2019 Summer School on Cosmology and Particle Physics

Monday, 22 July 2019 - Friday, 26 July 2019

CTPU PTC

Scientific Programme

Lectures
Higgs Physics
Higgs Physics 1: The subject is Lorentz invariance and basic Quantum Field Theory.

Higgs Physics 2: The subject is scalar field theory and Dirac equation.

Higgs Physics 3: The subject is gauge theory.

Higgs Physics 4: The subject is the Higgs mechanism for electroweak symmetry breaking.

Higgs Physics 5: The subject is the current status of Higgs physics at the LHC.

Physical Cosmology

Physical cosmology 1 : The subject of this lecture is expanding universe.

Physical cosmology 2 : The subject of this lecture is master equations

Physical cosmology 3 : The subject of this lecture is the growth of density perturbation

Physical cosmology 4 : The subject of this lecture is correlation functions

Physical cosmology 5 : The subject of this lecture is beyond the Newtonian picture

Standard Model and Beyond

강의 1 표준모형과 문제점 :

표준모형의 문제점들을 돌아보고, 유효장론의 관점에서 표준모형을 넘어서는 물리의 증거들에 대해서 토론한다.

강의 2 표준모형의 초대칭 확장 I :

초대칭 이론의 기초를 소개하고, 초대칭 이론을 여러가지 물리문제들에 적용한다.

강의 3 표준모형의 초대칭 확장 II :

초대칭 이론이 힉스 입자의 질량 문제에 시사하는 바에 대해서 토론하고, 보다 완전한 초대칭 이론의 구성에 대해서 논의한다.

강의 4 초대칭의 대체 이론 :

힉스 입자의 질량 문제를 해결하기 위해서 도입된 최근 이론들을 소개하고, Relaxion과 clockwork theory에 초점을 두고 최근 연구 동향을 소개한다.

강의 5 암흑 물질의 새로운 이론 :

최근에 주목을 받아왔던 가벼운 암흑 물질의 여러가지 생성 방법에 대해서 토론하고, 구체적인 표준모형의 확장을 소개한다.
Seminars

Particle dark matter: WIMP and beyond

Dark matter is one of the biggest mysteries of modern cosmology and particle physics. A weakly interacting massive particle (WIMP) has been a promising dark matter candidate. Electroweak-scale new physics, which explains the origin of electroweak symmetry breaking (or the naturalness problem), naturally provides a WIMP candidate with the correct relic abundance. On the other hand, the new physics scale has been pushed up to TeV by the Large Hadron Collider (LHC) experiment, leaving the naturalness problem unsolved. It requires new theoretical reasoning for a WIMP and may even motivate us to look for a beyond WIMP candidate. I will overview the current status of WIMP dark matter and beyond.

Composite Particles

Is the Higgs really an elementary scalar particle (the first and only found so far)? How can we test this? And why is the weak scale so much smaller than the Planck scale? Composite Higgs models are Standard Model extensions which try to address these questions. This seminar provides a brief introduction of the main ideas and concepts behind composite Higgs models, their virtues and their challenges, and a survey on the different ways of testing the models experimentally.

Electroweak Baryogenesis

Cosmic baryon asymmetry is tangible evidence that calls for new physics. While a lot of baryogenesis scenarios have been proposed so far, electroweak baryogenesis (EWBG) is the 1st scenario that we can verify wth on-going and near-future experiments. If this scenario is true, discovery is just around corner.

In this talk, I will start by giving a brief review of EWBG and talk about current status. Then I will

discuss EWBG possibility in a general two-Higgs doublet model and its phenological consequences. If I have time, I will also refer to thorny theoretical problems that exist in any EWBG scenarios.