INTRODUCTION

Chair: Cédric DEFFAYET

During the second half of the XXth century, physicists have built the so-called “standard model” of particles physics, which describes with great success all the known most intimate building block of nature. More concretely, it gives a unified description of all the known particles and of three of the four fundamental interactions at work in nature: the electromagnetic interaction, the so-called “strong” interaction and the so-called “weak” interaction. This standard model is expressed in the framework of a so-called “quantum theory of fields”, that is to say a theory which follows the principle of quantum mechanics but also those of special relativity, which were both enunciated in the first half of the last century. This remarkable achievement was made possible and has been tested with great precisions during many years thanks to particle accelerators such as the ones operating at CERN, in Geneva, the European Organization for Nuclear Research (an unfortunate name, since the last - and this will also be true for the next - generation of CERN accelerators was in fact able to explore sizes much smaller that the one of an atomic nucleus). The standard model is believed to describe at the most intimate level known today all the known phenomena of nature, hence for example, it is in principle possible (but can be very hard in practice) to use the standard model not only to describe what is going on inside a proton, one of the constituent of the atomic nucleus, but also to compute say the physical properties of liquid water or those of reinforced concrete. The standard model has been tested with great precision in particle accelerator, it also enables to give a successful description of an early period of the history of the Universe. However, one of the major piece of the standard model has still to be discovered, the so-called Higgs boson which is associated with the way particle masses are described. Moreover various arguments make one believe that the model has to be modified to describe phenomena occurring at energy slightly higher than those reached in the last generation of accelerators. It is the goal of the future CERN accelerator, named LHC (standing for “Large Hadron Collider”) to explore those issues. The LHC is now under construction, and will start operating in 2008. It will then be the most powerful particle experiment in the world and help enlighten the physics beyond the standard model. The new discoveries that the LHC should bring, could also potentially have impact on cosmology, helping one to better understand an era even more remote than the one currently believed to be understood. This session will be dedicated to discussing with more details those issues. Our speakers will be an experimentalist and a theorist in the field of high energy physics. The former, Caroline COLLARD, working on one of the experiment to be held at the LHC will discuss with more details the LHC project and the related experiments, the latter, Koichi HAMAGUCHI, will provide us with more details on the theoretical issues involved.