

# Galaxies

**Our Sun belongs to a giant whirlpool of stars called the Milky Way. Huge collections of stars are called galaxies, and like all galaxies the Milky Way is unimaginably vast.**

Galaxies come in many shapes and sizes. Some are spirals like our own galaxy, but others are fuzzy balls or shapeless clouds. The smallest have just a few million stars. The largest contain trillions.

Although they look packed with stars, galaxies are mostly empty space. If you made a scale model of the Milky Way with a grain of sand for each star, the nearest star to the Sun would be 4 miles (6 km) away. The furthest would be 80,000 miles (130,000 km) away. The stars in a galaxy are held together by gravity and travel slowly around the galactic heart. In many galaxies, including ours, a supermassive black hole lies hidden in the center. Stars and other material are sucked into this cosmic plughole by gravity and disappear forever.

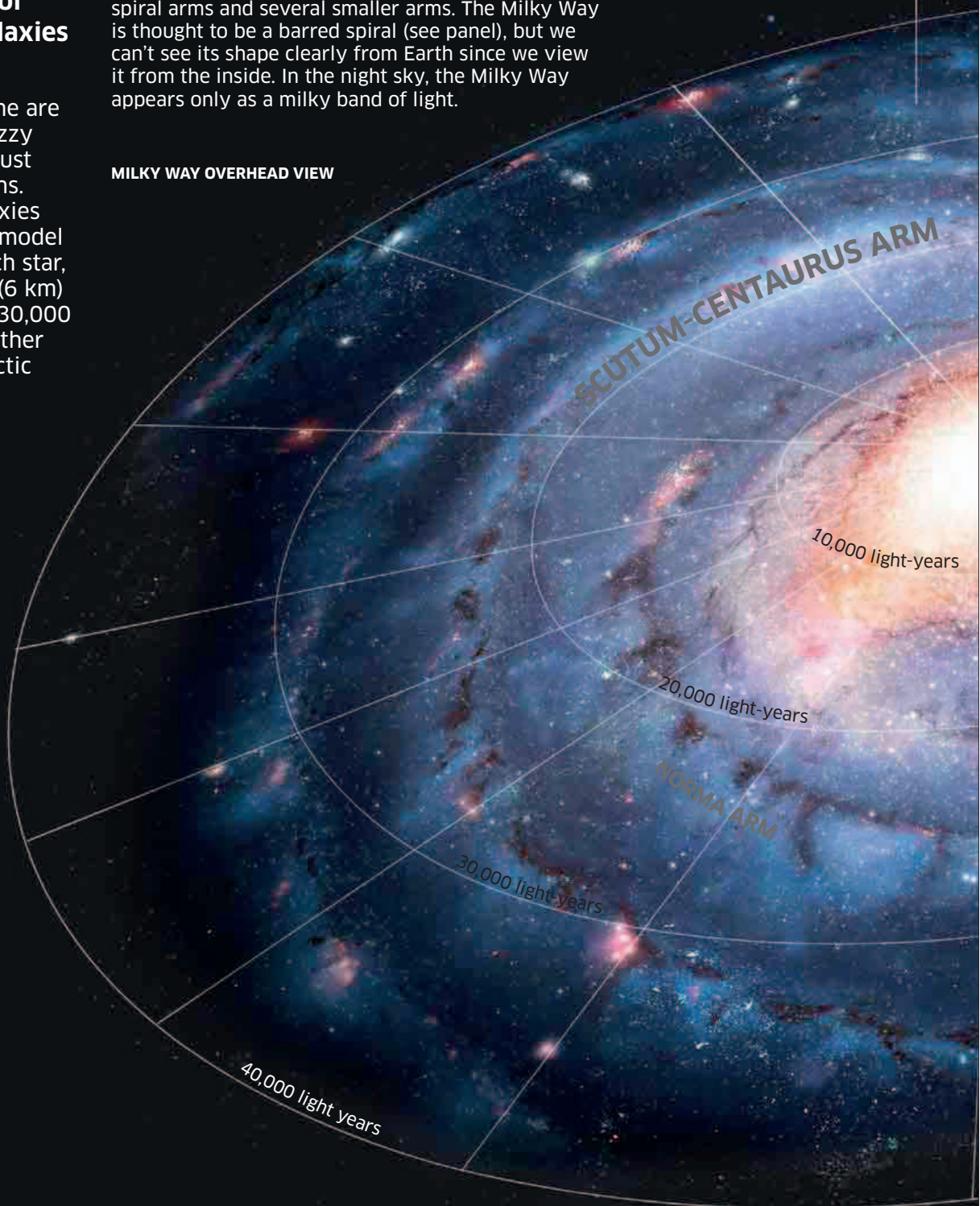
## The Milky Way

If you could look down on the Milky Way galaxy from above, the view would be like flying over a glittering city at night. Most of the galaxy's 200 billion stars are in the central bulge. Curving around this are two vast spiral arms and several smaller arms. The Milky Way is thought to be a barred spiral (see panel), but we can't see its shape clearly from Earth since we view it from the inside. In the night sky, the Milky Way appears only as a milky band of light.

### Orion Arm

Our Solar System lies in this small arm. Many of the stars we see in the night sky are in the Orion Arm.

MILKY WAY OVERHEAD VIEW

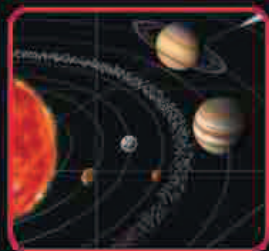


MILKY WAY SIDE VIEW



### 1 Galactic center

This photo from an infrared (heat-sensitive) telescope shows stars and gas clouds packing the center of the Milky Way. A supermassive black hole lies hidden somewhere in this area.



### 2 Solar System

Our Solar System is in a minor spiral arm called the Orion Arm. We orbit the center of the galaxy once every 200 million years, traveling at about 120 miles (200 km) a second.



### 3 Crab Nebula

Clouds of gas and dust occur throughout the Milky Way, especially in the spiral arms. The Crab Nebula is a cloud of wreckage left behind by a dying star that exploded.

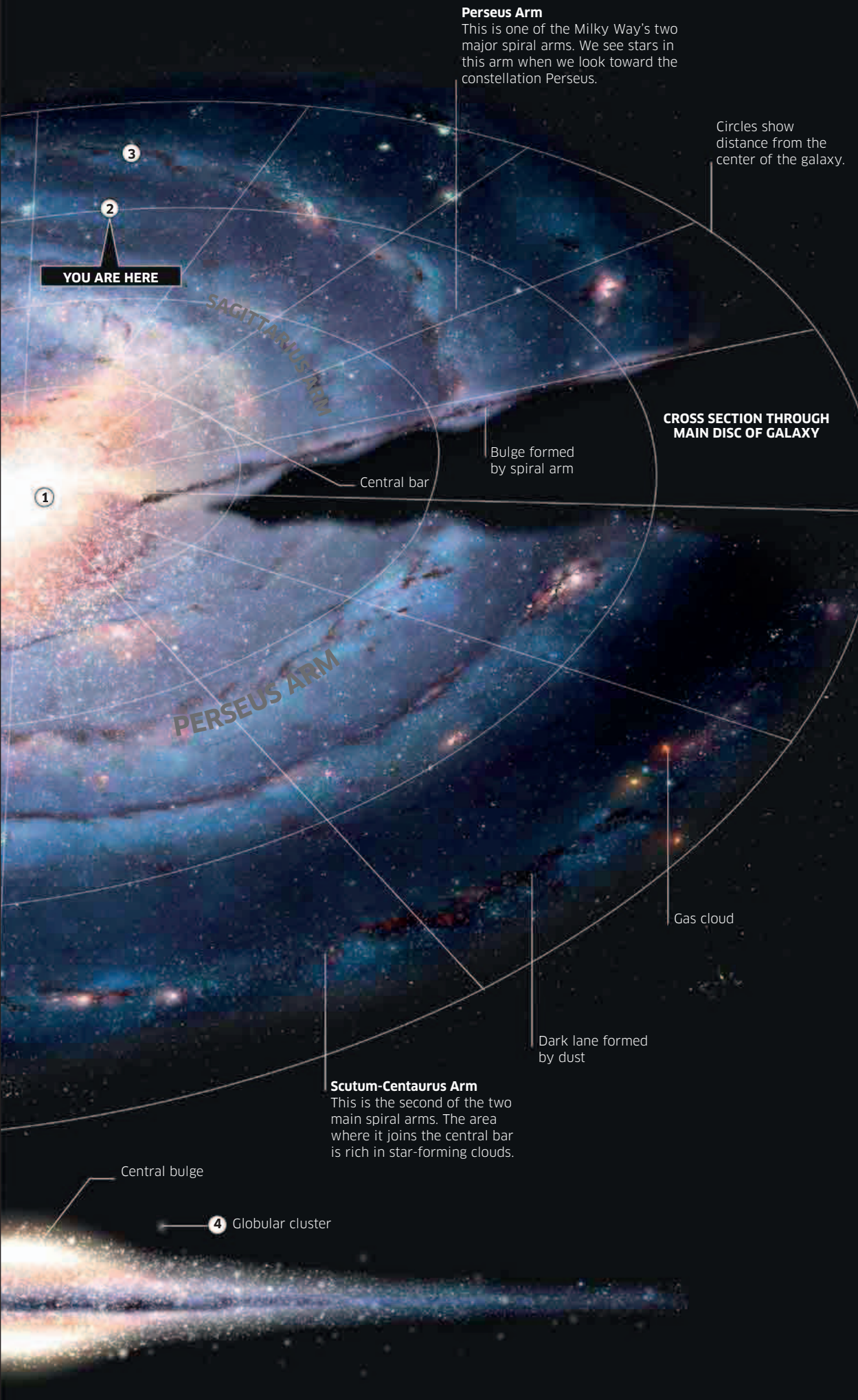


### 4 Globular cluster

Not all the Milky Way's stars are in the main disc of the galaxy. Many are in globular clusters—tightly packed balls of ancient stars floating above and below the galaxy in a spherical region called the halo.

Main disc containing arms





**Perseus Arm**

This is one of the Milky Way's two major spiral arms. We see stars in this arm when we look toward the constellation Perseus.

Circles show distance from the center of the galaxy.

**YOU ARE HERE**

**CROSS SECTION THROUGH MAIN DISC OF GALAXY**

Bulge formed by spiral arm

Central bar

Gas cloud

Dark lane formed by dust

**Scutum-Centaurus Arm**

This is the second of the two main spiral arms. The area where it joins the central bar is rich in star-forming clouds.

Central bulge

**4** Globular cluster

**Galaxy shapes**

Astronomers classify galaxies into just a few main types, depending on the shape we observe from Earth.



**Spiral**

A central hub of stars is surrounded by spiral arms curving out.



**Barred spiral**

A straight bar runs across the center, connecting spiral arms.



**Elliptical**

More than half of all galaxies are simple ball shapes.



**Irregular**

Galaxies with no clear shape are classified as irregular.

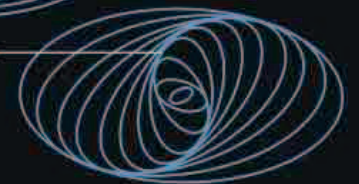
**How spiral arms form**

The stars in a galaxy orbit the center, taking millions of years to make one circuit. Spiral arms appear where stars pass in and out of crowded areas, like cars passing temporarily through a traffic jam. One theory is that these traffic jams happen because the orbits of different stars don't line up neatly.



If stars all had neat, parallel orbits, the galaxy would have no spiral arms.

If stars' orbits don't line up neatly, crowded zones form, giving the galaxy spiral arms.



**Colliding galaxies**

Sometimes galaxies crash and tear each other apart. Individual stars don't collide, but gas clouds do, and gravity pulls the colliding galaxies into new shapes.



**End of the Milky Way**

In 4 billion years our galaxy will collide with the Andromeda galaxy. This artist's impression shows what the sky might look like as they merge.