THE FASCINATION OF BLACK HOLES

Chapter 1

Black Holes – They Really Do Exist

When we think of black holes, we think of science fiction and Hollywood movies. Massive monsters that suck in the surrounding universe and break the laws of physics. They are incredibly fascinating.

People have been theorising about black holes since the 18th century. For a long time, however, their existence could only be described or predicted mathematically.

Black holes were considered difficult to study because they don't have a surface like other objects. Their gravitational pull is so strong that they swallow light itself, meaning that black holes are invisible.

In his general theory of relativity, formulated in 1915, Albert Einstein hinted at how they might still be detected.

Essentially, he said: All bodies with mass or energy interact with four-dimensional spacetime. This spacetime is curved by the acceleration of mass, creating oscillations. It is therefore plausible that, in addition to swallowing everything, black holes also have measurable effects on their surroundings.

In 1969, mathematician Roger Penrose suggested that the rotational energy of a black hole might also be found outside of it. He has since been proven right.

The first empirical evidence for the real physical existence of black holes came from radio astronomers in the 1960s. They discovered star-like centres, quasi-stellar radio sources that shine very brightly, which they named quasars. At their heart are powerful centres of energy, that we now know are black holes.

These various hypotheses and observations eventually culminated in our ability to physically detect black holes. We now understand that there is a radius around the black hole called the event horizon. At this edge, the motion of passing stars or gas clouds is accelerated to such an extent that they heat up and can, for example, be seen in infrared light.

This effect can be observed using space telescopes, which capture non-optical light, in combination with optical telescopes and computers.

There are thought to be hundreds of millions of black holes in the Milky Way alone. One of them, the Sagittarius A* region, is located in the constellation Sagittarius, right at the centre of our galaxy.

Its mass is 4.3 million times greater than the mass of the sun.

German astrophysicist Reinhard Genzel and American astronomer Andrea Ghez used long-term observations of stellar motions to prove its existence, providing the most convincing evidence so far that black holes really do exist.

Together with the aforementioned mathematician Roger Penrose, they received the 2020 Nobel Prize in Physics for their work.