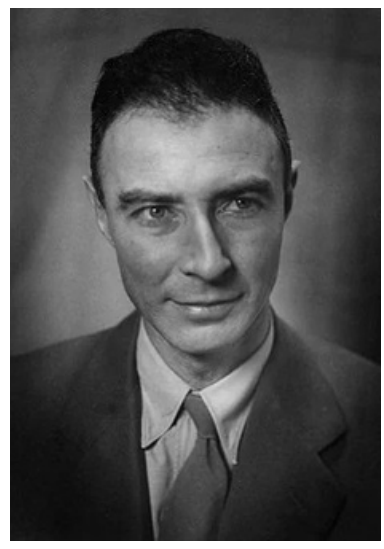
THE PHYSICS CHRONICLES

“On Continued Gravitational Contraction”

J. Robert Oppenheimer & Hartland Snyder, 1939

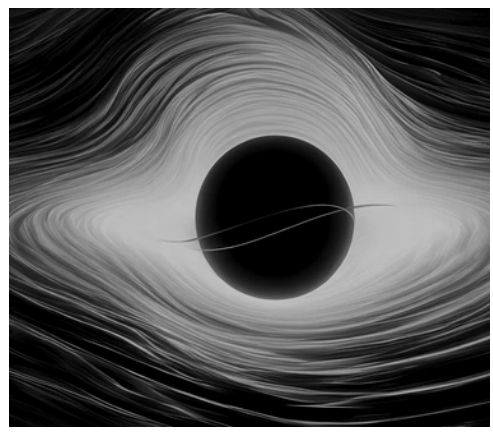
Although known as the "father of the atomic bomb," Oppenheimer also made significant contributions to theoretical physics. His work on gravitational contraction and black holes is a cornerstone in astrophysics. Physicist and graduate student of Oppenheimer, Snyder collaborated with him on this 1939 paper, providing crucial insights into the theoretical underpinnings of black holes.

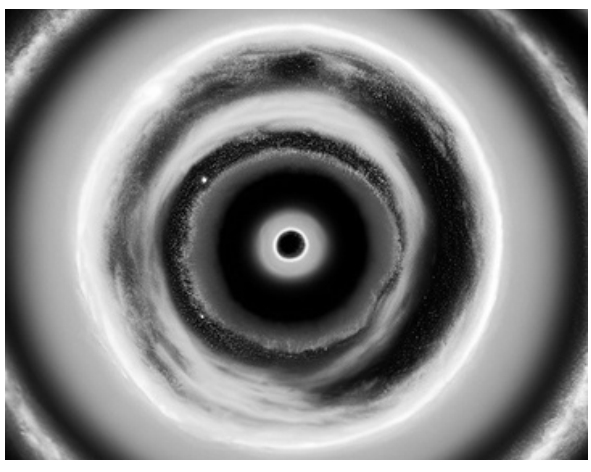


Key Concepts of *“On Continued Gravitational Contraction”*

Gravitational Collapse

Massive stars can undergo continual gravitational contraction when their nuclear fuel is exhausted, causing the inward pull of gravity to dominate over the outward pressure from nuclear reactions. This process can lead to a runaway collapse where the core contracts to an extremely small size and immense density, potentially forming a singularity.



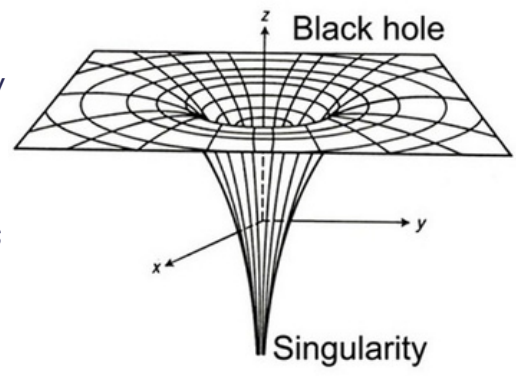


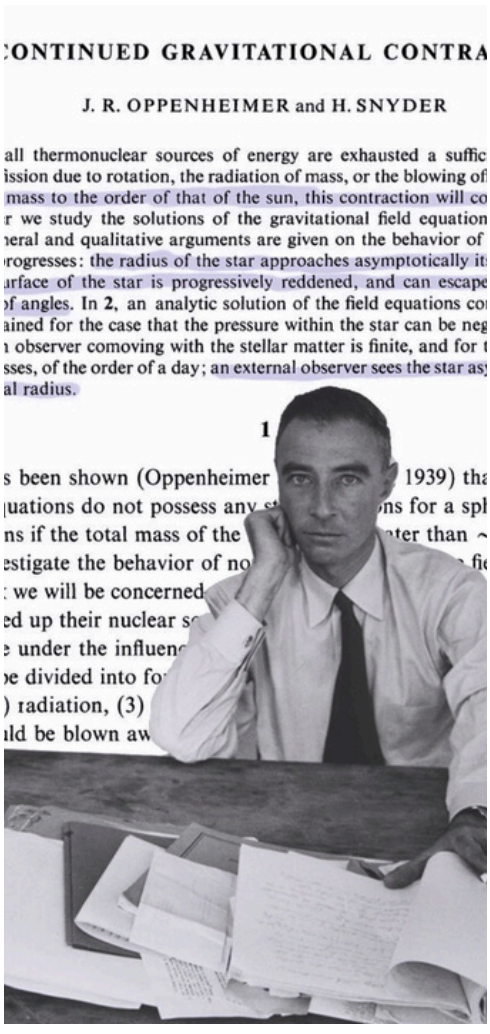
The Event Horizon

The event horizon marks the point at which the escape velocity equals the speed of light, making it impossible for information or matter to leave the black hole. This is described by the Schwarzschild radius for non-rotating black holes.

The Singularity

A singularity is a point in space where density becomes infinite and the laws of physics as we know them break down. At the singularity, spacetime curvature becomes infinite. General relativity predicts this outcome, but quantum gravity theories are needed to fully understand the physics at this extreme point.





CONTINUED GRAVITATIONAL CONTRA

J. R. OPPENHEIMER and H. SNYDER

all thermonuclear sources of energy are exhausted a suffic
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mass to the order of that of the sun, this contraction will co
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Scientific Context Before *“On Continued Gravitational Contraction”*

Oppenheimer and Snyder's work built on the theoretical groundwork laid by earlier physicists, including Karl Schwarzschild and Subrahmanyan Chandrasekhar, and introduced a mathematical framework for understanding gravitational collapse in the context of general relativity.

Impact on Physics

“On Continued Gravitational Contraction” paved the way for modern astrophysics and the study of black holes. Their theoretical model provided a basis for understanding how massive stars could collapse into objects so dense that not even light could escape their gravity.

Want to Learn More?

Books:

"Black Holes and Time Warps: Einstein's Outrageous Legacy" by Kip S. Thorne

"A Brief History of Time" by Stephen Hawking