



Picturing Powehi¹

Capturing the first image of the silhouette of a black hole was a triumph for astrophysics, but like other scientific and technological breakthroughs, it would not have been possible without mathematics. Geometry, trigonometry, and complex numbers were part of the process of synchronizing and combining tremendous amounts of data gathered from a global collection of eight observatories into a representation of what a single telescope the size of Earth would observe. To avoid any potential bias, teams then worked independently and used the mathematics involved in signal processing to convert the data into the image below. The teams' images were remarkably similar when evaluated at thousands of parameters, so with that confirmation, they were able to reveal to the world what had previously been unseeable.

Part of the excitement generated by the image is the confirmation of many theoretical results about black holes, whose existence was deduced from the equations of general relativity. These nonlinear equations are very difficult to solve, but 50 years after their introduction, mathematician Roy Kerr astonished the scientific community by finding exact solutions for rotating black holes and the important features that describe them, such as angular momentum. All of this research seeks to understand significant but seemingly paradoxical astronomical bodies that are black but bright,

with a huge mass concentrated in a tiny point. Knowing more about black holes could ultimately reconcile quantum mechanics and gravity.

For More Information:

“Black hole imaged for first time,” by Davide Castelvecchi, *Nature*, April 18, 2019.

¹Powehi: A Hawaiian word meaning “the adorned fathomless dark creation.”

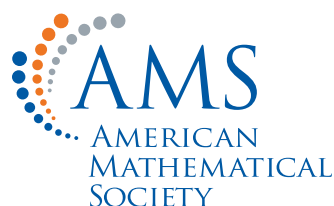


Image: Event Horizon Telescope collaboration et al.

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