RF3: Fundamental Physics in Small Experiments

Rare and Precision Frontier Topical Convener Meeting

25 June 2020

Tom Blum & Peter Winter

RF3 - Fundamental Physics in Small Experiments: a) People / Groups / Experiments contacted so far

- Experiments:
  - C, P, T, CP, and CPT violation (EDMs, atomic and hadronic parity violation)
  - Magnetic moments (g-2)
  - Anti-hydrogen experiments
  - QIS: quantum coherence at e+e-
  - QIS: quantum mechanics tests at e+e- and hadronic machines
  - Related theory
- We contacted various people to solicit contacts of those areas:
  - P and CPT violation: We contacted Tom's UConn colleagues, experimental groups at JLab (and Bob Mckeown), and ANL HEP division director, and two at IU Center for Spacetime Symmetries
  - Anti-hydrogen experiments: We contacted Dieter Grzonka (FZJ, former ATRAP member) to get contacts for the CERN anti-hydrogen community
  - QIS: Alexey Petrov gave us some contacts for the QIS sections
- We started to send out request for LOIs (see next page):
  - We have no list of anticipated LOIs
  - Should expect some in the EDM sector, g-2 and anti-hydrogen will have to see

RF3 - Fundamental Physics in Small Experiments: a) People / Groups / Experiments contacted so far

Topic area	Recipient	Sent by / on
All	RF email list	PW 6/24
All	Slack channel	
EDM	Yannis Semertzidis	PW 6/24
	Frank Rathmann, Dieter Grzonka (FZJ)	PW 6/24
	Michael Ramsey Musolf	TB 6/24
	Klaus Kirch	PW 6/24
	David DeMille	
	Tim Chupp	PW 6/24
parity violation	Krishna Kumar	TB 6/24
	Bob McKeown	TB 6/24
	P. Souder	TB 6/24
	David Armstrong	TB 6/24
CPT, C, CP, T violation	Alan Kostelecky	TB 6/24
	Ralf Lehnert	TB 6/24
g-2	Muon g-2 spokes	PW 6/24
	Gerry Gabrielse	PW 6/24
	Tsutomu Mibe	PW 6/24
	Mueller	
Antihydrogen	ALPHA: Jeffrey Hangst	
	ASACUSA: Eberhard Widmann, Yasunori Yamazaki	
	BASE: Stefan Ulmer	
	GBAR: Patrice Perez	
	AEgIS: Michael Doser	

RF3 - Fundamental Physics in Small Experiments: b) Meeting schedule

- We plan at least one workshop before our main frontier workshop.
- The EDM community is large enough to have a separate mini-workshop in Fall or Winter
- There is a workshop concerning ideas for the use of the Muon g-2 storage ring (mu minus, EDM, ...) which could have a good overlap with our group. The organizers (Muon g-2 collborators) are planning to work with Tom and me
- Timing is not yet defined since we also want to understand the scope of the Fermilab meeting

RF3 - Fundamental Physics in Small Experiments: c) Subgroups / subconveners

- EDM:
  - Since this is a large group of experiments, we decided to form a subgroup with two co-conveners
    - Yannis Semertzidis agreed
    - Tanmoy Bhattacharya agreed
- P/CP/CPT violation: JLab / UConn ? Michael Ramsey-Musolf ?
- g-2: We think Tom and I can handle that
- Anti-hydrogen: Not decided yet since this is all CERN based so we would need to understand how much they will tie into Snowmass21
- QIS: Just starting to explore the landscape but might be useful to get co-conveners to help us

RF3 - Fundamental Physics in Small Experiments: d) Impact of European Strategy

4. Other essential scientific activities for particle physics

a) The quest for dark matter and the exploration of flavour and fundamental symmetries are crucial components of the search for new physics. This search can be done in many ways, for example through precision measurements of flavour physics and electric or magnetic dipole moments, and searches for axions, dark sector candidates and feebly interacting particles. There are many options to address such physics topics including energy-frontier colliders, accelerator and non-accelerator experiments. A diverse programme that is complementary to the energy frontier is an essential part of the European particle physics Strategy. *Experiments in such diverse areas that offer potential high-impact particle physics programmes at laboratories in Europe should be supported, as well as participation in such experiments in other regions of the world.*

- European Strategy mostly focused on collider but explicit mentioning to also focus on EDMs / MDMs. We are definitely planning to tie in with the European community (e.g. FZJ, PSI, ...)
- Other areas that could be of interest are accelerator and instrumentation R&D but need to study the European Strategy more closely

RF3 - Fundamental Physics in Small Experiments: e) Work with other topical groups or frontiers

- Tom has been in several long conversations within RBC/UKQCD collaboration, including topical group conveners in the Theory and Computational frontiers.
- Tom will talk with E06 (QCD…) on June 30

RF3 - Fundamental Physics in Small Experiments: g) Phenomenological models probed

- We did not get to make a list yesterday
- This needs significant effort by Tom
- Will report next time

RF3 - Fundamental Physics in Small Experiments: h) Accelerator technologies

- Accelerator based EDMs:
  - All electric or hybrid (B + E fields) storage rings could require high electric fields
  - Low energy muons (muonium production) is one technology needed to improve for the J-PARC g-2