# RF05 – Charged Lepton Flavor Violation

## Rare and Precision Frontier Convener Meeting - Sep 25, 2020

S. Davidson (Lyon), B. Echenard (Caltech)

# LOI distribution

## Theory – light new physics

Rare muon decays and light new physics
physics potential with MEGII-fwd
Possibility of Search for Bound $\mu^- \rightarrow e^-a$ Decay
Theory challenges and opportunities of Mu2e-II

## Theory – $\mu^- \rightarrow e^+$ & muonium-antimuonium

Searching for $\mu^- \rightarrow e^+$ Conversion at Upcoming Experiments and the Process of Radiative Muon Capture
Search for Muon to Positron Conversion in $\mu^- \rightarrow e^-$ Conversion Experiments
Physics of muonium and anti-muonium oscillations

## Current experiments

Search for μ-e Conversion by using Muonic Atoms Produced in a Primary Production Target
COMET
Mu2e
The MEG II experiment and its future developments

## Mu2e II

Mu2e-II
The Mu2e-II Calorimeter
Mu2e-II Tracker
An Enhanced Cosmic Ray Veto Detector for Mu2e-II
Considerations for a Mu2e-II Stopping Target Monitor
Considerations for a Mu2e-II Production Target
Mu2e-II: a 2-level TDAQ system based on FPGA pre-filtering LOI
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Mu2e-II: a 2-level TDAQ system based on FPGA pre-filtering LOI
Mu2e-II: TDAQ based on GPU co-processor LOI
Mu2e-II: a trigger-less TDAQ system based on software trigger LOI
Crystal and Photosensor Development for a Fast BaF2 EM Calorimeter
Beam Delivery for Mu2e-II in the PIP-II Era

## High-energy colliders

Charged Lepton Flavour Violation at the FCC-ee**
The CMS Collaboration contribution to Snowmass 2021

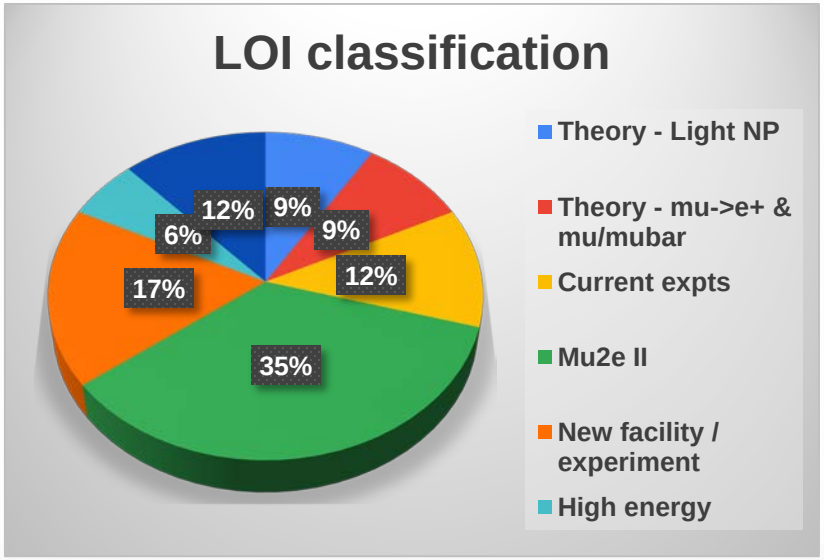
## Tau

Tau Physics and Precision Electroweak Physics with Polarized Beams at SuperKEKB/Belle II
Physics Potential of a Super tau-Charm Facility*
Precision experiments at Super Charm-Tau Factory*
Physics in the τ-charm Region at BESIII

## New facility and new experiments

Upgraded Low-Energy Muon Facility at Fermilab
A New Charged Lepton Flavor Violation Program at Fermilab
A Phase Rotated Intense Source of Muons (PRISM) for a $\mu \rightarrow e$ Conversion Experiment
Bunch Compressor for the PIP-II Linac
A new experiment for the $\mu \rightarrow e\gamma$ search
Search for Muonium to Antimuonium Conversion

**TOTAL : 25 LOIs**




*not classified RF0 or RF5 but still relevant
** misclassified

# LOI comments

**Misclassified**

| | | |
|---|---|---|
| Charged Lepton Flavour Violation at the FCC-ee | RF6 -> RF5 | (cleared with RF6) |
| Neutrino mass models at colliders in a post-ESU era | RF5 -> RF4 | (cleared with RF4) |

**Claiming ownership – *not sure who to contact for IF0***

| | |
|---|---|
| Mu2e-II tracker | (submitted to IF0 / RF0) |

**Broadly / marginally related to RF5 - *will not take lead on these (need to contact them)***

| | |
|---|---|
| Lepton universality and lepton flavor conservation tests with dineutrino modes | (RF1) |
| Opportunities and New Physics Implications for (g − 2)e,μ | (RF3) |
| Nuclear Matrix Elements for BSM Searches from Lattice QCD | (TF5) |
| Development of Novel Inorganic Scintillators for Future High Energy Physics Experiments | (IF6) |
| Atmospheric ½ÄAppearance in the Deep Underground Neutrino Experiment | (NF1) |
| Triple-Product Asymmetries | (RF1) |

**Interesting LFV elsewhere - *physics interest, identify+retain contact***

| | |
|---|---|
| Meson decays to LFV final states | (RF1,2) |
| Heavy (h,Z, t,Z'…) decays to LFV final states | (EF2,EF9) |

**Shared with AF5 – *will leave them all the work and take all the glory***

Beam Delivery for Mu2e-II in the PIP-II Era
Upgraded Low-Energy Muon Facility at Fermilab
A New Charged Lepton Flavor Violation Program at Fermilab
A Phase Rotated Intense Source of Muons (PRISM) for a ¼' e Conversion Experiment
Bunch Compressor for the PIP-II Linac

# LOI themes

**LOI main themes:**

- Maximize physics at currently planned experiments
- Pursue next generation of muon conversion experiment at Fermilab (Mu2e II)
- Proposal of high intensity muon complex at Fermilab (ENIGMA) with FFA / surface muon beam to perform next generation of muon experiments
  - multi-experiment facility
  - concepts for next generation mu-e conversion, mu->e gamma, mu-mubar expts to improve current / near term sensitivity by several orders of magnitude
  - requires coordination with AF

**Not sure what you mean by “What are people are asking for Snowmass / P5”, but I suspect money is the right answer!**

# Townhall talks

List of talks for RF5 parallel session

| Talks | Speaker |
|---|---|
| Rare muon decays and light new physics | D. Redigolo |
| Theory challenges and opportunities of Mu2e-II | L. Borrel |
| Searching for μ- → e+ Conversion at Upcoming Experiments and … | M. MacKenzie |
| Physics of muonium and anti-muonium oscillations | A. Petrov |
| Mu2e, COMET, DeeMe | S. Middleton |
| The MEG II experiment and its future developments | A. Baldini |
| Mu2e-II | B. Chislett |
| Beam Delivery for Mu2e-II in the PIP-II Era | E. Prebys |
| Upgraded Low-Energy Muon Facility at Fermilab | R. Kaplan |
| A New Charged Lepton Flavor Violation Program at Fermilab | R. Bernstein |
| A Phase Rotated Intense Source of Muons (PRISM) for a μ → e … | J. Pasternak |
| A new experiment for the μ → eγ search | G. Tassielli |
| Search for Muonium to Antimuonium Conversion | J. Tang |
| Charged Lepton Flavour Violation at the FCC-ee | M. Dams |
| CLFV in tau decays | S. Banerjee |
| Heavy state summary | S. Grisano |
| General discussion | |

All talks are 10+2 min except Mu2e-II (15+2) – 3h15 of talks + discussion at the end (+break)

All speakers have been invited, 13/16 have already accepted, will follow-up on the 3 remaining ones.

**RF5 is involved in the “New accelerator concepts for high intensity muon beams” session (#44)**

**Proposed content**

- Possibilities with PIP II (E. Prebys)
- Existing and future muon beamlines at PSI and TRIUMF (A. Papa?)
- Muon collider - synergies with high intensity muon beam (D. Neuffer?)
- Discussion

# CLFV workshops

The schedule (including past events) can be found on the CLFV topical group page: *https://snowmass21.org/rare/clfv*

## Next workshops

- July 2: Muon transitions and decays, muonium-antimuonium
- July 23: Tau decays, electron-tau transitions
- September 3: Heavy states decays (with EF02 / EF09)
- **September 28-29: LFV and LUV in meson and baryon decays with RF01/02**
- TBA: CLFV with high intensity muon factory