Why No One Can Get Out of a Black Hole

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Black Holes are surprising things. But they were discovered to be a strange possibility way back in 1917, when a German soldier fighting the Russians on the Eastern Front of World War I, received in the mail a physics journal containing a new paper by Albert Einstein announcing his Theory of General Relativity. And Karl Schwarzschild (I knew his son) solved the equations that Einstein had just discovered—Einstein had only been able to solve them approximately. Karl's solution, as I will make clear to you, is a Black Hole.

Einstein was already famous for his Special Relativity, discovered in 1905, but revealed, in 1908, by his former teacher, Hermann Minkowski, to be nothing but a simple extention of the famous Pythagorean Theorem, to include a fourth dimension, time, which is distinguished from being just one more space dimension only by its minus sign in the Theorem.

What Einstein's new, General Relativity showed us, was that the presence of a massive object (for example the Sun) distorts the Euclidean geometry of his (Pythagorean) Special Relativity. Why? We still to this day have no idea why! Here is Karl Schwarzschild's solution: which may, perhaps, be the first equation ever to appear in a Washington Post Op-Ed:

\[ h^2 = \frac{x^2}{\left(1 - \frac{2m}{x}\right)} + 0^2 + 0^2 - \left(1 - \frac{2m}{x}\right) t^2 \]

We can easily see that this is only a distortion, by a mass \( m \), of Hermann Minkowski’s 1908 Special Relativity Pythagorean Theorem equation,

\[ h^2 = x^2 + y^2 + z^2 - t^2 \]

The mass \( m \) is located at the origin of coordinates. If \( m \) is zero, the two equations are identical, except for the fact that in the first equation I decided to display the particular case of someone actually falling straight into the Black Hole along her \( x \)-axis (that is why her \( y \) and \( z \) always remain zero).

So why can't she get out of the Black Hole? Follow what happens to her, as \( x \), her distance from the origin of coordinates, shrinks. When her \( x \) is finally less than \( 2m \), \( 1 - 2m/x \) becomes negative; that is, \( x \) becomes her time direction. She cannot get out simply because she cannot go backward in time!