Notes from internet sources on Kuluza-Klein Theory

http://www.matter-antimatter.com/kaluza-klein_theory.htm

Modern Kaluza-Klein Theory

The Modern Kaluza-Klein Theory unifies Maxwell's Theory of Electromagnetism and Einstein's Theory of General Relativity & Gravity. The theory provides the scientific and technical basis for modeling galaxies, solar systems, and spacecraft for traveling to the stars.

- In 1919, Theodor Kaluza unified Maxwell's Electromagnetism and Einstein's Theory of General Relativity & Gravity by adding a fifth dimension. The idea came from Hermann Minkowski who had successfully used the fourth dimension to solve the "space-time continuum." In 1921, Kaluza published his theory, with Albert Einstein's encouragement.
  Kaluza's Theory became the framework for Einstein's Theory on General Relativity.

- In 1926, Oskar Klein applied Kaluza's Theory to quantum theory, which is used in modern string theory. Over the past seventy years, scientists have had difficulty correlating the Kaluza-Klein Theory to physical reality. They have modified the assumptions, evaluated compactified, and used extra dimensions. The String & Super String Theories, which have resulted, do not give acceptable solutions to the physical world.

- In 1998, Overduin & Wesson successfully demonstrated that the fifth dimension would solve the Space-Time-Matter Continuum by eliminated the cylindrical assumption from Kaluza-Klein Theory. In Wesson's book, "Space-Time-Matter, Modern Kaluza-Klein Theory," there are numerous examples that correlate Modern Kaluza-Klein Theory to the physical reality including general relativity and elementary particle physics.

People will be able to visualize the possible solutions of the "Space-Time-Matter Continuum" that would enable them to travel to the stars within this century.

http://astro.uwaterloo.ca/~wesson/home.html

We are a loosely bound group of physicists and astronomers with a common interest in pursuing Einstein's dream: the unification of what he called the "low-grade wood" of matter and energy with the "fine marble" of geometry. Our approach follows one originally due to Kaluza and Klein, but with important differences. Like Kaluza, we write down Einstein's field equations in more than four space-time dimensions, with *no explicit higher-dimensional source terms*. Unlike Klein and many others since, we avoid overly restrictive assumptions about the scale or topology of the extra coordinates. Dimensional reduction then leaves us with the usual field equations of gravity in four dimensions, *plus*

extra terms. We identify these extra terms with matter and energy in the four-dimensional world.

http://arkadiusz-jadczyk.org/papers/kk.htm

RIEMANNIAN GEOMETRY, FIBER BUNDLES, KALUZA-KLEIN THEORIES AND ALL THAT.....

http://www.daviddarling.info/encyclopedia/K/Kaluza-Klein_theory.html

Kaluza-Klein theory

A model that seeks to unite classical gravity and electromagnetism by resorting to higher dimensions. In 1919 the German mathematician Theodor Kaluza (1885-1954) pointed out that if general relativity theory is extended to a five-dimensional space-time, the equations can be separated out into ordinary four-dimensional gravitation plus an extra set, which is equivalent to Maxwell's equations for the electromagnetic field, plus an extra field known as the dilaton. Thus electromagnetism is explained as a manifestation of curvature in a fourth dimension of physical space, in the same way that gravitation is explained in Einstein's theory as a manifestation of curvature in the first three.

https://ncatlab.org/nlab/show/dilaton :

"Generally in a context of Kaluza-Klein compactification a dilaton is a field on a lower-dimensional spacetime which is a component of the field of gravity on a higher dimensional spacetime, in that it is part of the metric of the fiber-spaces on which the KK-compactification takes place. Specifically for KK-compactification on a circle fiber "the dilaton" (or "radion") is the lowest Fourier mode of the metric of the circle, hence is the length (circumference) (or radius, up to a factor) of the circle fiber."

In 1926 the Swedish physicist Oskar Klein (1894-1977) proposed that the reason the extra spatial dimension goes unseen is that it is compact – curled up like a ball with a fantastically small radius. In the 1980s and 1990s, Kaluza-Klein theory experienced a big revival and can now be seen as a precursor of string theory.

• SPACE AND TIME
• PARTICLE PHYSICS
• COSMOLOGY
• MATHEMATICS