2.2 Einstein's Field Equations

The foundation of general relativity is built upon the concept of spacetime curvature, which is described by Einstein's field equations.[1] These equations elucidate the relationship between the distribution of matter and energy and the curvature of spacetime. They can be written as:

$$G_{\mu\nu} = 8\pi T_{\mu\nu}$$

where ($G_{\mu\nu}$) is the Einstein tensor, ($T_{\mu\nu}$) is the stress-energy tensor, and the speed of light ($c = 1$) is assumed.[1]

The Einstein tensor is a mathematical object that describes the curvature of spacetime, while the stress-energy tensor describes the distribution of matter and energy.
The Einstein field equations can also be expressed in a more compact form using Einstein's summation convention:

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu}$$

where ($R_{\mu\nu}$) is the Ricci curvature tensor, (R) is the scalar curvature, and ($g_{\mu\nu}$) is the metric tensor. The Ricci curvature tensor and scalar curvature are mathematical objects that describe the curvature of spacetime.[1], [3]

Einstein's field equations play a crucial role in understanding the behavior of the universe at large scales, as they describe the behavior of the universe as a whole. They are also important for understanding the behavior of black holes and other exotic objects in space.[4]

In order to incorporate the extra three dimensions of our proposed 7-dimensional universe, we need to modify Einstein's field equations. This is done by adding terms to the Einstein tensor that describe the curvature of the extra dimensions. We derive these modified field equations in section 3.4. First, let's look at how spacetime might be shaped in 7 dimensions.