

# A BRIEF HISTORY OF BLACK HOLES

Relevant for: Geography | Topic: The Earth and the Solar System

In the album *A Farewell to Kings* (1977), Canadian rock band Rush tells the story of a cosmic voyager who is trapped in the event horizon of a black hole called Cygnus X-1. It seems initially that he has not survived, but he is found later in a parallel dimension resembling the Olympus of Greek mythology.

And in the film *Interstellar* (2014), a wormhole — a portal in the fabric of space and time — leads to a supermassive black hole called Gargantua, located 10 billion light years from earth, with a mass approximately 100 million times that of the sun.

Our cosmos has long been a source of fascination for artists, writers and theologians, and it's not hard to see why — our sun is just one tiny point of light among the hundreds of billions of stars swirling around the Milky Way galaxy. So vast is the distance between the outer edges of the galaxy, it would take a vessel moving at the speed of light 100,000 years to cross it.

Our very own Milky Way has a black hole the size of 4 million solar masses at its core. It would take us 27,000 years to reach it travelling at the speed of light.

## Einstein's singularity

In his general theory of relativity, Einstein conceived of stars and planets as weighted spheres that stretch the fabric of space much like a bowling ball stretches a rubber sheet, causing it to sag, and drawing lighter bodies to the heavier object in the centre.

Basically, time appears to move more slowly near massive objects because the object's gravitational force bends space-time, a phenomenon called gravitational time dilation.

Thus, gravity was not a 'force' as Isaac Newton had envisaged it, but the result of a distortion in the fabric of *spacetime* — a continuum that extends throughout the known universe.

Einstein's equations further suggested the existence of a spatial entity that scientists now refer to as a 'naked singularity': the centre of a spherical gravitational field — a *black hole* — that sucked in everything — matter, information and light — that crossed its 'event horizon,' or the point of no return.

A couple of weeks ago, scientists released a breakthrough image of a black hole at the centre of Messier 87, a galaxy 55 million light years away from our own, finally proving Einstein's theory correct. The golden ring of light shown in the image is that of the event horizon, the boundary encircling the black hole.

Try to picture this: our sun is 330,000 times the mass of earth. Now visualise an entity 6.5 billion times more massive than our sun. That is the estimated size of the *Virgo A* black hole captured in the now iconic image.

Furthermore, the image we are looking at is 55 million light years old, because that is how long it would take for light to travel from that region of space to our own.

## Awe and reverence

When we consider that ours is just one out of hundreds of billions of galaxies in the universe, it is not difficult to see how contemplation of the cosmos can lead to feelings of religious awe and reverence.

There are many striking parallels between Eastern thought and modern astrophysics, especially in their imagining of space, time and the birth of the universe.

Another name for the Hindu god Shiva is Mahakala, the lord of time. He represents the void at the dissolution of the universe and has the power to subsume even time and space into himself.

Mahakala is typically visualised as black in colour. Just as all colours are absorbed and dissolved into black, all names and forms are said to merge into Mahakala — symbolising his all-encompassing nature.

Black can also represent total stillness or the complete absence of light, much like a black hole. Again, in this case, it signifies the nature of Mahakala as the primordial source of creation known as *Bindu* in Yogic terminology, conceptually identical to the singularity in astrophysics.

The idea of blackness as the primordial state of the universe can also be found in the *Rig Veda*:

*At first there was only darkness wrapped in darkness.*

*All this was only unilluminated cosmic water.*

*That One which came to be, enclosed in nothing,*

*arose at last, born of the power of heat. (Nasadiya Sukta)*

## **Mystics and moderns**

It has taken a cosmic minute, but modern science is finally beginning to see eye-to-eye with mystics who have long held the view that everything is interconnected with consciousness as the glue that binds it all together.

“As we penetrate into matter, nature does not show us any isolated ‘building blocks’, but rather appears as a complicated web of relations between the various parts of the whole,” wrote theoretical physicist Fritjof Capra. “These relations always include the observer in an essential way. The human observer constitutes the final link in the chain of observational processes, and the properties of any atomic object can be understood only in terms of the object’s interaction with the observer.”

Scientists now believe that black holes are not just central to the existence of the universe as we know it but crucial to our very own existence. This new understanding has led cosmologists to indulge in some dizzying speculations. Could it be possible that the cosmos we inhabit came out of a universal black hole that consumed all the matter of a previous universe, collapsed into itself, then vomited everything out in a colossal explosion that resulted in our present universe?

Hindu, Buddhist and Taoist adepts would simply nod in recognition, as these ideas mirror their worldview. Hindu mythology is undergirded by the notion of the One — *Brahman* — multiplying into the many, manifesting as the world, then collapsing back into itself. This cycle of cosmic creation and destruction is called *Lila*, the play of god.

Or, as Carl Sagan said, “The cosmos is within us. Some part of our being knows this is where

we came from. We long to return. And we can, because we're made of star stuff. We are a way for the universe to know itself."

*The filmmaker, columnist and scholar likes to hang out with his cats, toucans and pet iguana.*

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The data generated will help scientists understand how the jets of luminosity that enabled us to see the black holes actually work and behave.

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