SYUM 1: Ursprung der Masse

Zeit: Mittwoch 14:00–16:20 Raum: HSZ-01/02

Plenarvortrag SYUM 1.1 Mi 14:00 HSZ-01/02

The Higgs mechanism and beyond — •Alex Pomarol — Dept. Fisica, Universitat Autonoma de Barcelona, 08193 Bellaterra (Barcelona), Spain

I will give a brief introduction to the Higgs mechanism that give masses to the W & Z gauge bosons, and leads to the Higgs boson prediction. I will then discuss the implications of the recent Higgs discovery and what its mass and couplings tell us. The existence of the Higgs opens new questions about its origin (is it composite?, supersymmetric?, or does it arise from extra-dimensions?) upon which I will also elaborate.

Plenarvortrag SYUM 1.2 Mi 14:35 HSZ-01/02

The Higgs mechanism as a challenge for philosophy — •Simon Friederich — Philosophisches Seminar, Universität Göttingen, Deutschland

The Higgs mechanism raises interesting conceptual and methodological challenges. Conceptually, it is widely associated with the notion of a spontaneously broken local gauge symmetry, but this notion appears puzzling if one thinks of gauge symmetries as connecting physically identical situations. One may therefore wonder what it means for such a symmetry to be "spontaneously broken" and how such a breaking can have a physical effect such as particle mass generation. On a methodological level, the Higgs mechanism has often been accused of being unsatisfying and "ad hoc". However, the Higgs mechanism does not qualify as "ad hoc" according to how philosophers of science have used that notion in the past. I argue that it makes perfect sense to criticise the Higgs mechanism as an ad hoc hypothesis and that this speaks against these philosophers' views.

Plenarvortrag SYUM 1.3 Mi 15:10 HSZ-01/02

Majorana-Masses of Neutrinos: Origin and Phenomenology — •Werner Rodejohann — MPIK, Heidelberg

The vast majority of theories beyond the Standard Model predicts neutrinos to be Majorana particles. The seesaw mechanism and its variants are presented as generic examples. Neutrinoless double beta decay is the only realistic possibility to prove the Majorana nature of neutrinos. The expected half-lives can be partly constrained through the observed neutrino oscillations. In addition, the decay is a method to measure neutrino mass, complementary to other experiments like KATRIN or cosmological observations. However, there is a number of theories beyond the Standard Model which can also cause double beta decay, but are not directly connected to neutrino physics. These alternatives have often consequences for LHC physics and lepton flavor violation, and can be tested by these means.

Plenarvortrag SYUM 1.4 Mi 15:45 HSZ-01/02

Hadrons and Nuclei: Mass without Higgs — •Ulf-G. Meissner — Universität Bonn & Forschungszentrum Jülich

This talk concerns the generation of the masses of hadrons and nuclei that make up most of the visible matter in the universe. I discuss how the strong interactions generate the mass of hadrons made of light quark through gluonic interactions and the role of the small quark masses. The ab initio calculation of nuclei and in particular the spectrum of carbon-12 is discussed. I show how the generation of carbon and oxygen is modified when the quark masses undergo small variations. The implications for the anthropic principle are also laid out.