

# Indirect Searches for New Physics at the time of LHC

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### Organizers

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(later applications will be considered)

Low energy precision experiments test the predictions of the Standard Model (SM) to a high level of accuracy. They also put stringent constraints on the possible New Physics, the masses of the new particles it entails, their couplings, the symmetries it may or may not violate. In this sense, precision experiments *indirectly search* for New Physics at very short distance scales. These indirect searches are conducted at low energy experiments based on high statistics muon, kaon, tau, charm and B production, as well as through the precise measurements of SM parameters at high-energy colliders. The indirect searches are therefore complementary to the direct searches for new particles at the Tevatron and the LHC but they can in principle be sensitive to much shorter scales than the latter experiments.

In early 2010 the physics results of the B factories and Tevatron will be close to final and we may hope that the first results of several flavour physics experiments will become available. Among them *i*) LHCb, the B physics experiment at LHC; *ii*) the MEG experiment searching for Lepton Flavour Violation (LFV) in  $\mu \rightarrow e\gamma$ , *iii*) the experiments looking for the Electric Dipole Moment (EDM) of the neutron at the ILL & PSI, *iv*) the searches for the rare Kaon decays  $K \rightarrow \pi\nu\bar{\nu}$  at NA62 & JPARC. We also expect improvements in lattice calculations that will help uncover new physics in the QCD environment, and a flow of interesting results in electroweak precision physics. The ever more accurate determination of the low energy spectral function at various  $e^+e^-$  machines will lead to a reduction of the hadronic uncertainty in the Standard Model prediction of the muon  $g-2$ . This experimental anomaly could therefore be confirmed and reinforced. At the same time Tevatron should provide more precise values of the  $W$  and top masses, as well as important constraints on the Higgs mass range. The convergence of these new precision data with the very first findings of LHC should make 2010 an ideal moment for a first assessment of the consequences for New Physics.

### Workshop topics

The main aim of the workshop will be to investigate the interplay of the *high energy frontier* (direct searches) with the *high intensity frontier* (indirect searches) in the light of the latest experimental results. It is well known that, if LHC will observe deviations from the SM expectations, the interpretation of these deviations will require a careful investigation of the low-energy constraints on New Physics models. In

particular, it will be important: a) to identify the pattern of possible deviations from the Standard Model expectations and to make sure that these deviations are not related to our still limited understanding of hadronic effects but are true signals of new phenomena; b) to identify New Physics models that fit these pattern of deviations both through a study of specific models and through model independent analyses and derive constraints on possible extensions of the SM; c) to study the interplay between these indirect investigations and the first LHC results.

In order to have a thorough and useful discussion of the issues mentioned above, we plan to bring together the main theory experts of the field and a few experimentalists, encouraging, at the same time, the participation of young postdocs and advanced PhD students.

## Program

The workshop will be organized in topical weeks focussed on the following subjects:

- 1 Status of the quark flavour sector of the SM, prospects of lattice calculations.
- 2 Search for NP in the quark flavour sector: LHCb prospects and complementarity with a future SuperB, rare kaon decays, mixing and CP violation in D decays.
- 3 First high  $p_T$  results from LHC (if any); status and prospects of electroweak precision measurements (muon  $g - 2$  etc).
- 4 Search for NP in the lepton sector: lepton flavor violation ( $\mu \rightarrow e\gamma$ ,  $\tau \rightarrow \mu\gamma, \dots$ ), CP violation in EDMs, connections to leptogenesis.
- 5 Interplay between high  $p_T$  and low energy physics in understanding and disentangling new physics scenarios.

The last of these points should be understood as an attempt to answer the following two questions: if new particles are discovered at ATLAS/CMS, what can the flavour measurements tell us about their properties and the very high energy theory that determines them? And similarly, if deviations from the CKM predictions are found in the flavour measurements, can ATLAS/CMS provide further complementary information that will close in on the source of these deviations?

On the first day of each week we plan to have one or two review talks or introductory lectures on the topic discussed in that week. The remaining days will be mostly devoted to informal discussions and meetings in a relaxed atmosphere, with very few formal talks and possibly a round-table discussion on friday, where the main topics of the week will be reviewed and summarized. We also plan to invite a few experimentalists to review the status and prospects of their analyses. The workshop will be closed by a three-days **conference on March 22–24**.