UNIVERSITA' DEGLI STUDI DI PAVIA

DOTTORATO DI RICERCA IN FISICA

COLLOQUIA 2017-2018

Giovedì 31 Maggio 2018
Aula 102 “L. Giulotto”, ore 16.00

Dipartimento di Fisica, via Bassi 6, Pavia

How to determine the masses of the lightest quarks

Gilberto Colangelo

Albert Einstein Center for Fundamental Physics
Institute for Theoretical Physics, Bern U., Switzerland

Abstract: The fundamental theory of strong interactions, Quantum Chromodynamics (QCD), is formulated in terms of quarks and gluons, which however are never seen in detectors. Gluons are massless, but quarks are not. Since QCD has its own mass scale, which one can identify with the mass of the proton, it is natural to compare quark masses to this scale and correspondingly define light and heavy quarks. In this talk I will start with general introduction on the problem of the determination of the light quark masses. A key ingredient of this analysis is the notion that in the limit in which the light quark masses are sent to zero, QCD is invariant under chiral transformations, but this invariance is spontaneously broken. The Goldstone bosons which are generated dominate the dynamics at low energies and one can describe the latter with the help of an effective field theory, which I will introduce. With this theory one can also describe the effect of light quark masses, which can be treated as small perturbations, and by comparing to phenomenology, extract their values. After the general introduction, I will describe recent work in which not only the average of the up and down quark masses, but also their difference was determined, by analyzing the decay eta -> 3 pions. A comparison to lattice determinations of quark masses and their ratios will also be presented.