Fundamental Physics in Small Experiments (TG3)

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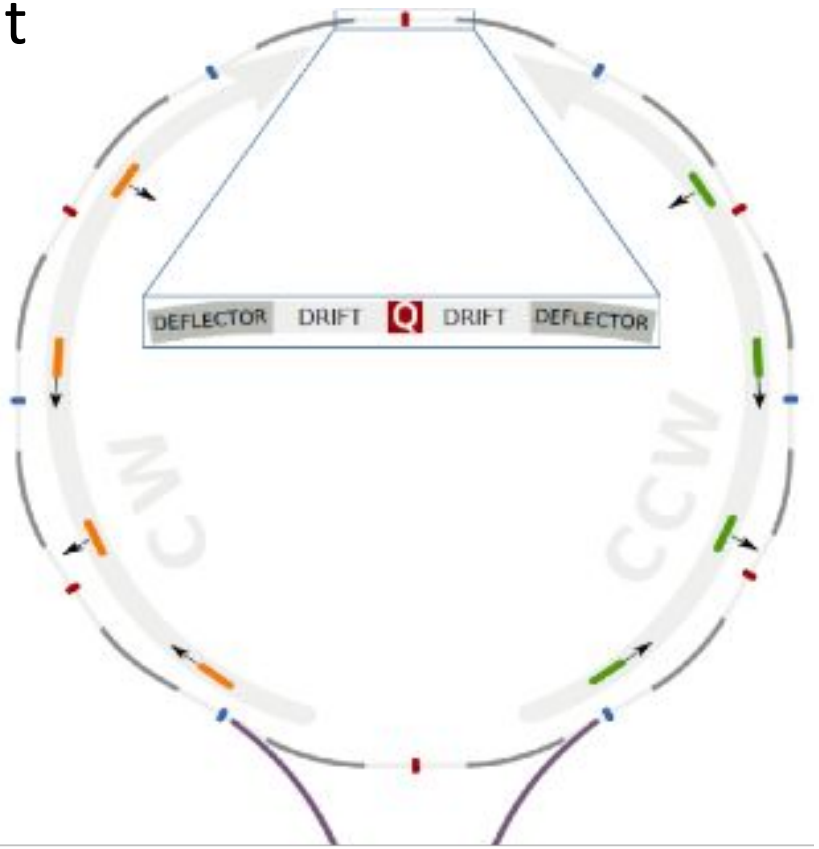
EDM Sub-conveners: Yannis Semertzidis (IBS-CAPP and KAIST) and Tanmoy Bhattacharya (LANL)

Main physics topics

- Electric dipole moments, e.g. T (CP) violation (especially relevant for HEP: storage ring EDMs)
- Experiments to study fundamental symmetry violation (C, T, and Lorentz (CPT)) and gravity
- Low-energy muon facility (relevant for several physics topics and Snowmass groups)
- Muon g-2 contributions from theory and related physics (e+e-)

Proton storage ring EDM experiment

- Sensitivity to 1e-29 e-cm (three orders improvement for theta-QCD, critical for axions)
- Significant impact for axion searches
- New (SUSY) Physics reach to 1000 TeV
- Generic mass scale to 10000 TeV
- Best for T violation in Higgs sector (30x eEDM)
- Holds CW and CCW bunches simultaneously
- Sensitive to vector dark matter/energy models
- 10 years to first publication
- Highly complementary to molecule EDM expt's
- Later add deuteron, 3He, complementary physics



Overlap with other frontiers, communities

- Strong AMO effort (electron, atoms, molecules, ...)
  - Working closely to strengthen ties (Nick Hutzler)
    - workshop this past summer on Radioactive molecules
    - white paper in progress
  - Impressive EDM searches already, ambitious goals
  - What should we ask from P5?
- Computational, Theory Frontiers: lattice QCD and p/nEDM
- Constraints on BSM strong with both hadron+AMO searches
  - LOIs across frontiers support vision
- Other communities with physics overlap:
  - Anti-hydrogen community at CERN
  - Parity violation community at JLab

White paper plans

- We received 21 LOIs for this group and are in the process of organizing white papers
- Current plan from conveners:
  - WP1: Facilities (1-2 LOIs)
  - WP2: Gravity/Lorentz/CPT/T (5-6 LOIs)
  - WP3: EDM / CPV (6-8) LOIs
  - WP4: BSM (3 LOIs)
  - WP5: g-2 theory (5 LOIs)
  - WP6: clocks (2 LOIs), maybe in WP3
- Next:
  - Contact LOI authors to suggest the White Paper grouping, identify editors
  - Group conveners will start preparing a White Paper summary document

Summary

- Tests of fundamental symmetries (P, CP, CPT,...) offer a compelling program for the next decade:
  - EDMs strong part of the next decade's research program, especially with prospects for storage ring EDMs, ongoing nEDM experiments, and complimentary AMO experiments
  - Magnetic dipole moments (electron, muon) also have timelines that span the next decade; the Fermilab Muon g-2 result may clarify the path forward
  - Gravity, Lorentz (CPT) and fundamental symmetry tests
  - Reached out to other communities:
    - Parity violation program (at JLab) will continue/expand for many years
    - Antihydrogen experiments will continue to make progress at their two main focus areas (precision spectroscopy, antigravity)

- Ask P5 for robust support to complement Energy Frontier