

The Helix planetary nebula.
This is one of the closest planetary nebulae known. The light it emits takes 700 years to reach the Earth (while light from the Sun takes only 8 minutes).



Planetary nebulae

Stars with masses similar to that of the Sun end their lives in a much calmer way.

They swell up in size, losing their external layers, which are then illuminated by the remnant of the parent star, producing the so-called planetary nebulae.

The term planetary nebulae was coined by William Herschel in 1785 to describe these nebulae because with his telescope they looked like planets. He later regretted not having called them 'stellar nebulae'.

Planetary nebulae

The Horsehead nebula.
It is made of dust grains mixed with gas.



Where stars form

Stars are not eternal: similar to human beings, they come into the world, evolve throughout their lives and finally die.

They form in large interstellar clouds, by a process that is not yet fully understood. This process involves gravitational contraction, allowing the matter to reach the high densities of stellar interiors.

Some of these recently born stars are so hot that they can remove the electrons from the atoms in the surrounding cloud, creating ionized nebulae such as the Orion nebula.

Where stars form

Interstellar dust clouds

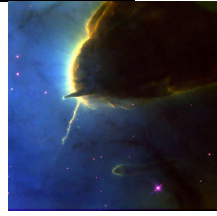
In photos of nebulae and galaxies, dark zones can sometimes be seen. They are produced by concentrations of interstellar dust grains.

These grains, which are microscopic solid particles of carbon or silicon, absorb energy from the visible light of nearby stars.

As they cool, they emit a light invisible to the human eye but detectable with infrared telescopes.



Quiz



Do you recognize these types of nebulae?



Solutions on overleaf

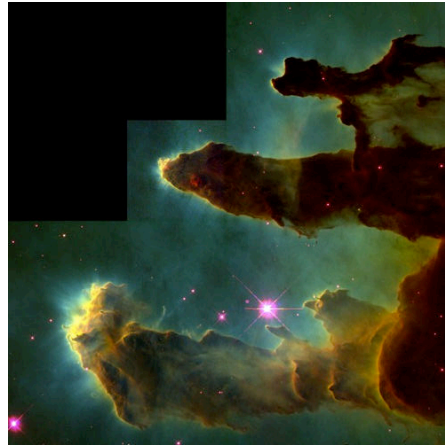
The Universe in my pocket



The nebular universe

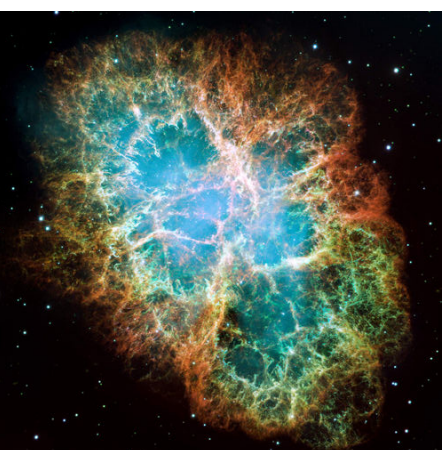


Grażyna Stasińska
Paris Observatory



Part of the nebula M16, called « The Pillars of Creation ». It is in clouds of interstellar gas and dust like these, that new stars are formed.

The Crab nebula.
This is the remnant of a supernova whose explosion was recorded by Chinese astronomers in 1054.



Earlier, galaxies were called 'nebulae' because it was not known that they were made of stars.

Some of them older than ten thousand million years.

Other galaxies, those with a rugby ball shape, do not form stars any more. All of their stars are old -

are only a few million years old.

galaxies are still forming stars, and contain many « young » stars that

large amounts of gas. Such

or irregular shape, also contain

billions of stars.

Galaxies

The Universe in my pocket No. 1

This booklet was written in 2013 by Grazyna Staszewska from Paris Observatory (France) and revised by Stan Kurtz from the UNAM Radio Astronomy Institute in Morelia (Mexico).

It is dedicated to the school children of Choroni (Venezuela) and their families.

The front cover shows the Cat's Eye planetary nebula. The photos from this booklet were obtained with the ESO large telescopes and with the Hubble Space Telescope. They are provided by NASA, the STScI and by ESA.



To learn more about the series and about the topics presented in this booklet, please visit:
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But with the help of large telescopes on Earth and in space, astronomers are able to see the richness of the nebular universe and share their discoveries by publishing beautiful photographs of these nebulae.

A supernova remnant is the nebular matter that remains after the explosion.

A supernova remnant is the manufactured during its lifetime.

the elements that it

throwing into interstellar space

on the contrary, a dying star,

We now know that a supernova is,

where no star was seen before.

witnessing the appearance of a

new star at a place in the sky

Astronomers called this

phenomenon a « supernova »,

because they thought they were

life in a huge explosion.

A star with a large mass ends its

Supernova remnants

without star, very obscure & pretty large'.

astronomer Charles Messier published in

stars are being formed.

In its spiral arms, new generations of

This is a galaxy similar to the Milky Way.

The spiral galaxy M101.



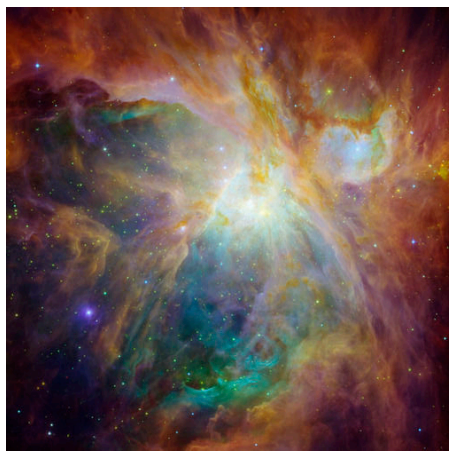
M17, a nebula where stars are forming.

NGC 2207 and IC 2163, two spiral galaxies in collision.

The supernova SN 1987A.

The planetary nebula IC 4-18, called 'the spirograph nebula'.

The Unicorn: a part of the Trifid nebula obscured by interstellar dust.



The Orion nebula.
This is the brightest nebula in the sky, and it can be seen with the naked eye.