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## **The Standard Model of Particle Physics and Beyond**

### **Abstract**

The Standard Model (SM) of Particle Physics is understood as comprising all presently established knowledge of the fundamental particles and their interactions in the microscopic realm. It is built on the known ultimate constituents of matter, i.e. the quarks and leptons, as well as the mediators of their interactions, i.e. the photon, the intermediate bosons, the gluons, and the Higgs boson. Thereby it provides the fundamental theory for the electromagnetic, weak, and strong forces in nature. The theoretical framework relies on quantum theory and relativity. In principle, the SM should thus be capable of explaining all phenomena of the microscopic world in a consistent manner.

Over the past decades, however, it has become clear that the SM is neither sufficient nor can be extended to a complete theory (of everything). Such beyond-standard-model (BSM) problems consist, e.g., in observations of dark matter, matter-antimatter asymmetry, and neutrino oscillations as well as the challenge of formulating a fundamental theory of gravity.

As far as time allows, we shall present the essentials of the SM and discuss problems of BSM physics.

### **Short CV of Willibald Plessas**

Willibald Plessas is a Professor Emeritus at the Institute of Physics of the University of Graz. In his professional career as a university professor he concentrated on teaching theoretical physics and mathematics. His scientific research has ranged from mathematical physics over nuclear to particle physics. Notable results have been achieved in the fields of few-body physics, by



developing models of nuclear forces and the description of hadron properties on the basis of fundamental interactions in elementary-particle physics.

Willibald Plessas has been principal investigator in a number of national and international research projects, organizer of workshops, schools, and conferences as well as editor-in-chief of the journal *Few-Body Systems*.

Beyond physics he was also the chairman of the university council of the University of Music and Performing Arts Graz during 2003-2008.