SHORT TERM SCIENTIFIC MISSION (STSM)
SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA15108
STSM title: (g-2) via leptoquark loops
STSM start and end date: 26/07/2019 to 10/08/2019
Grantee name: Ilja Doršner

PURPOSE OF THE STSM:

The main pupose of this STSM was to facilitate an effective collaboration between a member of Jožef Stefan Institute, prof. Svjetlana Fajfer, and myself with regard to a possibility to address a long-standing discrepancy between experimentally observed value and theoretical predictions for the anomalous magnetic moment of muon through the use of scalar leptoquarks in view of the latest flavor physics, electroweak precision, and LHC data. This STSM has allowed me to bring this project closer to conclusion together with my collaborators prof. Svjetlana Fajfer, Institute Jožef Stefan, and dr. Olcyr Sumensari, University of Padova.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

During my stay at Jožef Stefan Institute my collaborators and I have investigated possible one-loop level leptoquark contributions towards anomalous magnetic moment of muon and generated viable parameter space for such scenarios. We have concentrated our attention of those scenarios where the pairs of leptoquarks need to mix with each other via the Standard Model Higgs field(s) in order to complete the loop, while the fermions in the loop that generate new physics contributions to (g−2) of muon are either bottom quark or top quark. (We find that the contributions that are proportional to the masses of lighter quarks are not sufficient to address the observed discrepancy.) There are three combinations of pairs of leptoquark multiplets that can generate large enough effect. We have accordingly calculated, for each of these three scenarios, contributions to relevant flavor processess, evaluated impact of the leptoquark mixing on the electroweak precision measurements and investigated associated signatures at the LHC in order to constrain available parameter space. All of this has been done with an extensive use of the software package Mathematica.

Since the project is in its final stage, we have also been working on the draft for an arXiv submission on this topic throughout my stay at Jožef Stefan Institute. The anticipated arXiv submission will be publicly available within the next thirty days at most.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

My colleagues and I have catalogued relevant pairs of leptoquark multiplets that can, via mixing with the Standard Model Higgs field(s), contribute to the anomalous magnetic moment of muon. We have found the viable parameter space for all three possible scenarios that can account for the observed disagreement between experimentally measured value and theoretical predictions for (g−2) of muon. In all three instances the quarks in the loop need to be of the third generation.

FUTURE COLLABORATIONS (if applicable)

My collaborators - prof. Svjetlana Fajfer and dr. Olcyr Sumensari - and I will continue working towards completion of this project and one other project that has been indentified during numerous discussion we have had during this STSM. The new direction for our research aims to provide direct connection between the Georgi-Jarlskog set-up to address the mismatch between the down-type quark and charged lepton masses and the observed value of the anomalous magnetic moment of muon.