## **Project title: Topics in non-abelian gauge theories**

## Code: PN-II-ID-PCE-2012-4-0078

## Contract: 34/02/09/2013

## Abstract:

One of most difficult tasks in contemporary particle physics phenomenology is to compute higher order corrections to different processes, to the Green functions or to the beta functions. Present knowledge for the scalar or QED beta functions stops at five loops whereas for QCD at four loops. Beta functions in non-abelian gauge theories are important not only for determining the behavior of the gauge coupling constant with the energy but also for studying their conformal window and the dynamics of the phase transitions of theories beyond the standard model. Our project aim to introduce for a large class of theories, with emphasis on the non-abelian gauge ones, new analytical non perturbative techniques based on the whole properties of the corresponding partition functions rather than on the perturbative expansion in the coupling constants. We plan to investigate not only the possibility of obtaining all order beta functions for specific gauge theories or for the anomalous dimension of the scalar field but also to explore the phase diagram of these theories in connection to the non perturbative method introduced but also to the intricate spin structure at two loops.