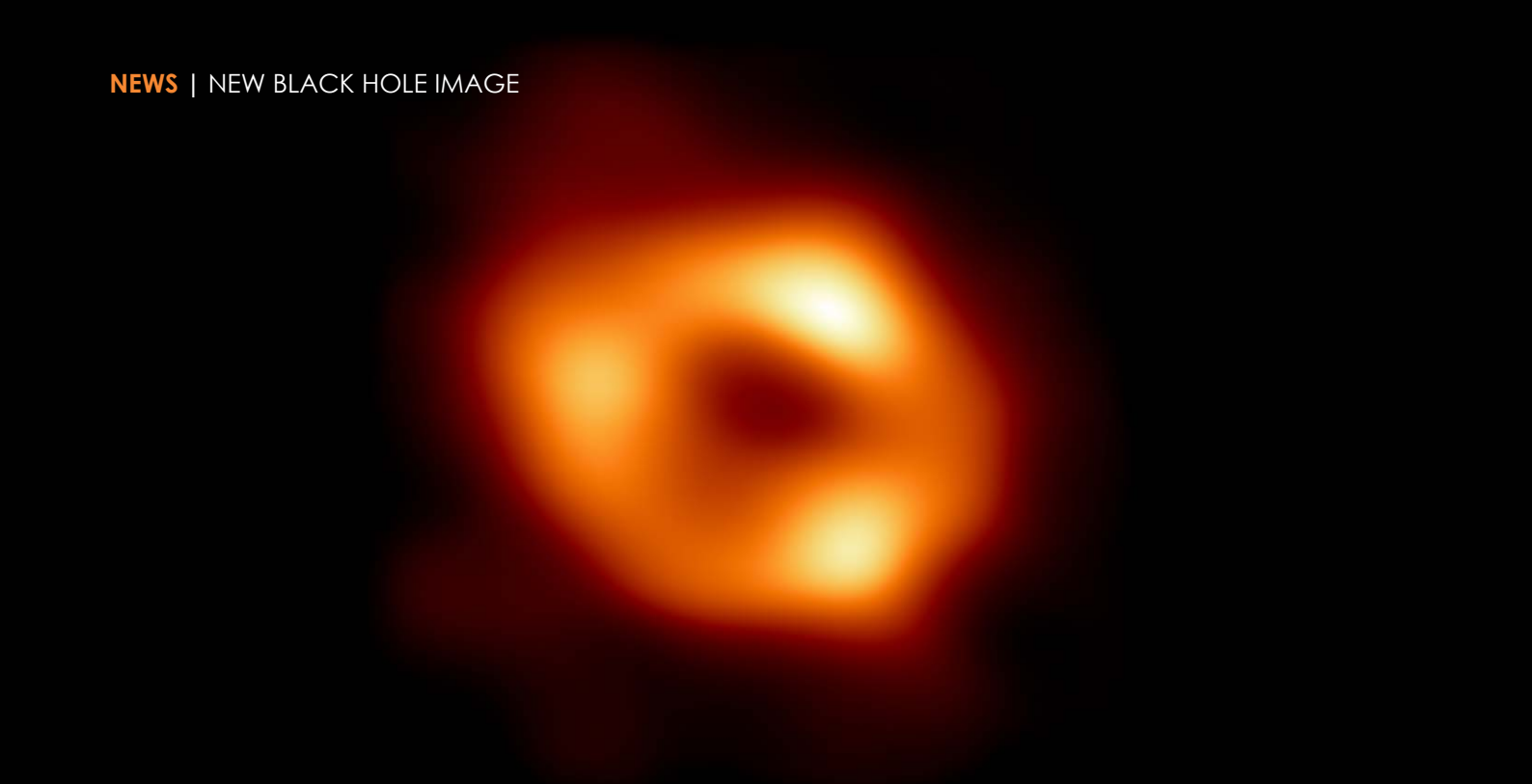

The first composited image of the black hole at the centre of the Milky Way. Photo: Event Horizon Telescope(EHT)/European Space Observatory (eso.org)

Astronomers reveal first image of the **black hole** at the centre of the **Milky Way galaxy**

At simultaneous press conferences around the world, including at the Wits Planetarium at the University of the Witwatersrand, Johannesburg, astronomers on the 12th of May unveiled the first image of the supermassive black hole at the centre of our own Milky Way galaxy.

According to the official press release issued by the University of the Witwatersrand (Wits), this result provides overwhelming evidence that the object is indeed a black hole and yields valuable clues about the workings of such giants, which are thought to reside at the centre of most galaxies. The image was produced by a global research team called the Event Horizon Telescope (EHT) Collaboration, using observations from a worldwide network of radio telescopes.

Scientists had previously seen stars orbiting around something invisible, compact, and very massive at the centre of the Milky Way. This strongly suggested that this object – known as Sagittarius A* (Sgr A*, pronounced "sadge-ay-star") – is a black hole, and the new image provides the first direct visual evidence of it.

Seeing the dark

Although we cannot see the black hole itself, because it is completely dark, glowing gas around it reveals a tell-tale signature: a dark central region (called a "shadow") surrounded by a bright ring-like structure. The new view captures light bent by the powerful gravity of the black hole, which is four million times more massive than our Sun.

"We were stunned by how well the size of the ring agreed with predictions from Einstein's Theory of General Relativity," said EHT project scientist Geoffrey Bower from the Institute of Astronomy and Astrophysics, Academia Sinica, Taipei.

"These unprecedented observations have greatly improved our understanding of what happens at the very centre of

our galaxy and offer new insights on how these giant black holes interact with their surroundings." The EHT team's results were published in a special issue of *The Astrophysical Journal Letters*.

Because the black hole is about 27 000 light-years away from Earth, it appears to us to have about the same size in the sky as a doughnut on the Moon. To image it, the team created the powerful EHT, which linked together eight existing radio observatories across the planet to form a single "Earth-sized" virtual telescope. The EHT observed Sgr A* on multiple nights, collecting data for many hours in a row, similar to using a long exposure time on a camera.

The breakthrough follows the EHT collaboration's 2019 release of the first image of a black hole, called M87*, at the centre of the more distant Messier 87 galaxy. The two black holes look remarkably similar, even though our galaxy's black hole is more than a thousand times smaller and less massive than M87*.

"We have two completely different types of galaxies and two very different black hole masses, but close to the edge of these black holes they look amazingly similar," says Sera Markoff, co-chair of the EHT Science Council and a professor of theoretical astrophysics at the University of Amsterdam, the Netherlands.

"This tells us that General Relativity governs these objects up close, and any differences we see further away must be due to differences in the material that surrounds the black holes."

The effort was made possible through the ingenuity of more than 300 researchers from 80 institutes around the world that together make up the EHT Collaboration. In addition to developing complex tools to overcome the challenges of imaging Sgr A*, the team worked rigorously for five years, using supercomputers to combine and analyse their data, all while compiling an unprecedented library of simulated black holes to compare with the observations.

African contribution

Only two of the more than 300 researchers are based on African soil, Wits postdoctoral fellow, Dr Iniyan Natarajan, and Prof. Roger Deane, Director of the Wits Centre for Astrophysics and Extraordinary Professor at the University of Pretoria. Their contributions included precision measurements of the black hole ring size using a suite of algorithms, as well as developing the sophisticated software suite used to simulate realistic EHT datasets. These were critical to robustly compare the observations with predictions from Einstein's General Theory of Relativity.

Scientists are particularly excited to finally have images of two black holes of very different sizes, which offers the opportunity to understand how they compare and contrast. They have also begun to use the new data to test theories and models of how gas behaves around supermassive black holes. This process is not yet fully understood but is thought to play a key role in shaping the formation and evolution of galaxies.

Wits' Professor Deane notes: "Southern Africa holds a distinct geographic advantage to host new EHT telescopes, especially if we wish to make movies of the Milky Way's supermassive black hole, which passes directly above us in the southern sky."

Efforts to add these African nodes to the global network are underway with several national and international partners, including Wits and the University of Pretoria. In addition to enabling higher precision tests of General Relativity, the expansion of the EHT into Africa has a strong synergy with the future continental expansion of the Square Kilometre Array mid-frequency array centred in the Northern Cape, with the South African Radio Astronomy Observatory's MeerKAT telescope serving as its precursor.

For more information visit the EHT Website: https://eventhorizontelescope.org

Kwisithangami sabezindaba kumhlaba jikelele kufaka ne Wits Planetarium at the University of the Witwatersrand,egoli, izazi zezinkanyezi ngomhlaka 12th May zambula isithombe sokuqala esitshengisa umgodi omnyama omkhulu ophakathi nendawo nomthamo wezinkanyezi. Ababili kulezizazi abasize ukuthi lesisithombe sitholakale bavela kumhlaba wase Afrika.

Translated by Zamantimande Kunene

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