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Interstellar inside black hole scene

Franklin knew his computers would do everything he told them. That was a problem and a temptation. It's very easy to fall into the trap of breaking the rules of reality, says Franklin, a senior supervisor at the Oscar-winning effects house Double Negative. And these rules are actually quite strict. So he asked Thorne to generate equations that would guide their effect software as physics governs the real world. They started with wormholes. If light around a wormhole wasn't behaving classically – that is, traveling in a straight line – what would it do? How could this be described mathematically? Thorne sent his answers to Franklin in the form of heavily researched memos. Pages long, deeply procured and covered in equations, they were more like scientific journal articles than anything else. Franklin's team wrote a new rendering software based on these equations that raised a wormhole. The result was extraordinary. It was like a crystal ball reflecting the universe, a spherical hole in space-time. Science fiction always wants to disguise things like never being happy with the ordinary universe, he says. What we got out of the software was immediately convincing. McConaughey explores another world in Interstellar (above). Thorne's diagram of how a black hole distorts the light. Diagrams courtesy of Kip Thorne Your success with the wormhole encouraged the effects team to try the same approach with the black hole. But black holes, as the name suggests, are murder of the light. Filmmakers often use a technique called Ray Tracing to render light and reflections in images. But ray tracing software generally assumes that light travels on straight roads, says Eugénie von Tunzelmann, CG supervisor at Double Negative. It was a very different kind of physics. We had to write a completely new renderer, she says. Some individual frames took up to 100 hours to render, the calculation overwhelmed by the bendy bits of distortion caused by an Einstein effect called gravitational lens. In the end, the film was brushed against 800 terabytes of data. I thought we could cross the petabyte threshold here, says von Tunzelmann. Chris really wanted us to sell the idea that the black hole is spherical, Franklin says. I said, 'You know, it's going to look like a disc.' The only thing you can see is the way it distorts starlight. Then Franklin began to read about accretion disks, agglomerations of matter that orbit some black holes. Franklin thought he could use this ring of orbiting detritus to define the ball. Von Tunzelmann tried a tricky demo. It created a flat, colorful ring - a stand-in for the accretion disc - and around her spinning black hole. Something very, very strange happened. We found that wardening the space around the black hole also distorts the accretion disk, Franklin says. So instead of looking like Saturn's rings around a black sphere, the light produces light Halo. That's what led Thorne to his why, of course, moment when he first saw the last effect. The Double Negative team thought it must be a mistake in the renderer. But Thorne realized that they had correctly modeled a phenomenon inherent in the mathematics he had delivered. At the heart of each galaxy is a supermassive black hole where gravity is so strong that nothing – not even light – can escape its boundary. The film Interstellar focuses on a fictional black hole called Gargantua. The film was released exactly five years ago, in November 2014. In it, Matthew McConaughey and Anne Hathaway play astronauts traveling through a wormhole – a tunnel that allows almost instant journeys between distant points – to explore three planets orbiting Gargantua, 10 billion light-years from Earth. In the end, McConaughey's character navigates his ship into the supermassive black hole, in which he discovers a fifth dimension, interdimensional omniscient beings, and the ability to communicate with his estranged daughter over time and space. Director Christopher Nolan and his visual effects team sought superior scientific accuracy in Interstellar – they even hired the theoretical physicist and Nobel laureate Kip Thorne as a consultant. Neither wormholes nor black holes were depicted in a Hollywood movie as they would actually appear, Thorne said in an interview before the film's release. This is the first time that the presentation began with Einstein's general relativity equations. In fact, the depiction of Gargantua was hailed as the most accurate film depiction of a black hole of all time. An artist's concept of a supermassive black hole. NASA/JPL-Caltech/Reuters But over the past five years, a handful of important discoveries about black holes have given physicists new insights into what these massive objects look like and how they behave. Based on this information, Gargantua wasn't quite accurate, although in many ways it's still close. Here's what Interstellar did right and wrong. The first image of a black hole ever capturedsupermassive black holes form when stars in themselves collapse at the end of their life cycles. On average, they are millions of times more massive than the sun. Scientists have struggled for decades to capture one in front of the camera because black holes are so massive and rotate so fast that they distort space-time and ensure that nothing can detach from their gravitational force. Since even light cannot escape, these forces create a unique shadow in the form of a perfect circle in the middle of the black hole. The outer edge of this centre as the event horizon of the black hole or point of no return. But in April, a group of scientists from the international Event Horizon Telescope (EHT) Collaboration released the first photo of a supermassive black hole to the public. Although the image was fuzzy, it showed that black holes, as predicted, look like dark spheres that are made of a Ring of Light. As a gas cloud approaches the black hole, it accelerates and heats up, Josephine Peters, an astrophysicist at Oxford University, previously told Business Insider. It glows brighter the faster and hotter it gets. At some point, the gas cloud comes so close that the pull of the black hole stretches it into a thin arc. This unprecedented photo shows the supermassive black hole at the center of the Messier 87 galaxy, which is about 54 million light-years from Earth. The mass of the black hole is equivalent to 6.5 billion suns. On April 10, 2019, the Horizon Telescope Team released the first image ever taken of a black hole. Event Horizon Telescope Collaboration/Maunakea Observatories via AP To capture the image, astronomers relied on years of data from eight telescopes synchronized around the world. So the image is a reconstructed view, not a photo. It feels like looking at the gates of hell, at the end of space and time, said Heino Falcke, an employee of the Event Horizon Telescope. when the photo was released. The next target of the EHT team is probably Sagittarius A*, the black hole at the center of our own galaxy. We simulated what it might look like to hang near a black hole since the EHT image was so blurry in April, NASA scientists created a visualization of what a black hole might look like in close-up and in action. The animation shows how the gravity that surrounds the black hole would distort light from the orbiting cloud of gas, dust, dead stars, and other space detritus (the so-called accretion disk). This would seem like a rainbow of fire bent over a dark abyss. The black hole would change in appearance depending on how you viewed it. A side view, such as the one below, would show that the accretion disk slithers around the event horizon. An illustration of a black hole, as seen from the side. NASA's Goddard Space Flight Center/Jeremy Schnittman appears brighter on one side than on the other because the M87's black hole is likely to rotate, which also orbits the dust and gas cloud. So the material approaching our eyes seems to be brighter than the material moving away – a bit like the beacon of a lighthouse. However, if you looked at the black hole from above or below, the accretion disk would form a near-perfect circle and the light would appear more evenly distributed. According to Thorne, the reason why the black hole in Interstellar does not match the M87 image of the black hole is that Nolan chose to omit this brightening and dimming phenomenon. Thorne told Gizmodo that the human eye probably won't be able to detect the brightness differences on both sides of the hole when the overall brightness is so extreme. Therefore, the black hole of the film seems to have the same brightness. The depiction of a black hole in the film Interstellar. Paramount Pictures scientists confirmed that there is a supermassive black hole at the center of our galaxy Supermassive black holes are in the universe – they were found at the center of almost every galaxy that scientists have studied. The black hole in the center of the Milky Way, Sagittarius A*, is 25,000 light-years away and 4 million times as heavy as our sun. The accretion disk of Sagittarius A* is about 100 million miles wide or slightly wider than the distance between Earth and the Sun. In October 2018, astronomers revealed that they had observed Sagittarius A* sucking from hot gas at 30% of the speed of light – 201 million mph – in blobs. This triggered three powerful radiation eruptions discovered by telescopes on Earth. The center of the Milky Way, captured by the infrared cameras of the Spitzer Space Telescope, October 9, 2019. NASA, JPL-Caltech, Susan Stolovy (SSC/Caltech) et al. At the time, the study authors said the torches provide a long-awaited confirmation that the object at the center of our galaxy is, as long thought, a supermassive black hole. Josephine Peters, an astrophysicist at Oxford University who was not involved in the study, had previously told Business Insider that the observations followed material that came as close as possible to a black hole without being consumed by it. But Peters added that Sagittarius A* is still incredibly mysterious. The more scientists learn about black holes like Sagittarius A*, the better directors like Nolan can portray them in Hollywood blockbusters. Blockbuster.

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