The imaging of Sagittarius A*: A monumental scientific achievement

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On Thursday, the Event Horizon Telescope (EHT) Collaboration released the imagery of the supermassive black hole at the center of our Milky Way galaxy, Sagittarius A*. It is a direct detection of one of the most elusive types of astronomical objects and the culmination of more than a century of theoretical and experimental astronomical studies. The results are also a brilliant demonstration of the possibilities engendered by human labor coordinated on an international and scientific basis.

More than 300 astronomers and hundreds of engineers and support staff from 60 institutions across 20 countries and regions on all seven continents made the observations, processed the data and maintained the technical infrastructure needed for such an immense undertaking. After the observations of Sgr A* were made in 2017, thousands of terabytes of data were transported to the MIT Haystack Observatory and the Max Planck Institute of Study to be processed and analyzed on some of the world's most powerful supercomputers. Five years of labor proved necessary to characterize and understand the results.

The immediate result is the product of more than two decades of planning by the collaboration, which was launched in 2009 with the primary goal of observing the two largest black holes in the sky as seen from Earth, Sagittarius A* (Sgr A*) and the black hole at the center of galaxy Messier 87. To do so, the collaboration incorporated radio telescopes from around the world and combined their observing capabilities to view astronomical objects never before directly seen.

The telescopes involved in capturing the data needed to produce the final graphic include the Atacama Large Millimeter Array and the Atacama Pathfinder Experiment in Chile, the Heinrich Hertz Submillimeter Telescope in Arizona, the IRAM 30m telescope in Spain, the James Clerk Maxwell Telescope and the Submillimeter Array in Hawaii, the Large Millimeter Telescope in Mexico, and the South Pole Telescope in Antarctica.

The graphic produced is also a resounding blow against all forms of irrationalist thought, whether it be the mysticism of religious obscurantism or postmodernism and its assertion that all "narratives" are equally valid. There is in fact an objective, material reality, which is governed by physical, knowable laws.

Further and more in-depth results are expected to follow in the coming months and years. EHT completed in March its latest observing campaign, which included three new telescopes that will allow for even better imagery. And now that data has been collected and released on the collaboration's two main targets, it will explore other even more esoteric regions of the Universe, particularly the galactic-scale energetic jets produced by supermassive black holes as large amounts of gas and dust flow into them.

As with any scientific discovery, the EHT array itself is the product of more than a century of pioneering work in theoretical astrophysics and advanced engineering. Einstein's theory of general relativity, upon which the modern understanding of black holes is based, was developed in 1915. The initial detection of radio waves from the galactic core happened in the 1930s and the astronomical techniques needed to detect matter spiraling into a black hole were developed in the 1960s. It was only in the 1980s that Sgr A* was first hypothesized to be a black hole, and observations in the 1990s and 2000s ruled out the vast majority of other possibilities.

At the same time, producing such imagery is an inherently international process. In order to achieve the necessary resolution to see the black hole (in reality the

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extremely hot gas surrounding the invisible object), radio telescopes have to be built and maintained on opposite ends of the globe, effectively turning Earth itself into a giant radio antenna capable of detecting extraordinarily faint signals.

Such vast scientific undertakings are becoming increasingly routine. The Large Hadron Collider, the detection of gravitational waves, the IceCube experiment to detect neutrinos, as well as virtually every space mission, require an international effort to succeed. As an example in the negative, the European Space Agency's ExoMars mission, which was scheduled to launch this year, will now not launch until at least 2028 after Russia withdrew its participation in the mission as a result of sanctions imposed on the country after it was provoked by the US and NATO into war with Ukraine.

The necessity of international collaboration was remarked on by Xavier Barcons, the director general of the European Southern Observatory, who said in a press conference to announce the findings that "This extraordinary result would not have been possible to achieve by one single facility or even the national astronomical community of a single country. It took eight radio observatories around the world, and that network has already expanded to 11 today, many built, funded, operated and supported through international organizations across many countries around the world."

Barcons then felt compelled to note that the discovery "shows what we can achieve when we cooperate, when we work together. This is very important to remember in the times that we are living in, where the world is not running in that direction unfortunately."

Indeed not. One can assume that Barcons was referring to the spiraling conflict between NATO and Russia, which threatens humanity with nuclear annihilation. Or perhaps the COVID-19 pandemic, which has killed an estimated 20 million people worldwide and where wealthy countries have hoarded vaccines and other therapeutics.

Barcons could have also been referencing the ongoing and accelerating climate catastrophe, which world governments have done nothing to abate and which threatens to drown the world's coasts by the end of the century. And despite warnings for more than half a century of the looming disaster, nations have consistently refused to reduce greenhouse gas emissions in the name of their national capitalist interests.

This state of affairs is a product of definite social and political relations and objective economic processes. It is the division of the world into rival nation-states competing in a global capitalist market that produces such horrors, not to mention the crushing inequality and poverty faced by billions every day.

Serious scientific collaboration involves a certain conscious effort by those involved to reject the chauvinist and nationalist mantras spewed by every government, governments that would much rather see these scientists producing ever-more terrible weapons of mass destruction than working together toward understanding nature and our place within it.

Those same governments have overseen an astronomical redistribution of wealth during the pandemic, handing over trillions of dollars to Wall Street and other financial markets, while forcing workers back on the job amid a pandemic to pay for the bailouts. The war in Ukraine has produced shortages of basic necessities, food and baby formula, while inflation has skyrocketed, forcing more and more of the world's population into destitution.

But towering scientific achievements like the imaging of Sagittarius A* give a glimpse of another basis of social organization. If the principles of scientific planning and international collaboration that brought about this triumph were applied to contemporary society, it would be possible to end war, poverty, preventable disease and all other forms of social misery.

The capitalist class has proven that it is committed only to the continued accumulation of private profit, no matter the consequences for Earth's ecology or the cost in human lives. It is thus left to the working class, the objectively revolutionary and international social force in society, to overthrow capitalism as a whole, paving the way for a new and higher social order, socialism.

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