How can we ‘see’ black holes?

Since black holes do not emit light, astrophysicists can only detect them indirectly, taking advantage of the way the black holes affect their surroundings.

» Orbits

By observing how stars orbit around an invisible centre, one can infer the existence of a black hole. This method was used to conclude the existence of a supermassive black hole, called Sagittarius A*, at the centre of our galaxy.

» X-ray emission from accretion

Material that comes close enough to a black hole is pulled inwards, in a process called accretion. As the matter falls in, it is accelerated and heated, resulting in the emission of X-rays, which we can detect.

» Black hole shadow

When located in front of a very bright background, black holes cast a shadow. Observing the shadow can reveal important information about the region surrounding the black hole.

Types of black holes

When a black hole forms, it loses any memory of how it was made. For this reason, it makes no difference if it was ordinary or dark matter that gave rise to it.

» Stellar-mass black holes

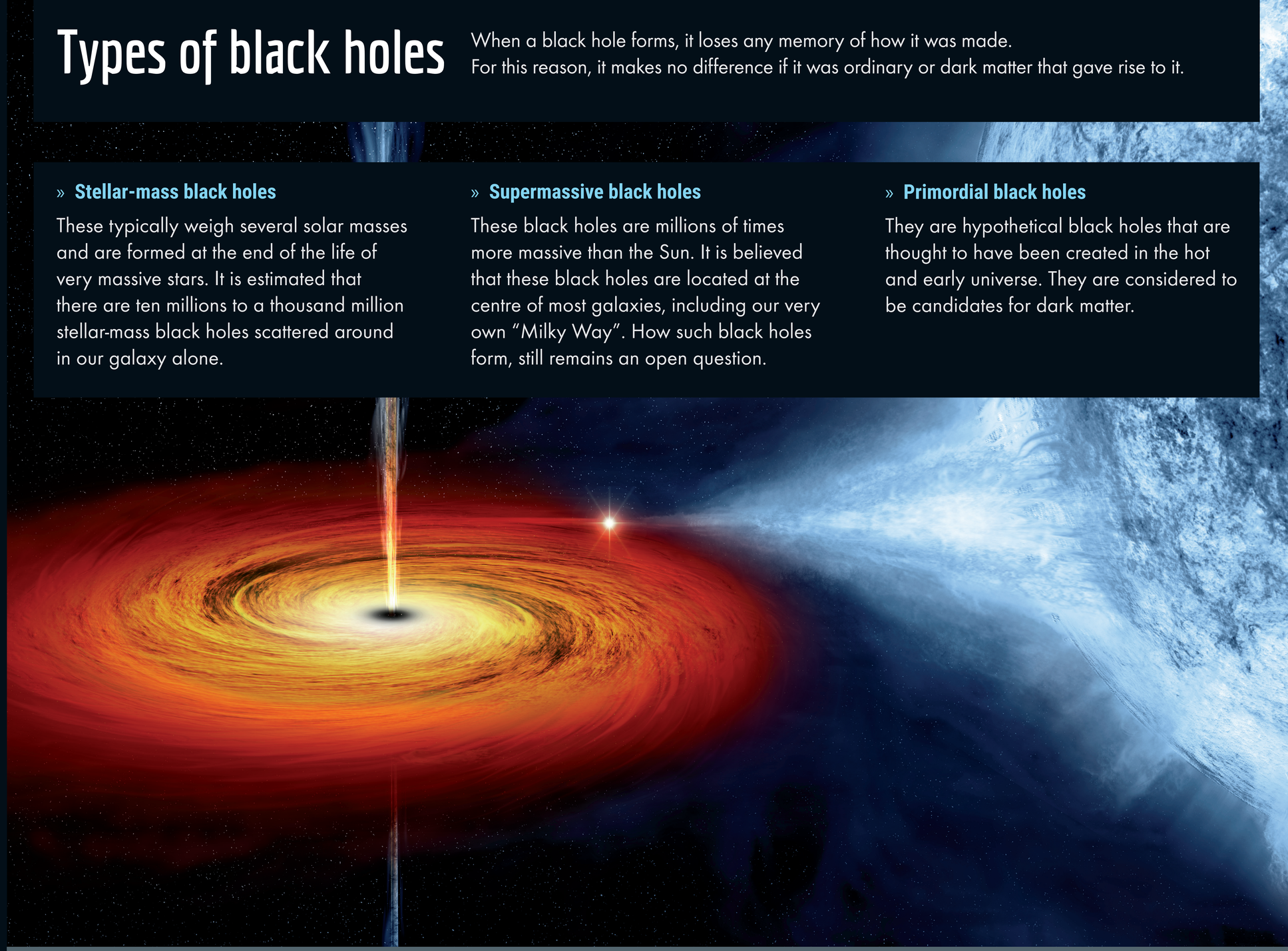
These typically weigh several solar masses and are formed at the end of the life of very massive stars. It is estimated that there are ten millions to a thousand million stellar-mass black holes scattered around in our galaxy alone.

» Supermassive black holes

These black holes are millions of times more massive than the Sun. It is believed that these black holes are located at the centre of most galaxies, including our very own “Milky Way”. How such black holes form, still remains an open question.

» Primordial black holes

They are hypothetical black holes that are thought to have been created in the hot and early universe. They are considered to be candidates for dark matter.



Artistic impression of the Cygnus X-1 system. The black hole pulls material from a massive, blue companion star toward it. This material forms a disk before falling into the black hole or is redirected away from the black hole in the form of powerful jets. (NASA/CXC/M.Weiss)

2004

Sagittarius A* is a black hole

Simulation of gas cloud approaching the supermassive black hole at the centre of the Milky Way (ESO)

Strong evidence for the existence of a supermassive black hole (called Sagittarius A*) at the centre of our galaxy is obtained.

2016

Black hole detection by LIGO

Detection announcement (National Science Foundation)

The LIGO collaboration (Laser Interferometer Gravitational wave Observatory) provides the most ‘direct’ evidence for black holes, in the form of gravitational waves.

2017

Event Horizon telescope

Milky Way over ALMA antennas (ESO/B. Tafreshi (twanight.org))

The “Event Horizon” telescope, designed to observe black hole shadows, will become fully operational.