

Introduction

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Strong2020 Meeting – 18/12/2020



Reminder: Strong2020

- European project (<http://www.strong-2020.eu>)
- WP21 — JRA3 PrecisionSM: “*Hadron Physics for Precision Tests of the Standard Model*”
- Goal: combine theory and experiment for precision tests SM & BSM
- **Task 2: Hadronic Effects in Precision Tests of the electromagnetic sector of the Standard Model: Muon $g-2$:**
 - 2.1 Hadronic Vacuum Polarization from spacelike and timelike processes
 - 2.2 Hadronic Light-by-Light Scattering Contribution to $(g - 2)\mu$
- Deliverable for Task 2.1:
 - database for low-energy hadronic cross sections in e^+e^- collisions.

From the proposal

Task 2: Hadronic effects in precision tests of the electromagnetic sector of the Standard Model

We will coordinate efforts of EU researchers working on hadronic contributions to $(g-2)_\mu$ by organizing meetings and by contributing to *DOE Muon g-2 Theory Initiative* white books which are scheduled in parallel with anticipated Fermilab results with increased precision. In particular we will provide a data base for low energy hadronic processes relevant to $(g-2)_\mu$. **T2.1 - HVP: Compilation of an annotated database for low-energy hadronic cross sections in e^+e^- collisions.** The database will contain information about the reliability of the data sets, their systematic errors, and the treatment of RC. This project is supported by the Particle Data Group at the IPPP Durham (UU, INFN-Pisa, UL, USlaski, BINP, Mainz, LAL UPS). Feasibility studies for the spacelike HVP determination by developing methods for RC and multiple scattering effects with new level of precision. **T2.2 - HLbL: On the experimental side this subtask includes preparation of knowledge data base on the differential cross sections for the production and decay processes of mesons and production of meson pairs relevant to HLbL.** On the theory side various contributions to $(g-2)_\mu$ will be studied to see how they depend on the experimental constraints. This will be done using a variety of methods concentrating on Euclidean methods (Lund, Giessen) and dispersive constraints (Mainz, Bern). The groundwork for a new comprehensive analysis of the HLbL including the study of all theoretical asymptotic constraints and double counting issues at boundaries and between different types of contributions (Lund, Giessen, Barcelona, Marseille, Bucarest, LPHNE) will be laid. This will include comparison with lattice QCD, meson form factors, and other processes with off-shell photons. Meson transition form factors and hadronic decays will be studied theoretically (UBO, UU, Lund, Prague, Orsay, Bern, Mainz, UAB, FZJ).

- In June we discussed a first implementation of the DB (see <https://agenda.infn.it/event/23209/>)
- **Data/experiments (maybe not all for updated calculation of $g-2$):**
 - ACO, ADONE, ALEPH, AMY, ARGUS, BABAR, BBar, BCF, Belle, BES, BES3, BIG, CBALL, CELLO, CLEO, CMD, CMD2, CMD3, CUSB, DASP, DHHM, DM1, DM2, FENICE, GG2, JADE, KEDR, KLOE, LENA, M3N, MARK1, MARK3, MARKJ, MD1, MEA, MUPI, NA07, ND, OLYA, PLUTO, SND, SND2000, SPEAR, TASSO, TOF, TOPAZ, VENUS, VEPP2
 - +60 hadronic channels; +250 datasets
 - Statistical and systematic errors, covariance matrices, Radiative Corrections, etc..
 - Which data can be used (maybe some old set of data are superseded and/or can be discarded)?
 - Missing channels: parametrization, isospin relations, ...?
- We need to identify one/two contact persons for each experiment

- **Procedure:**

- Precision SM web page (<https://precision-sm.github.io/>)
- Input data (from HEPData)
- Check of «consistency» of input data
- Responsive Plots
- Production of useful quantities (VP, α_{EM} , Adler Function...)
- Maintenance of the web page and polling to HEPData

We will discuss most of this in the next presentations

- **How to proceed:**
 - Web page and uploading procedure essentially ready
 - Should we start (Uploading these data in HEPData) with $\pi^+\pi^-$ and $\pi^+\pi^-\pi^0$ channel, R?
 - Other suggestions?
 - How to organize/improve the web page?

$\pi^+\pi^-$ ACO BABAR BCF BES CLEO CMD CMD2 CMD3 DM1 DM2 KLOE MEA NA07 OLYA SND SND2000 TOF VEPP2

$\pi^+\pi^-\pi^0$ ACO BABAR BCF CMD CMD2 CMD3 DM1 DM2 GG2 M3N MEA MUPI ND OLYA SND SPEAR

K^+K^-J/ψ BELLE

R ALEPH AMY BBar BCF BES CBALL CELLO CLEO CUSB DASP DHHM GG2 JADE KEDR LENA M3N MARK1 MARK2
MARKJ MD1 MEA MUPI PLUTO TASSO TOPAZ VENUS

(Courtesy of F. Ignatov)

Draft PrecisionSM web site

- [Example code to create a responsive plot using results stored in HEPData.net](#)
- [Example of responsive plot integrated in this website](#)
- [Example notebook](#)
- [Fedor Ignatov responsive plots](#)

