

Muon Physics (WG4) Introduction



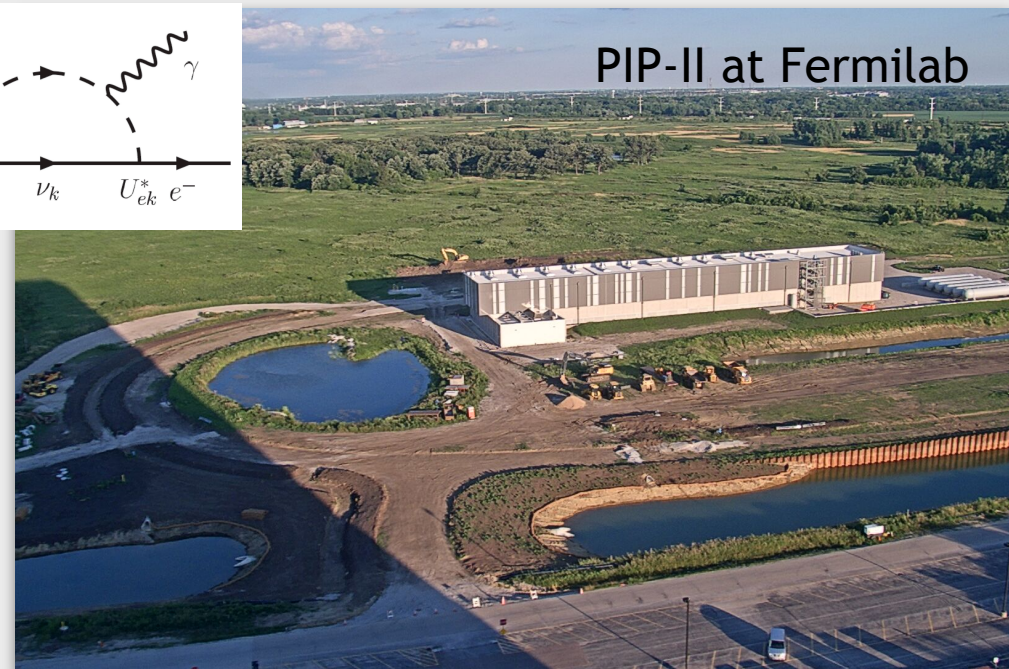
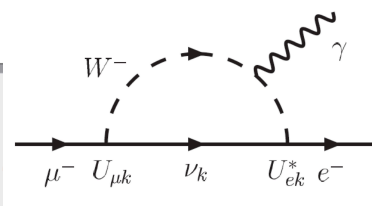
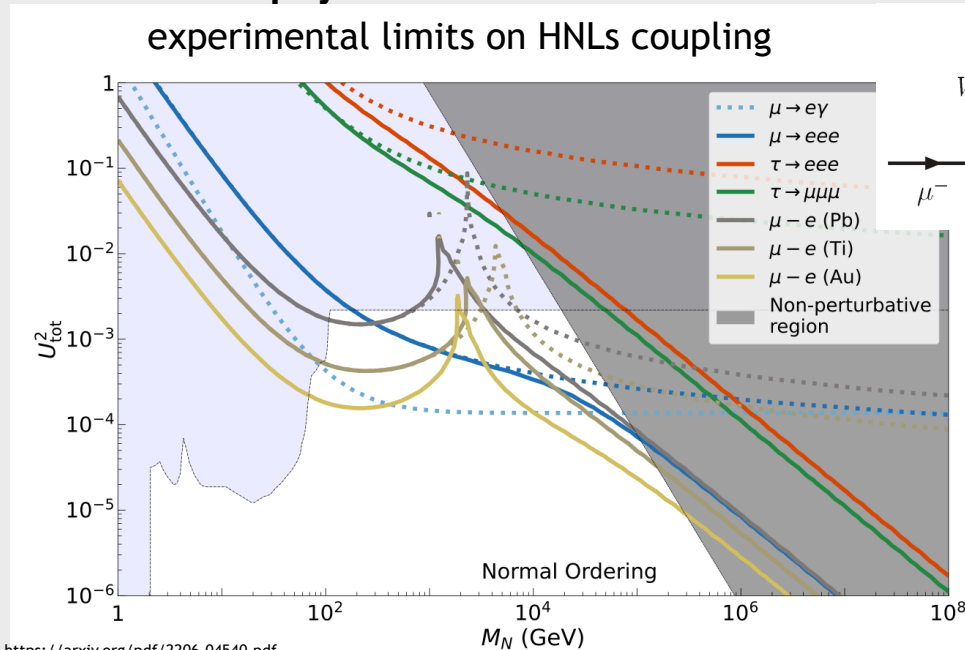
MONASH
University



Yuri Oksuzian, Yuki Fuji, Gavin Hasketh

- Muons and neutrino beam follow a similar production mechanism
 - ▶ Dune is powered by PIP-II, but consumes only a tiny fraction of beam power
 - ▶ Other Intensity Frontier experiments like Mu2e-II will benefit from PIP-II
- We know Lepton Flavor Violation (LFV) occurs in neutrino sector
 - ▶ Are neutral and charged LFV related? Does CLFV arise from neutrino-mass generation mechanism?
 - ▶ **"Connection between neutrino mass models and muon experiments" by Julian Heeck in WG5**
- CLFV $\mu \rightarrow e + \gamma$ occurs at the rate $\sim 10^{-54}$ due to neutrino oscillation
 - ▶ Neutrino masses could be generated via New Physics: low-scale seesaws, SUSY seesaw...
- Various New Physics models suggest enhancement to $\mu \rightarrow e + \gamma$ rate
 - ▶ **An observation of CLFV would be an unambiguous sign of New Physics, and might shed light on neutrino physics**

Aug 5, 2022, 11:15 AM
40m
Wasatch A
Speaker
Julian Heeck (University of Virgini...



■ Parallel talks start on Tue with two sessions on CLFV

process	current sensitivity	future	arXiv:2204.00564v1
$\mu \rightarrow e\gamma$	$< 4.2 \times 10^{-13}$ (MEG [6])	$\sim 10^{-14}$ (MEG II [7])	
$\mu \rightarrow e\bar{e}e$	$< 1.0 \times 10^{-12}$ (SINDRUM [8])	$\sim 10^{-16}$ (Mu3e [9])	
$\mu A \rightarrow eA$	$< 7 \times 10^{-13}$ (SINDRUM II [10])	$\sim 10^{-16}$ (COMET [11], Mu2e [12])	

$$\mu^+ \rightarrow e^+ \gamma$$

$$\mu^+ \rightarrow e^+ e^+ e^-$$

$$\mu^- Al \rightarrow e^- Al$$

$$\mu^- Al \rightarrow e^- Al$$

$$\mu^- Al \rightarrow e^- Al$$

$$\mu^- Al \rightarrow e^- Al$$

14:00	Status of the MEG II Experiment and Performance Results From the First Year's Data Taking <i>Dylan Palo</i> <i>Magpie A</i>	14:00 - 14:30
	Searching for Charged Lepton Flavour Violation with the Mu3e Experiment <i>Ann-Kathrin Perrevoort</i> <i>Magpie A</i>	14:30 - 15:00
15:00	Mu2e: The Search for Muon to Electron Conversion at Fermilab <i>Craig Group</i> <i>Magpie A</i>	15:00 - 15:30
	Coffee Break <i>Ballroom Lobby, Cliff Lodge</i>	15:30 - 16:00
16:00	Yields and Energy Spectra of Heavy Charged Particles After Nuclear Muon Capture with the AICap Experiment <i>Andrew Edmonds</i>	
	DeeMe --muon-electron conversion search experiment-- <i>Kazuhiro Yamamoto</i> <i>Magpie A</i>	16:30 - 17:00
17:00	Searching for Muon to Electron with the COMET Experiment <i>Sam Dekkers</i> <i>Magpie A</i>	17:00 - 17:30

- Plenary talks are on Wed
- We have two talks on experiments with muon beams
 - ▶ Present (or currently funded) experiments
 - ▶ Future experiments proposed at Snowmass
- Followed by a theory talk on CLFV
- Last talk is on Muon Collider - "The collider we need"
- Remote connection: <https://utah.zoom.us/j/91057737010>

Muon Physics Review - Present Experiments

Angela Papa

Ballroom 2&3

10:20 - 10:50

Muon Physics Review - Future Experiments

Kevin Lynch

Ballroom 2&3

10:50 - 11:20

Overview of cLFV in the muon sector

Jonathan Kriewald

Ballroom 2&3

11:20 - 11:50

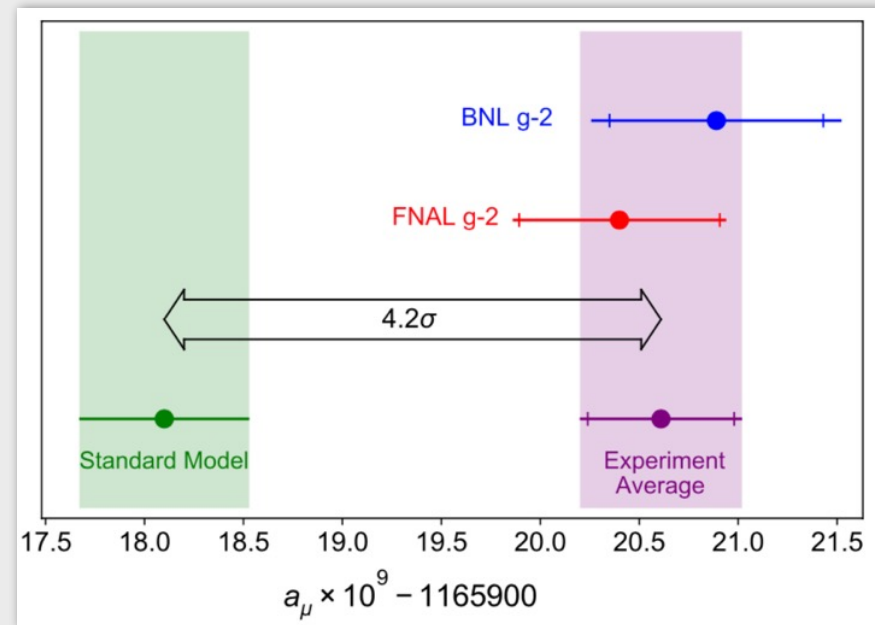
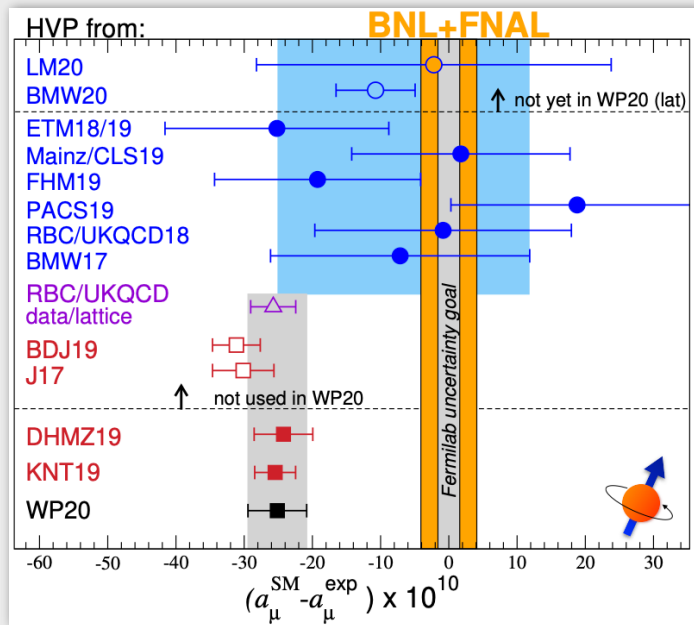
Muon Collider

Daniel Schulte

Ballroom 2&3

11:50 - 12:20

- First result from the muon g-2 experiment at FNAL produced 4.2σ discrepancy with SM
 - ▶ Comes from 6% of data available on tape
 - ▶ No updates from the g-2 experiment this year
- Lattice calculations of quark contribution to Muon g-2 making enormous progress



Preparing for MUonE experiment --- what can we learn from lattice and dispersive data?

Javad Komijani

Magpie A

11:20 - 11:50

The MUonE experiment proposal, status and plans

Lorenzo Capriotti

Magpie A

11:50 - 12:20

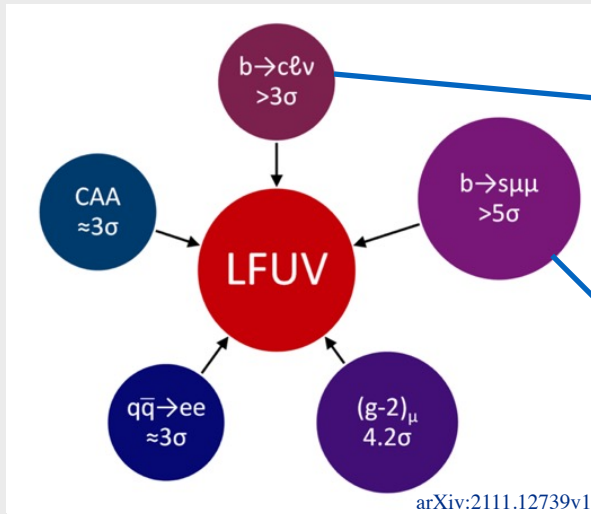
The Muon g-2 Experiment: Current status and outlook

Brynn MacCoy

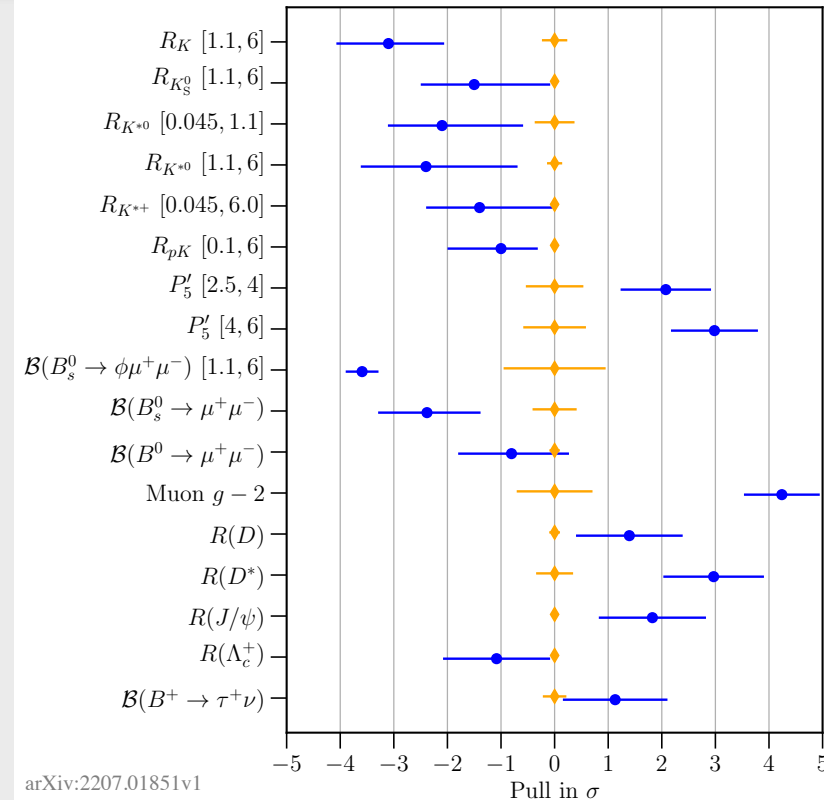
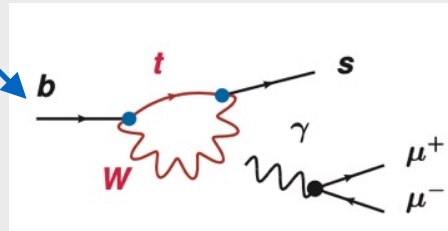
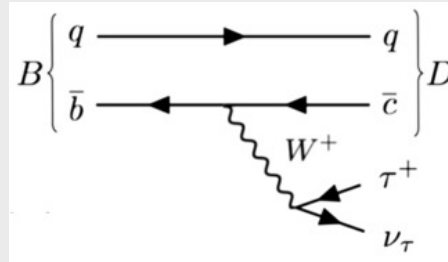
Magpie A

12:20 - 12:50

- B-factories show indications of deviations from SM in decays of bottom hadrons



Mounting Evidence for the Violation of Lepton Flavor Universality



Recent results from the NA62 experiment at CERN

Magpie A

Evgueni Goudzovski

14:20 - 14:45

Lepton flavor universality and lepton flavor violation tests at ATLAS

Magpie A

Noam Tal Hod

14:45 - 15:10

Recent results from Belle II

Magpie A

Karol Adamczyk

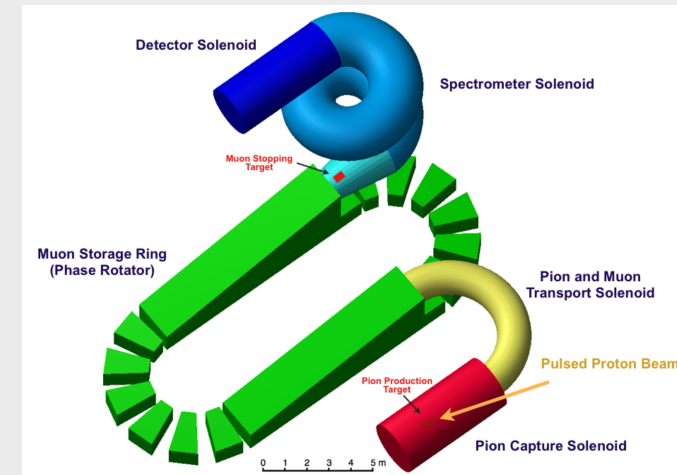
15:10 - 15:35

Status and future prospects of lepton universality tests ...

Francesca Dordei

Coffee Break

- This decade experiments (Mu2e, COMET...) with muon beams should deliver exciting physics results
- Next generation experiments: Mu2e-II or even more ambitious muon program using PRISM concept
- Future experiments rely on high power targetry
 - ▶ One of the main challenges of future experiments
 - ▶ Synergy with the Muon Collider



Physics potentials and accelerator challenges of Phase Rotated Intense Source of Muons (PRISM) Jaroslav Pasternak

Magpie A

16:10 - 16:40

Mu2e-II : next generation muon conversion experiment

Yuri Oksuzian

Magpie A

16:40 - 17:10

LDMX: The Light Dark Matter eXperiment

Matthew Solt

Magpie A

17:10 - 17:40

17:00

Accelerators/beamlines for CLFV exp

12:00	Muon acceleration for the muon g-2/EDM experiment at J-PARC	<i>Yuga Nakazawa</i>
	<i>Magpie AB</i>	11:15 - 11:40
	A Demonstrator For Muon Ionisation Cooling	<i>Chris Rogers</i>
	<i>Magpie AB</i>	11:40 - 12:05
	Fermilab's Muon Campus: Status, Experiments, and Future	<i>Steven Boi</i>
	<i>Magpie AB</i>	12:05 - 12:30
	Pion-production target for Mu2e-II: simulation design an...	
	<i>David Neuffer</i>	

13:00

Lunch

14:00

Cliff Conf Center Tent

12:50 - 14:20

g-2/EDM

15:00	The search for the muon EDM at the Fermilab \$g-2\$ experiment and beyond	<i>Samuel Grant</i>
	<i>Ballroom Lobby, Cliff Lodge</i>	14:20 - 14:50
	Status of the Muon g-2/EDM experiment at J-PARC	<i>Ce Zhang</i>
	<i>Ballroom Lobby, Cliff Lodge</i>	14:50 - 15:20
	muEDM: The search for a muon electric dipole moment using the frozen-spin technique at PSI	<i>Prof. Kim Siang Khaw</i>
	<i>Ballroom Lobby, Cliff Lodge</i>	15:20 - 15:50

16:00

Coffee Break

Ballroom Lobby, Cliff Lodge

15:50 - 16:10

Detectors in CLFV exp

17:00	Design, construction, and vertical slice performance tests of the Mu2e straw tracker	<i>Richard Bonventre</i>
	<i>Ballroom Lobby, Cliff Lodge</i>	16:10 - 16:40
	The High-Efficiency Cosmic Ray Veto Detector for the Mu2e Experiment at Fermilab	<i>Simon Corrodi</i>
	<i>Ballroom Lobby, Cliff Lodge</i>	16:40 - 17:10
	Online machine learning based event selection for COMET Phase-I	<i>Yuki Fujii</i>
	<i>Ballroom Lobby, Cliff Lodge</i>	17:10 - 17:40

- We might observe our next big discovery in the very near future
 - ▶ Current experiments produce intriguing hints of New Physics
 - ▶ This decade, new experiments will deliver a significant leap in the sensitivity reach
- Experiments with high intensity muon beams together with other frontiers can enhance our discovery potential and shed light on the underlying physics behind our observations
- We have prepared a fruitful agenda in WG4
 - ▶ Busy parallel sessions, a few posters and joint sessions with WG3, WG6 and a bit of WG5
 - ▶ Attend the sessions, participate in discussions and enjoy the scenery

