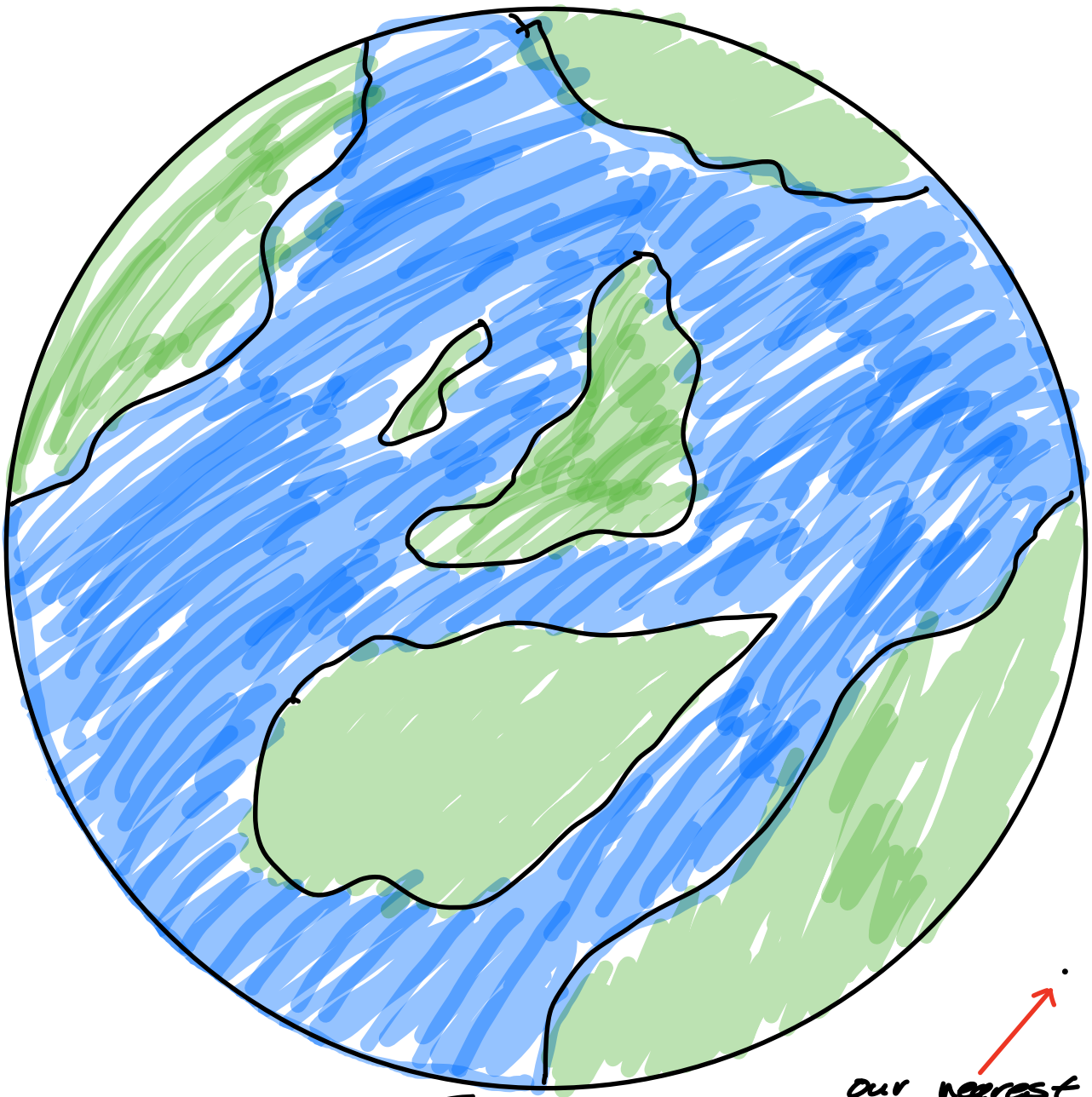
1. What is a black hole?

Black Holes are tiny.

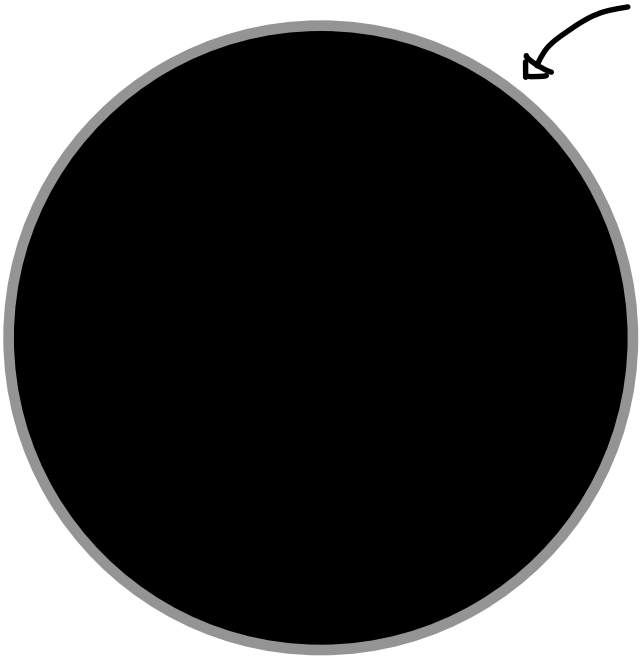


Earth

our nearest black hole HR 6819 (around 1120 light years from the Earth)

The black hole shown is five times the mass of the sun, but half the size of greater manchester.

Anatomy of a black hole:

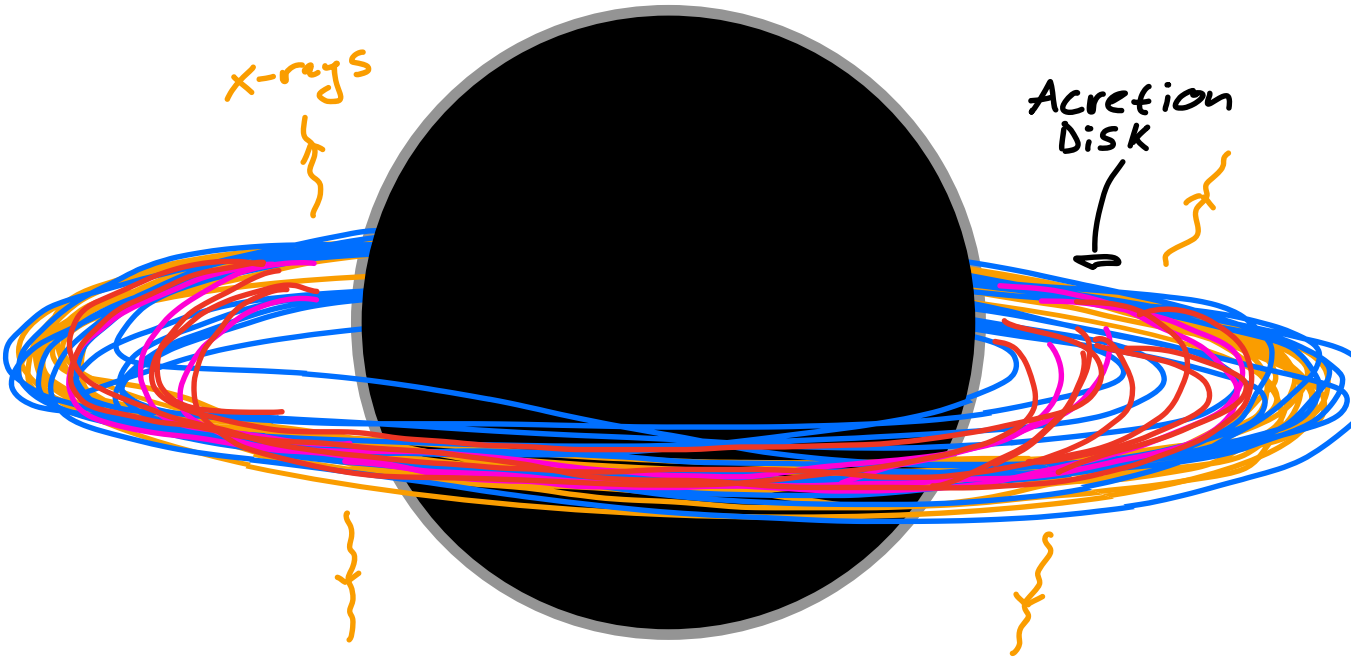


A Black Hole appears as a 3D hole.

Picture a black sphere.

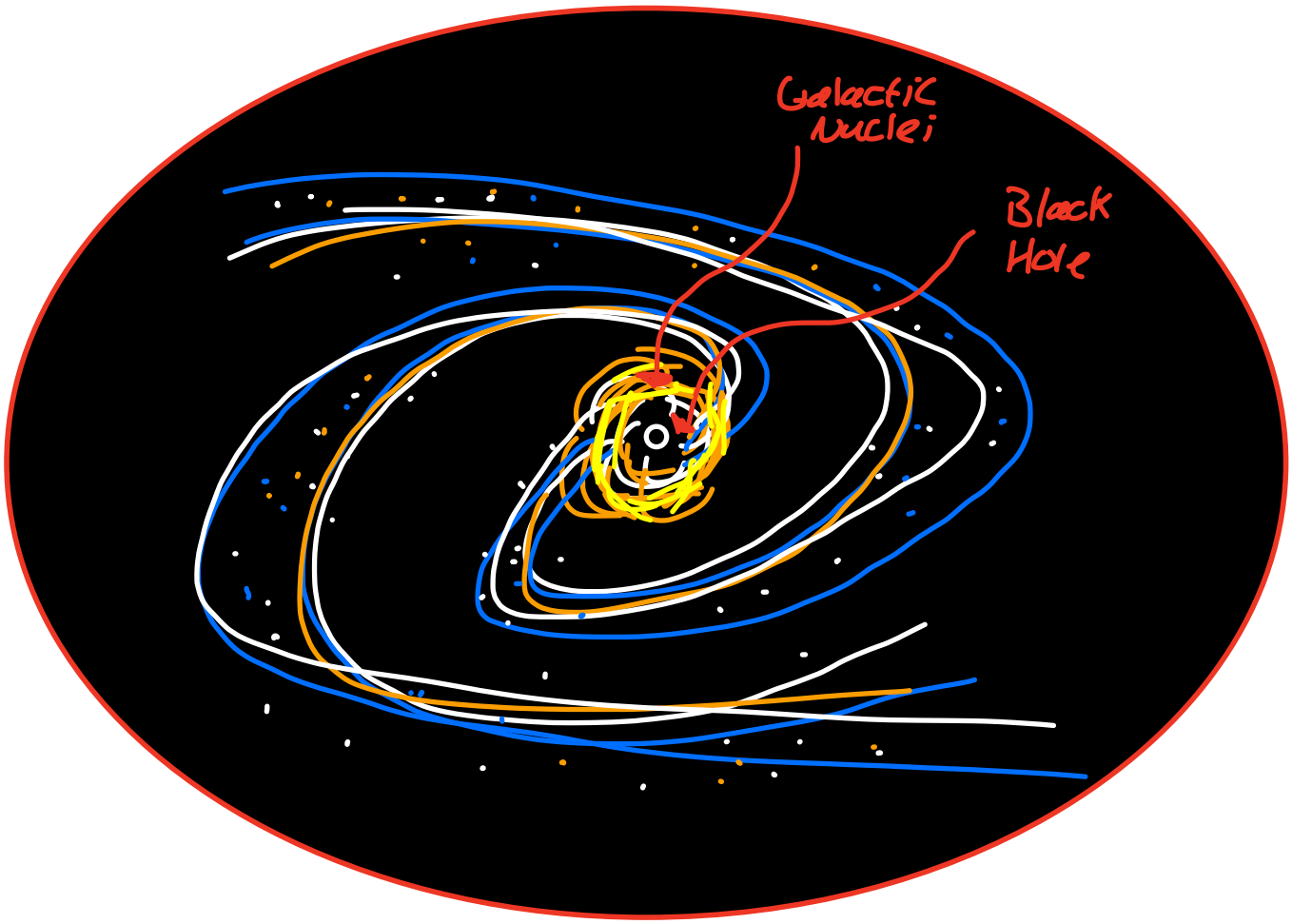
Once something falls in past the horizon, it can have no escape.

The horizon is the boundary between the interior of the black hole and the rest of the Universe.



When matter falls in towards the black hole, it can become trapped in a tight orbit around the black hole, forming an 'accretion disk' → a disk of very fast and hot matter gradually falling into the black hole.

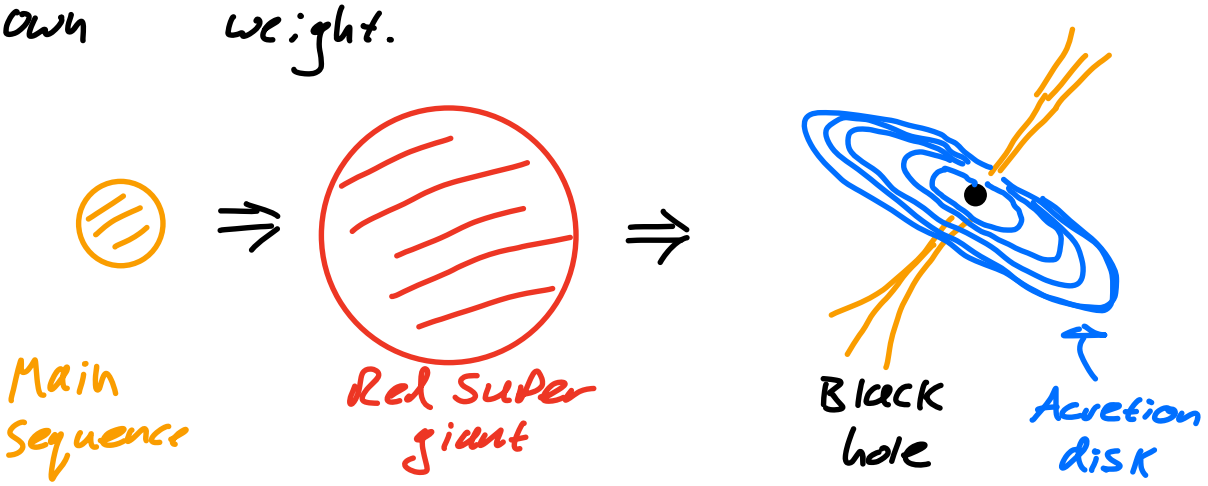
Every large galaxy has a supermassive black hole at it's centre.



'Supermassive' = Between one hundred thousand and one billion times the mass of the sun.

2. Where do black holes come from?

Black holes form when giant stars run out of fuel, and collapse under their own weight.



Stars that form black holes must have a core more than 2.17 times the mass of the sun.

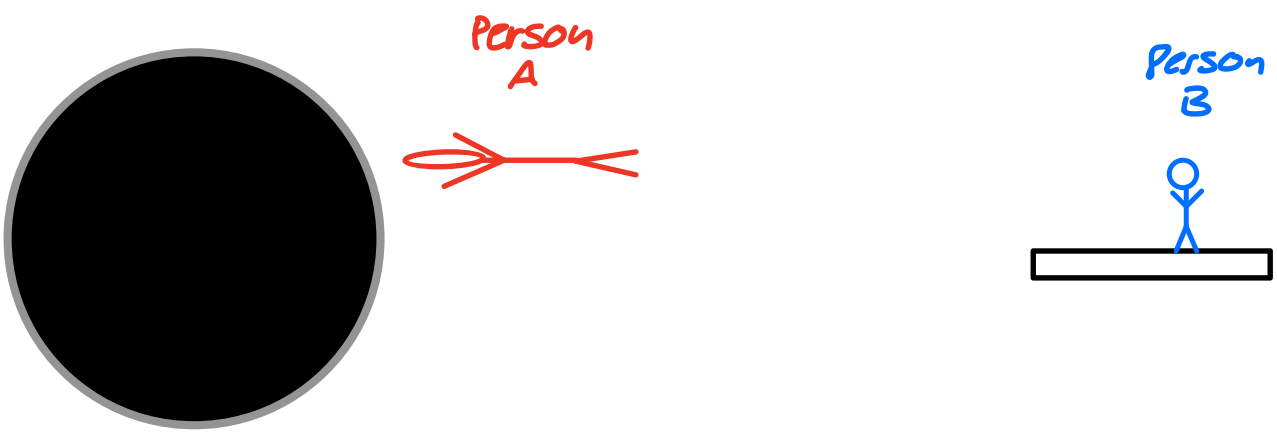
There is technically no minimum size for a black hole. There may be microscopic black holes popping in and out of existence all around us right now.

If we squashed the Earth down to form a black hole, we'd have to squash it to a diameter of five centimetres.

3. What do black holes do?

Black holes are natural time machines.

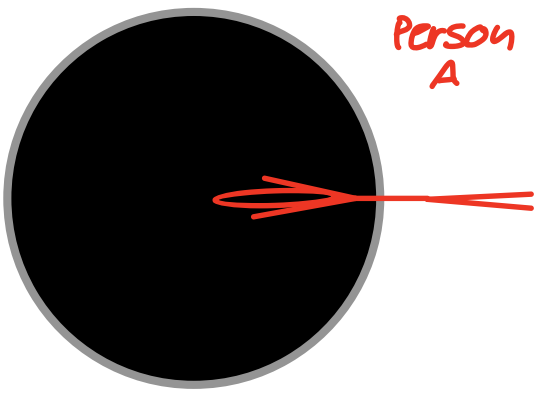
Let's imagine two people. One falling towards the black hole, one sitting far from the event horizon



What Person A and Person B experience are very different.

- from Person A's perspective:

Person A falls into the black hole, passing through the event horizon as if it wasn't there.



As they pass through the horizon, Person A looks back towards Person B and sees time pass very quickly.

→ As Person A falls in the strong and quickly changing gravitational field of the black hole spaghettifies Person A.

• from Person B's perspective:

Person B watches Person A fall towards the black hole. but never actually sees them fall in.

Person B sees Person A fall towards the black hole moving slower and slower, never passing through the horizon. As Person A approaches the horizon, they become flatter and flatter eventually freezing still and forming part of the horizon seen by Person B.