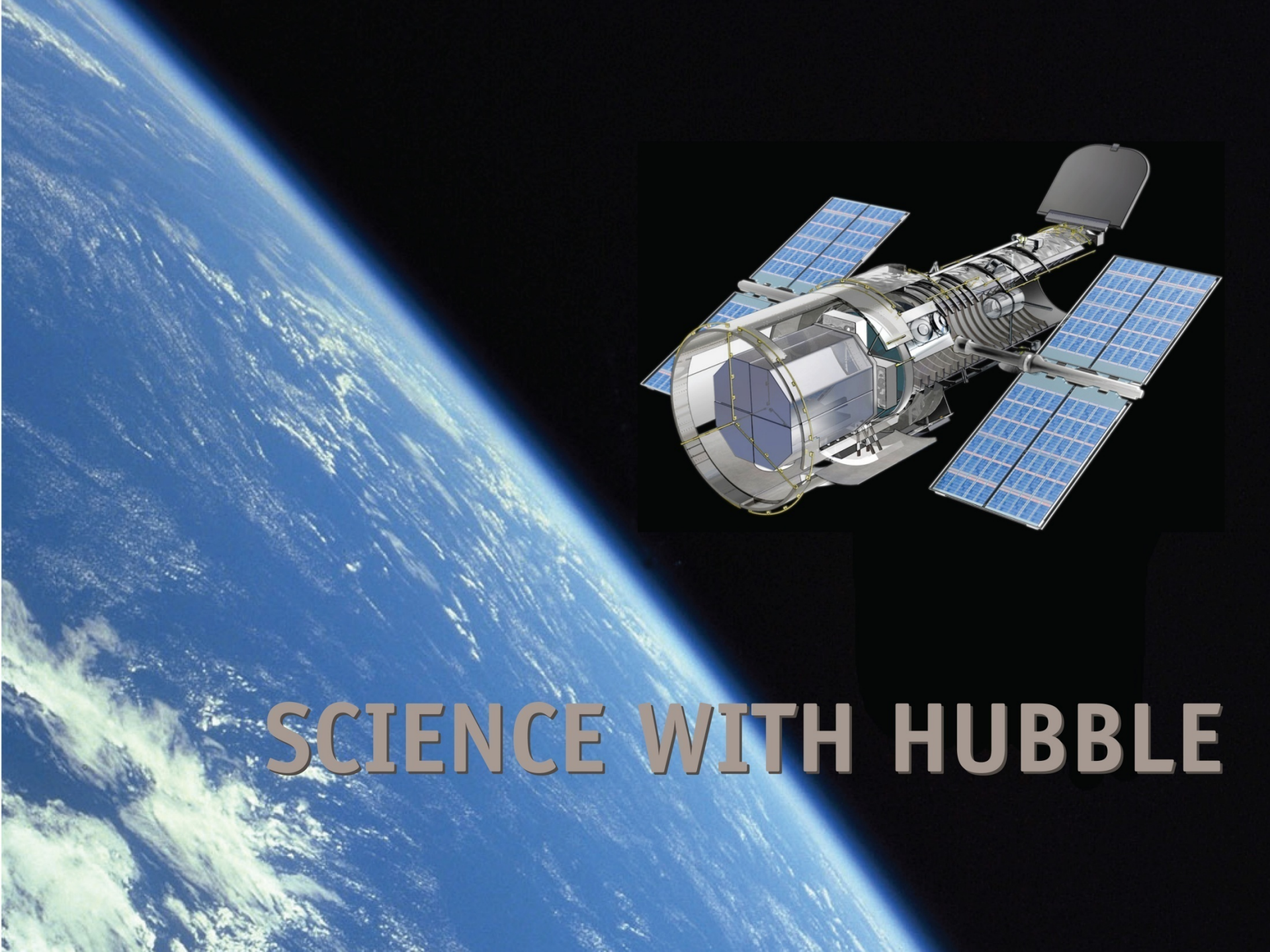


FINE GUIDANCE SENSORS

Hubble has three Fine Guidance Sensors on board. Two of them are needed to point and lock the telescope on the target and the third can be used for position measurements – also known as astrometry.



Hubble Instruments



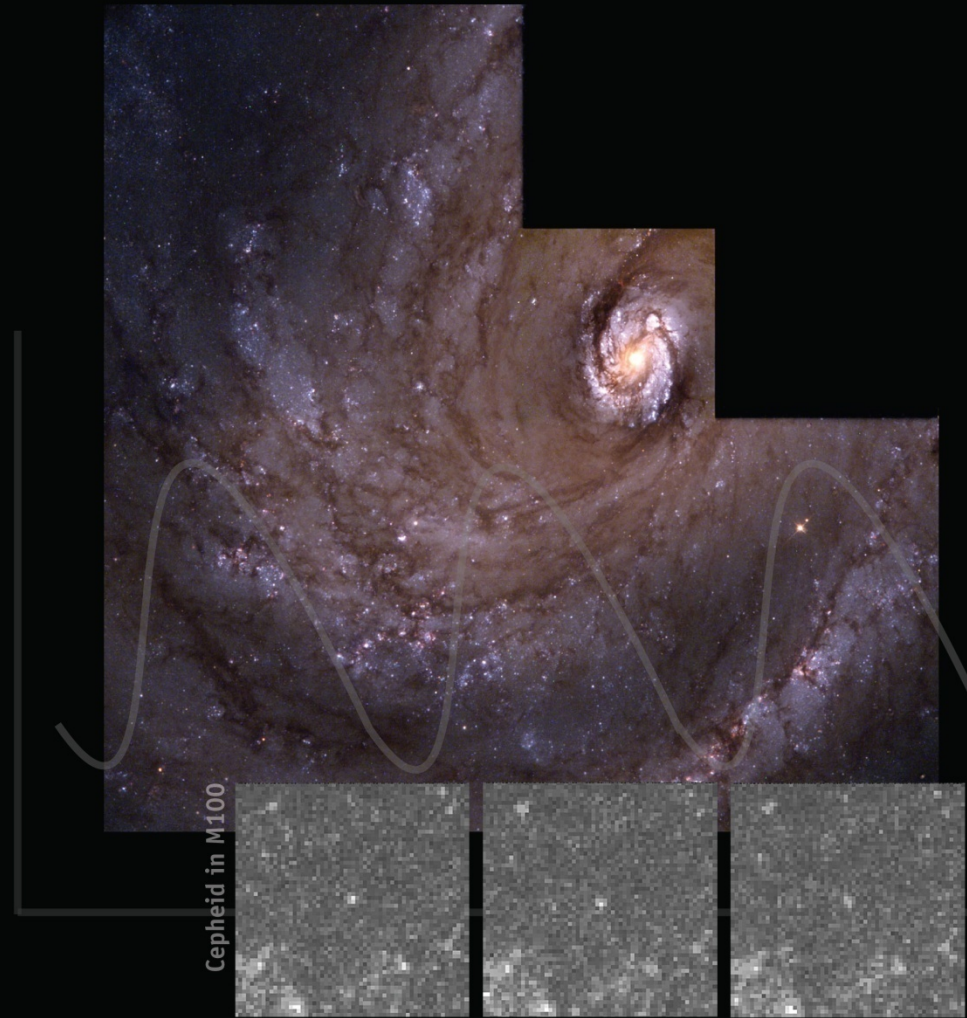
SCIENCE WITH HUBBLE

The Age and Size of the UNIVERSE

Supernova 1994D

SUPERNOVAE

Most scientists today believe that the expansion of the Universe is accelerating. This result came from combined measurements of remote supernovae with most of the world's top-class telescopes, including **Hubble**, and it was a very surprising one. For many years cosmologists have discussed whether the expansion of the Universe would stop in some distant future or continue ever more slowly. From the new results it seems clear that the expansion is nowhere near slowing down. In fact, due to some mysterious property of space itself (called vacuum energy), the expansion is accelerating and will continue forever.



CEPHEIDS

The top ranked scientific justification for building Hubble was to determine the size and age of the Universe through observations of Cepheid variables in distant galaxies.

Deep Fields

One of the main scientific justifications for building Hubble was to measure the size and age of the Universe and test theories about its origin. Images of faint galaxies give 'fossil' clues as to how the Universe looked in the remote past and how it may have evolved with time. The Deep Fields gave astronomers the first really clear look back to the time when galaxies were forming.



Hubble Ultra Deep Field



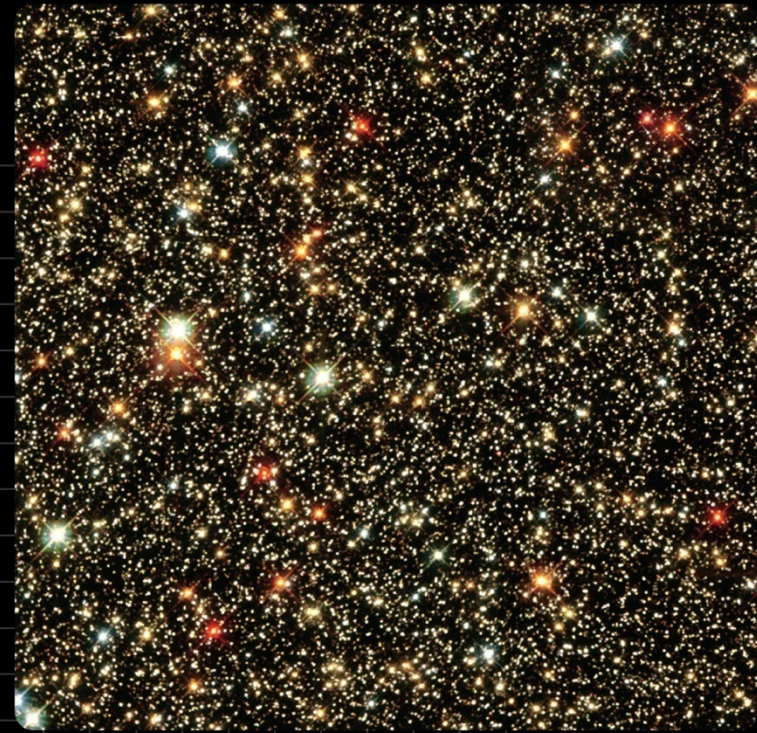
Hubble Deep Field

The Composition of the **UNIVERSE**

A ghostly "ring" of dark matter in the galaxy cluster ZwCl0024+1652.



Hubble has played an important part in work intended to establish the amount of **dark matter** in the Universe and to determine its composition.



Sagittarius Star Cloud



Globular Cluster M80

Investigation of **helium** in the early Universe is one of many ways that Hubble has used **distant quasars** as lighthouses.

Galaxies

Hubble is famous for its highly detailed studies of the galaxies in our neighbourhood. Its sharp vision can discern individual stars hundreds of millions of light-years away, and by studying actively star-forming galaxies in ultraviolet light the hottest and most exciting regions of nearby galaxies have been revealed.

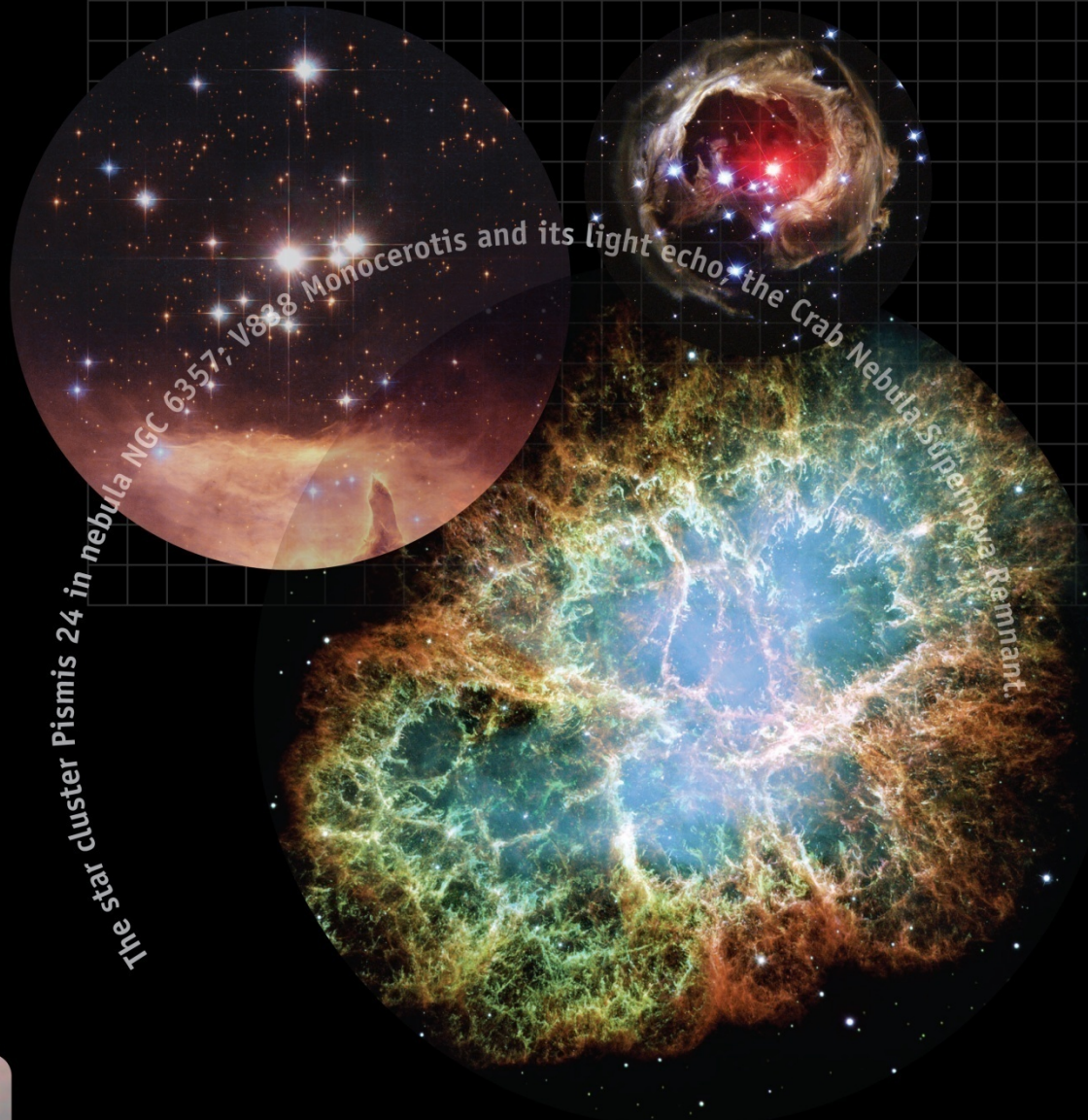
This image is a close-up view of the central part of Stephan's Quintet, giving a magnificent view of a gigantic cosmic collision



Stars

Stars are remarkable objects. They are huge glowing balls of gas varying greatly in size and mass and produce nearly all the light we observe in the Universe. Many generations of the heaviest stars have lived and died since the Universe was created in the Big Bang, whereas the first generation of the lightest stars has barely reached puberty.

Hubble's investigations of the stellar life cycle have shown intricate and unexpected details of star nurseries and graveyards. It has imaged the brightest and the feeblest stars in star clusters near and far, as well as compared stars in our own Milky Way with stars in many other galaxies.



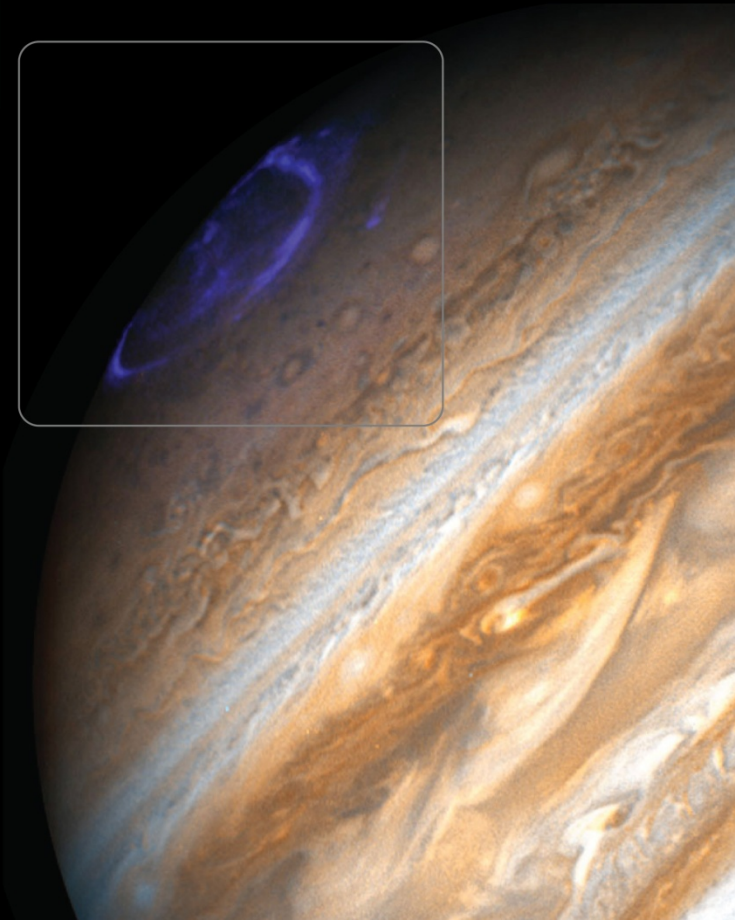
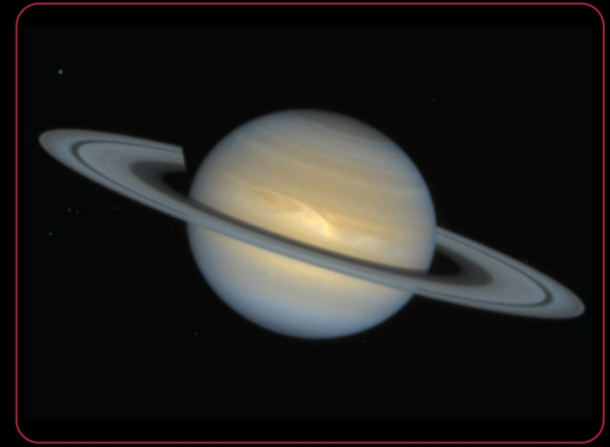
Protoplanetary Disks in the Orion Nebula

Life & Death

Solar System

The planets of our Solar System have captured the imagination and interest of scientists and thinkers from the earliest times.

Scientists have been able to use Hubble to monitor the planets over more than a decade, looking at surface features at regular intervals, or at short notice when especially interesting events come up. Hubble has observed cyclonic storms on Mars, the changing seasons on Saturn and the progress of Jupiter's Great Red Spot.



Hubble and Europe

Hubble has been of paramount importance to European astronomy. European astronomers are guaranteed 15% of the observing time with Hubble, resulting in several thousand scientific publications over the years. Two groups of European specialists work with Hubble. There are 15 people from the European Space Agency (ESA) currently working at the Space Telescope Science Institute (STScI) in the USA and in Munich, Germany, 22 people form the Space Telescope – European Coordinating Facility (ST–ECF).

