

**Title of the Project:**

The Effective Field Theory path to New Physics

**Abstract:**

Our understanding of the fundamental laws of Nature, built upon a wealth of experimental data spanning a wide range of scales, is encapsulated in the so-called Standard Model (SM), an extremely successful quantum field theory that describes how matter behaves at short distances, in terms of elementary constituents and their interactions. Theoretical arguments as well as unexplained phenomena in cosmological observations, however, point to the existence of New Physics (NP), whose exact nature and energy scale are currently unknown. A wide and diversified campaign of accurate measurements together with the direct search of new particles at the Large Hadron Collider, have not provided any clear indication of NP so far. The overarching goal of this proposal in theoretical physics is to obtain a series of conceptual, technical and phenomenological advances to significantly extend the sensitivity to heavy NP of current and future particle physics experiments above their direct reach, by interpreting their results in a global way through the SM Effective Field Theory (SMEFT).

**Goals of the research:**

The successful candidate will:

- 1] Identify and establish the potential of specific observables at the LHC, focusing on the exploration of rare processes which might have sensitivity to new interactions, yet have not been studied in detail so far in the context of the SMEFT because of the complexity of the final state/small rates.
- 2] Explore the sensitivity of quantum observables, such entanglement and the corresponding measures (such as concurrency), to probe the presence of SMEFT operators.

**Plan of activities:**

The successful candidate will pursue her/his research in the “Theory and Phenomenology of fundamental interactions” sector at the DIFA in collaboration with the group of researchers coordinated by Prof. Fabio Maltoni.