- Denominazione del Corso: Effective Field Theories for Particle Physics
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- Periodo di lezione previsto: Febbraio-Marzo 2021.

- Abstract/Programma:

This course provides an introduction on the basic ideas and methods of effective field theories (EFTs) in particle physics which are relevant for making contact with experimental observations. The intuitive idea behind effective theories is that you can calculate without knowing the exact theory.
(Engineers are able to design and build bridges without any knowledge of strong interactions or quantum gravity!) In some sense, the ideas of EFT are obvious. However, implementing them in a mathematically consistent way in an interacting quantum field theory (QFT) is not so obvious. These lectures provide pedagogical examples of how one actually implements EFT ideas in particle physics calculations of experimentally relevant quantities.

The topics discussed include both formal and phenomenological aspects.

THEORY: relevant and irrelevant operators and scaling, renormalization in EFTs, decoupling of heavy particles, power counting,
naive dimensional analysis (NDA). Fermi theory, EFT in the heavy-top limit. Chiral perturbation theory. Construction of the Standard Model
Effective Field Theory (SMEFT) in different bases (Warsaw basis, SILH basis, HEFT) and their related power counting.

PHENOMENOLOGY: flavor structure of EFT operators under the ansatz of Minimal Flavor Violation and Partial Compositeness. Leptonic and hadronic observables with flavor changing and/or CP violation. Higgs boson phenomenology and the use of EFTs to describe potential deviations from the Standard Model.
Application of the Chiral Lagrangian to beyond SM physics (Composite Higgs Models). Custodial symmetry and electroweak precision measurements. EFTs for Dark Matter: direct detection and collider searches. EFT of the SM with light axion-like-particles: construction of the chiral Lagrangian and relevant phenomenology.