Explained in 60 Seconds: The event horizon and the fate of fish

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Every time a physicist says the words "event horizon" a fish dies. It's not nice and it's not fair, but there we are.

We should perhaps expect a certain masochism in the type of person who chooses to dedicate their life to studying something so impenetrable as black holes and the fact is that no physicist has ever explained why a black hole is black without using the same fish-killing analogy. An analogy that I will, with wild abandon and an almost sadistic lack of concern for fish-kind, share with you now.

If spacetime is like a river, spacetime at a black hole is like that river flowing over a waterfall. Everything moves through spacetime, wriggling through the spatial elements and following traditionally straight paths through time. That includes light, our precious bringer of information about the Universe. Like a fish swimming down a river, light travels in a straight line through spacetime, oblivious to the larger pattern that guides its journey.

As the river speeds towards the sheer cliff face perhaps the fish realises that it's meant to be at dinner upstream. If it's above the crest of the waterfall and in good enough kip to swim faster than the speed of flow, it will swim merrily away. However, once the water flows over that crest and plummets down towards the base of the falls, our little fishy is beyond redemption. It will never be able to swim fast enough through the flow to get back up.

That's the event horizon. Outside, light can escape the black hole's pull — flying faster than spacetime flows into the hole. But inside, spacetime "falls" faster than light travels. Escape is denied — and the result? An area in space we can't see, and several very, very, dead fish.

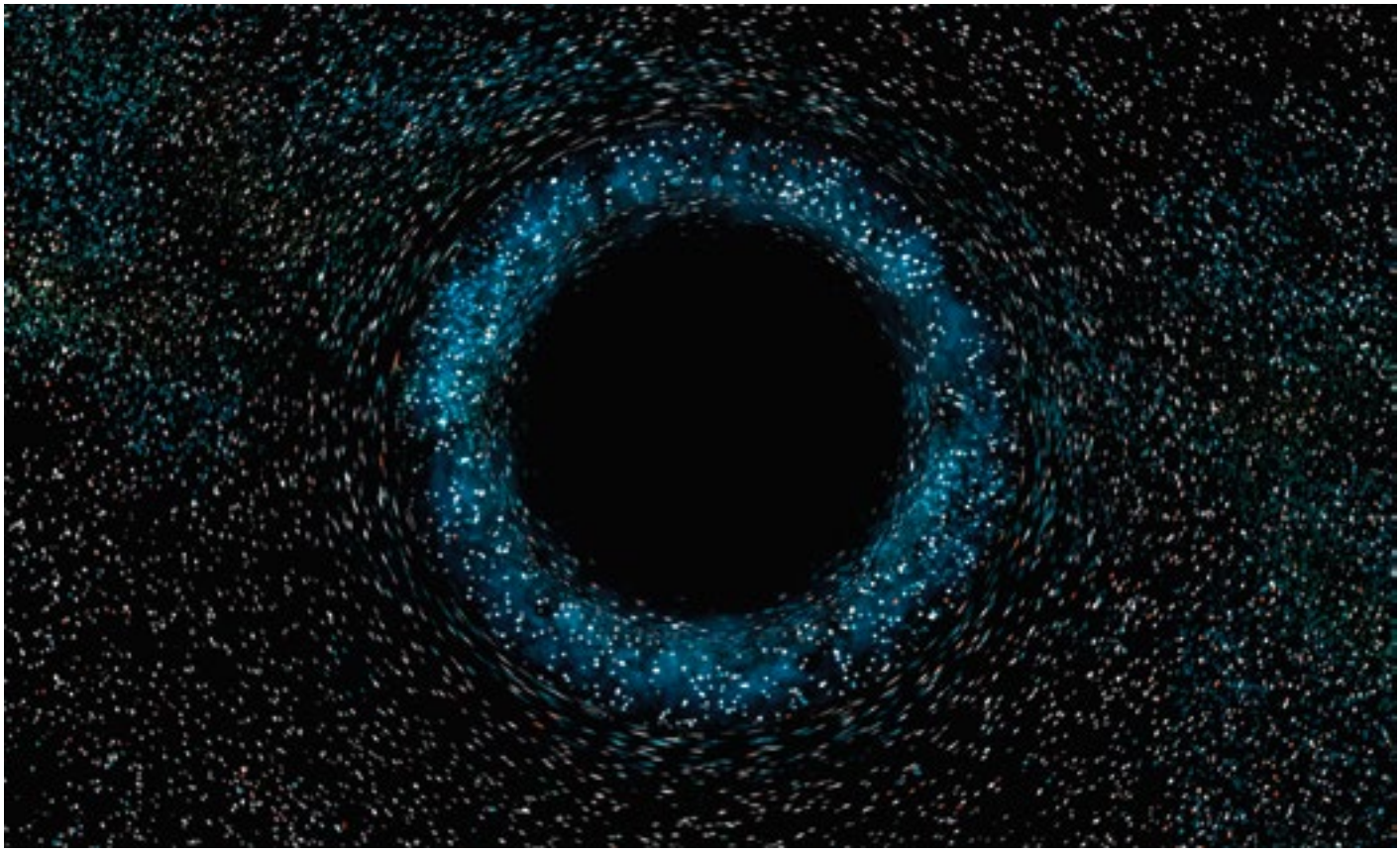

Figure 1. *Artist's impression of a black hole. Credit: ESA, NASA and F. Mirabel (the French Atomic Energy Commission & the Institute for Astronomy and Space Physics/Conicet of Argentina)*