Gravity as the theory of a self-interacting abelian gauge field.

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Three of the fundamental forces are described by Yang and Mills quantum field gauge theories on flat space-time, the fourth interaction, gravity is the exception. It is a classical theory involving the dynamics of curved space-time. Is this asymmetry intrinsic to gravity? Eddington mentions the possibility of representing the metric tensor of a four dimensional curved space-time in terms of the coordinates of a 10-dimmensional space with constant metric. We will first develop the equations of the standard theory of GR using the parametric representation of the metric tensor proposed by Eddington. Next, we present the fundamental ideas of the theory of a self-interacting abelian gauge field. Given a local abelian gauge symmetry the standard procedure in normal Yang and Mills theories is to define the covariant derivative by introducing an auxiliary field, the gauge potential , so that the combination is covariant. Here instead we define a new type of gauge theory in which the gauge potential belongs to the symmetry group, resulting in a self-interacting gauge potential and a corresponding non-linear covariant derivative. Finally we show that Einstein?s equations of the theory of general relativity when written using the parametric representation of the metric tensor are the same as those obtain from the new type of self-interacting abelian gauge theory on a Minkowski space-time background. Therefore, gravity can be describe either by the usual theory of general relativity, based on the dynamics of curved space-time or, alternatively as a non-linear self interacting gauge theory in Minkowski space. This allows formulating all fundamental interactions of matter on the bases of the general principle of gauge field symmetry.