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Part I

The Standard Model and its supersymmetric extensions

1 The Standard Model of particle physics

The formulation of a relativistic quantum field theory and of spontaneous symmetry breaking by the Higgs mechanism, allowed to built a theory which is capable to explain almost all observations of particle physics until today [**?**]. This theory is known as the Standard Model of particle physics. The existence of its last missing piece , the Higgs boson, could be proven at the LHC in the year 2012 [**?**].

The Standard Model is a SU(3)xSU(2)xSU(1) non-abelian gauge theory, of which its symmetries are reduced "after" spontaneous symmetry breaking to SU(3)xU(1). All particles that were found until today can be explained with it [**?**]. Furthermore, it is able to describe three of the four fundamental forces, the strong, weak and electromagnic force.

In the following, a small introduction to the theory and phenomenology of the Standard Model is given. It is not meant as a complete description. The reader is referred to [**?**], for a thorough and extensive description.

1.1 The Langrangian density

The heart of every quantum field theory is the Lagrangian density with which it can be described. For the Standard Model of particle physics, it is the following:

$$\mathcal{L} = \tag{1.1}$$

This is the smallest set of possible Lagrangian terms, that is renormilsable and contains all up to date known particles and the above mentioned gauge symmetries.

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