Final Discussion

Thank you for your participation…

…also to all our remote participants!

Timeline for the White Paper

- Earliest possible release date for Fermilab g-2 measurement:
  15-20 December 2019
- Post the WP on arXiv by:
  1 Dec. 2019
- Deadline for finalizing individual WP chapters:
  1 Nov 2019
  At this date the Overleaf chapters will be frozen.
- Editorial board will release complete WP to authors for feedback on:
  15 Nov. 2019
  will need to receive feedback from authors within a week
- Experimental and theoretical inputs used in WP must be published by:
  15 Oct 2019
  To make sure to be included in WP discussion, a paper to be posted in arXiv by same date.

Note: The WP will be posted on arXiv in December, even if the Fermilab experiment's release date is delayed.

White Paper Outline

- Executive Summary
- Introduction
- Chapter 1: data-driven HVP
- Chapter 2: lattice HVP
- Chapter 3: data-driven HLbL
- Chapter 4: lattice HLbL
- Chapter 5: QED + EW
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  D. Stöckinger, H. Stöckinger-Kim
- Summary, Conclusions, and Outlook

White Paper Structure

- Authorship:
  Contributors: open to participants in any of the workshops, and collaborators in group efforts, and of course everyone who is contributing to the writing of sections in the WP.
- Chapter authorship will be highlighted and described either in the introduction of the WP or in each WP chapter.

- Executive Summary (about 1-2 pages)
- Introduction will follow and describe the process that lead to the WP.

- WP will be published in a journal. Possibilities include:
  PRD, EPJC, Phys. Reports,
- Expect follow-up WPs after the publication of the first one, with timelines to be coordinated with the experiments.

Future Workshops

- **2020:**
  in Japan, to be organized by Tsutomu Mibe and Shoji Hashimoto. probably at KEK, likely in first half of June, exact dates to be determined. (possible alternative dates early October)

- **2021**:
  Vera Gülpers, Antonin Portelli, and Thomas Teubner will apply to host workshop (with Vera as chair) at the Higgs Centre in Edinburgh, dates to be determined.

- We hope to finalize and announce the dates for both workshops soon (before the end of 2019).

Dispersive HVP

- Status of the dispersive HVP WP chapter
- Presentations on status and recent developments of the experimental input data and the theoretical compilations, analyticity constraint, MC, MUonE
- Two intense and constructive discussion sessions (thanks to Dave for chairing the sessions, and to Martin for the comparison efforts):
- leading to agreement on procedures to overcome open questions and issues crucial for our WP chapter:
    i. How can we achieve the major charge of the Theory Initiative, to come up with ``one conservative prediction"
    ➠ see extra slide by Bogdan: detailed procedure based on general philosophy (as brought up e.g. by Dave), to achieve a ``merging" of the two main data-driven predictions
    ➠ no numbers yet, but simple enough to work on the short time-scale of WP v1, work will start immediately…
    ii. Agreement on how to deal with the description of how different groups incorporate analyticity/unitarity constraints in the most important 2pi channel.

Dispersive HVP

Proposal: *conservative merging* of model-independent HVP combination results

- Basic requirements for the *merging* procedure:

- *Conservative* (see tensions between experimental data and differences between combinations based on same datasets)

- *Accounting for correlations between different channels* (understood meaning of systematic uncertainties and identified 15 common ones, DHMZ since arXiv:1010.4180) Yields *unavoidable increase of total uncertainty* $693.9 \pm 1.0 \pm 3.4 \pm \boxed{1.6} \pm 0.1_{\psi} \pm 0.7_{\rm QCD}$

- Proposed *merging* procedure:

- *Central value*: simple average of the *DHMZ* and *KNT* sums of channels (the *DHMZ* and *KNT* central values are, *by chance*, very similar)

- Experimental uncertainties: in each channel/mass range use max(DHMZ, KNT) and see by how much to increase the corresponding DHMZ uncertainty (sq. difference); enhance the DHMZ *sum of channels (with correlations)* by these amounts (sq. sum)

- Use |*DHMZ*(ch.)-*KNT*(ch.)| / 2 as extra systematic in each channel; independent between channels (sign of algebraic difference fluctuates for various channels)

o) $\pi\pi$ BABAR/KLOE systematic: max(DHMZ B./K. syst., |*DHMZ*($\pi\pi$)-*KNT*($\pi\pi$)| / 2) (stay conservative, but avoid double-counting the effect of this B./K. tension)

o) $\pi^+\pi^-\pi^0$: do not include this systematic (difference understood: $1^{st}/2^{nd}$ order interp.)

Lattice HVP WP ToC

Data-driven HLbL

Summary of HLbL (as of May '19, very preliminary!)

Contributions to $10^{11} \cdot a_\mu^{\mathrm{HLbL}}$

- Pseudoscalar poles $= 93.8^{+4.0}_{-3.6}$
- pion box (kaon box ~ -0.5) $= -15.9(2)$
- S-wave $\pi\pi$ rescattering $= -8(1)$
- scalars and tensors with $M_R > 1$ GeV $\sim -2(3)$
- axial vectors $\sim 8(3)$
- short-distance contribution $\sim 10(10)$

Central value:	$85 \pm XX$
Uncertainties added in quadrature:	$XX = 12$
Uncertainties added linearly:	$XX = 21$

Whitepaper Outline

1. Introduction
2. HLbL on the Lattice
   - Approach to HLbL by RBC/UKQCD
   - Approach to HLbL by Mainz
3. Test case: HLbL scattering in QED
4. Pion-pole contribution
5. Cross-checks between RBC/UKQCD and Mainz
6. Results for physical pion mass
7. Additional cross-check: forward scattering amplitudes
8. Expected progress in next years
9. Summary of current knowledge from lattice