Full product specification

Product Name The Scrambler

Family Member Black Hole

Product Code Scr-BH

cram

Overview

The *Scrambler Black Hole* is one of three types of black holes currently available from Cosmic Caboodle. A black hole is a compact and very dense object in space with a super strong gravitational pull. It is so strong that not even light can escape it. They are commonly formed after the death of a giant star.

Status - Proven & Real

Black holes are real and exist in our very own Milky Way galaxy. Although we haven't actually seen a black hole (because they suck in any light nearby), we do know they exist. What we can see, with big telescopes and satellites, is what they do to the surrounding gases and stars. For example, scientists can observe gases that appear to be vanishing inside a black hole (see picture taken from the Hubble telescope)

Physical Properties Mass & Size

Our black holes are categorised into 4 groups based on size and mass (mass is the amount of *matter*, or 'stuff' that is inside an object)

Name Micro black hole Stellar black hole Intermediate mass black hole Supermassive black hole

Mass Up to M_{moon} About 10 M_{moon} About 1,000 M_{Sun} 100,000 to 10¹⁰ M_{Sun}

Size 0.1mm Up to 30km 10km to R_{Earth} 0.001-400 AU

Key

 M_{moon} Moon mass is the mass of our Moon (7.3477 x 10²² kg). (That's really heavy for something only 0.1mm big!) M_{Sun} Solar mass is mass of our Sun which weighs an amazing nonillion kilograms (1.98855 x 10³⁰ kg) R_{Earth} Earth radius is the distance from Earth's centre to its surface, about 6,371 km (3,959 miles). AU Astronomical Unit roughly the distance from the Earth to the Sun. Its exact number is 149,597,870.7 km

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This artist's concept illustrates a supermassive black hole with millions to billions times the mass of our sun. Public domain



NIVERSE IN THE PALM OF YOUR HANDS

Black Hole The Scrambler

Technical specification



We can't directly see a black hole which means we also can't see what's happening inside of one. However, scientists can *hypothesise* what's actually happening inside a black hole. A *hypothesis* is a bit like a well thought out guess or answer to your question. Instead of doing a real life experiment, scientists do what's called a *thought experiment.* They imagine what

would happen if we say sent some little aliens into a black hole and then they use the language of mathematics to explain what would happen next.

For the **Scrambler** black hole, a scientist by the name of Stephen Hawking used the mathematics called the theory of general relativity. General relativity was determined by the famous physicist Albert Einstein back in 1915. This mathematics helps explain how gravity works both here on earth and way out in deep, dark outer space. However, under this thought experiment he came up with a different result than our friend the Stretcher black hole and it's secret is revealed below.

So back to our little alien friends. As they float past the black hole, gravity starts to pull them closer and closer into the hole. Eventually they will reach what's called the **event horizon** but under this experiment, it is a

softer type of event horizon. It's called an apparent event horizon and when the alien gets close enough, it becomes temporarily suspended in its grasp. Next it scrambles up the alien into something totally unrecognisable from what it once was and you can't return it back to its former glory.



To see what that looks like inside a black hole, be sure to print and construct your Scrambler black hole below.



THE UNIVERSE IN THE PALM OF YOUR HANDS



This is one of three black holes available from Cosmic Caboodle. The Scrambler is a special black hole which you can now observe from the safety of your own home. Simply follow the instructions below and take a sneak look inside.



DIFFICULTY FACTOR

- One out of three cheeky aliens.
- Requires cutting and gluing.
- It takes about 5 minutes to make.

INSTRUCTIONS

YOU WILL NEED

- 1. Paper (1 sheet for double sided printing, 2 for single sided)
- 2. Scissors
- 3. Glue stick
- 4. Enthusiasm

METHOD

- 1. Print the following two pages double sided (or you can print two single sided sheets and then glue them together back to back).
- 2. Cut out the shape.
- 3. Roll up into a cone and glue together.
- 4. Peek into the cone to see what this type of black hole does to our little alien friends.







Cosmic Caboodle would like advise that no cute little aliens were actually hurt in the making of this black hole

Image credit: Stephen Hawking, NASA, public domain

