Tests of Symmetries & the Electroweak Interaction

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Convenors: Jason Fry (EKU), SG (UK), Paul Huffmann (NCSU), Emilie Passemar (IU), William Terrano (ASU)

Topics: CKM tests in neutron and nuclear beta decay, Hadronic parity violation, EDMs of the electron, neutron, atoms, and molecules, P- and T-odd neutron and nuclear beta decay correlations, Neutron lifetime

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Parallel Session Summaries
CIPANP — Madison, WI
June 13, 2025

Sessions: 3 stand alone + 4 joint (DM, 2 HF-CKM, PPHI+PGDNN)

→ Monday, June 9: (permanent) EDMs

Luiz Vale Silva
The EDM of the electron in the decoupling limit of the aligned 2HDM +SMEFT

Paul Huffman
nEDMSF - a new cryogenic search for the neutron electric dipole moment

Wolfgang Schreyer
Recent progress on the TRIUMF UltraCold Advanced Neutron source and EDM experiment TUCAN

→ Tuesday, June 10: (permanent) EDMs + "SALER" ($^{19}\mathrm{Ne}\,\tau$)

Connor Bray (Kyle Leach)
Towards Decay Recoil Spectroscopy in Short Lived Isotopes:
Prospects and Commissioning the SALER Experiment

Gordon Arrowsmith-Kron
Ongoing Upgrades to the Radium-225 EDM Experiment

Nicholas Nusgart
The FRIB-EDM3 Experiment: Designing a measurement protocol for CP-violation searches using radioactive molecules in solids $^{225}\mathrm{RaF}$ + Ar

Aiden Boyer
The FRIB-EDM3 Molecular Ion Source: Designing An Efficient Radioactive Molecule Source For Tests Of Fundamental Symmetries

Tuesday, June 10: Joint Session with DM

Thomas Mulkey
New Upper Bounds on Exotic Neutron Spin-Electron Spin Interactions via Neutron Spin Rotation Measurements in a Ferrimagnet

Gil Paz
On the sensitivity of nuclear clocks to new physics

Brenda Aurea Cervantes Vergara
Searching for millicharged particles at accelerator facilities with skipper-CCDs

Jianyang Qi
Recent R&D results from the first dual phase xenon doped argon TPC

DM

Thursday, June 12: Joint Session with PPHI+PGDNN

Wally Melnitchouk
Constraints on the weak mixing angle from future facilities

Kent Paschke
Measuring the Weak Charge of the Electron - The MOLLER Experiment

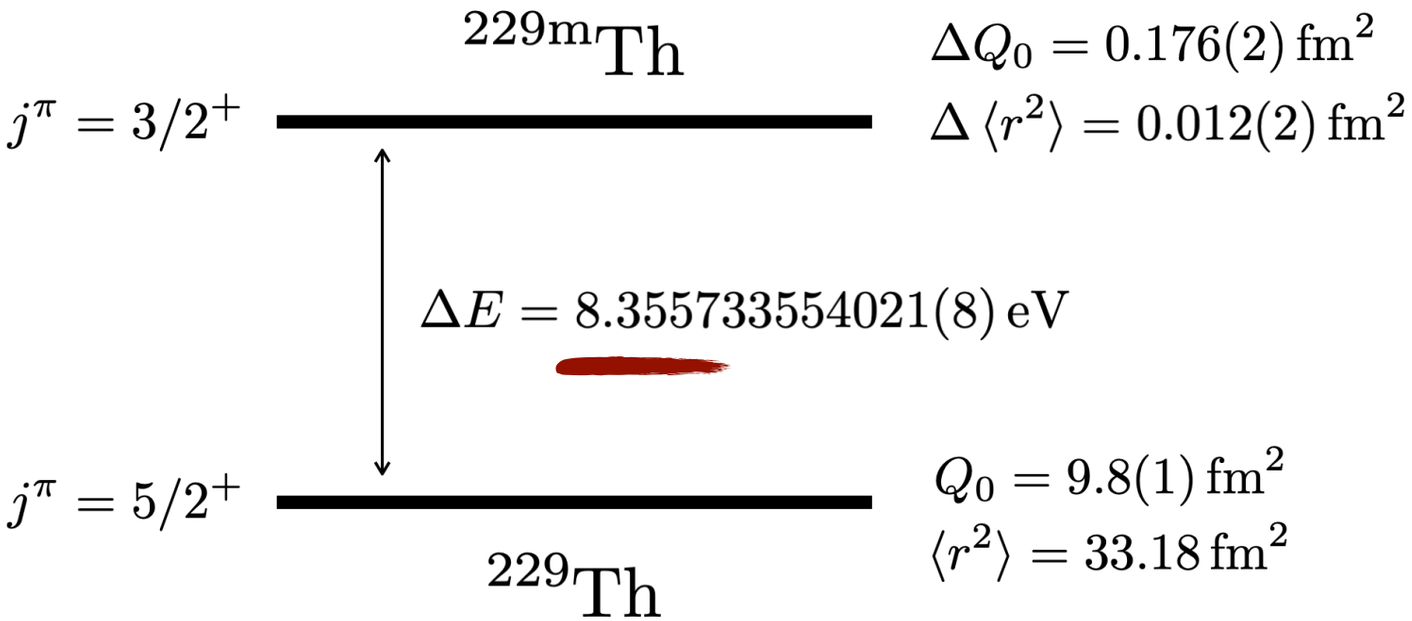
Caryn Palatchi
A high precision determination of the weak mixing angle at low momentum transfer - The P2 experiment

Sepehr Samiei
NOPTREX: Neutron Optics Parity and Time Reversal Experiment

PPHI

Laser Spectroscopy of a Nucleus now possible :

Nuclear clock



Paz

Enhanced sensitivity to time variations of α,

as long as $\Delta E_{\mathrm{em}}/\Delta E \neq 0$! Yes!

NOPTREX will study P-odd, P & T odd, and P-even, T-odd interactions in n forward scattering on complex targets (cf. $\vec{n} - {}^{139}\mathrm{La}$, 10% P-odd asym!)

Samiei

Wednesday, June 11: Joint Session with HF-CKM

First Row CKM Unitarity & beyond “V-A”

Love Richburg
Nab (Neutron a and b): A High Precision Free Neutron Beta Decay Experiment at the Spallation Neutron Source

Albert Young
The PNab Experiment: Angular Correlation Measurements with Polarized Neutrons

Grigor Sargsyan
Ab initio Nuclear Structure Calculations for Improving Limits on Tensor Currents in the Weak interaction

Wednesday, June 11: The Neutron Lifetime….

Peter Vander Griend
The Fermi Function, Factorization and the Neutron’s Lifetime

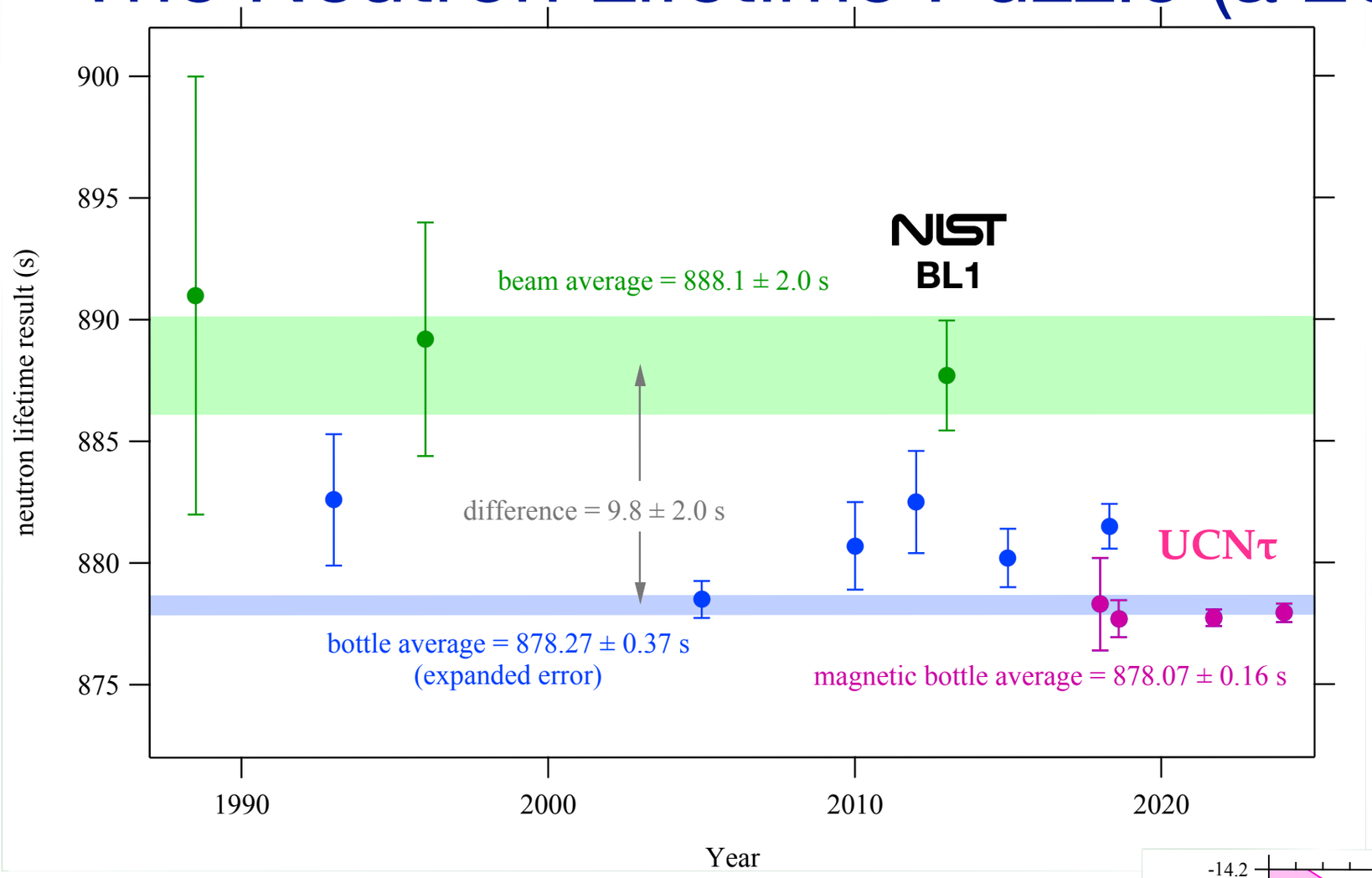
Maninder Singh
Latest neutron lifetime measurement using magneto-gravitational trap

Fred Wietfeldt
The BL3 Beam Neutron Lifetime Experiment

Ayala Glick-Magid
Unique forbidden beta decays at zero momentum transfer

can enable BSM searches

The Neutron Lifetime Puzzle (a 20th anniversary!)

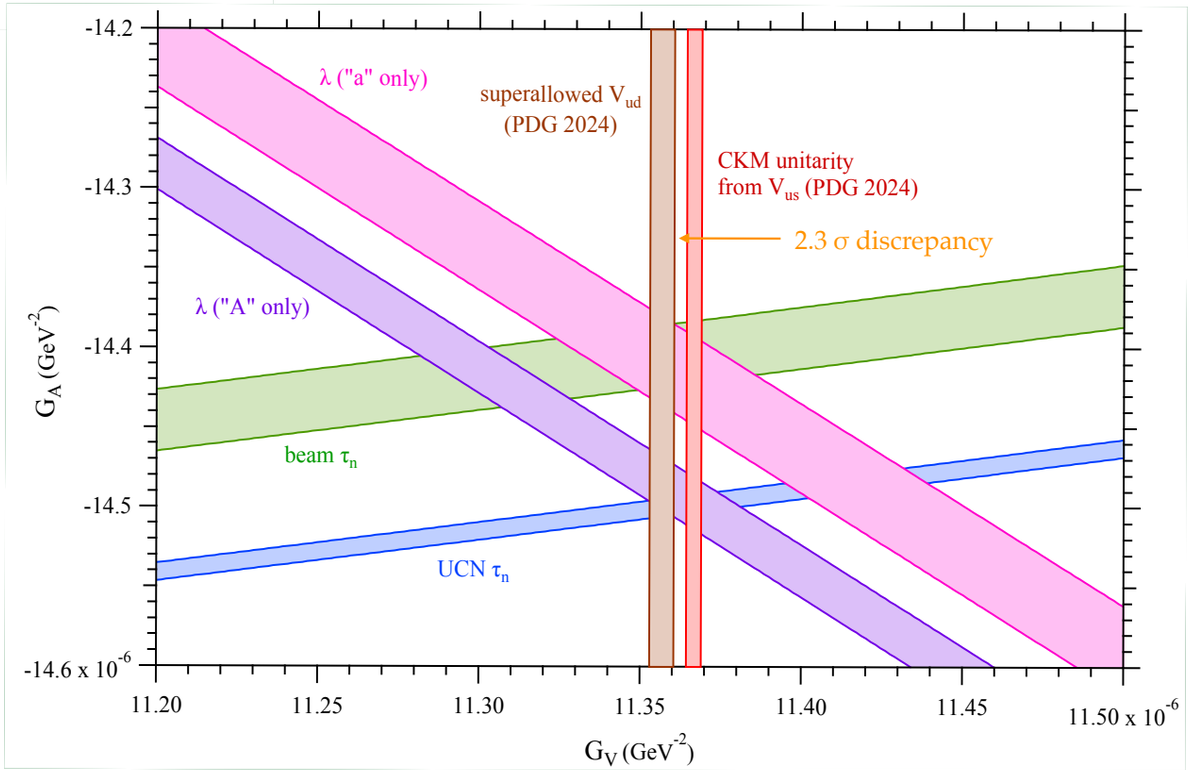


Wietfeldt
BL3

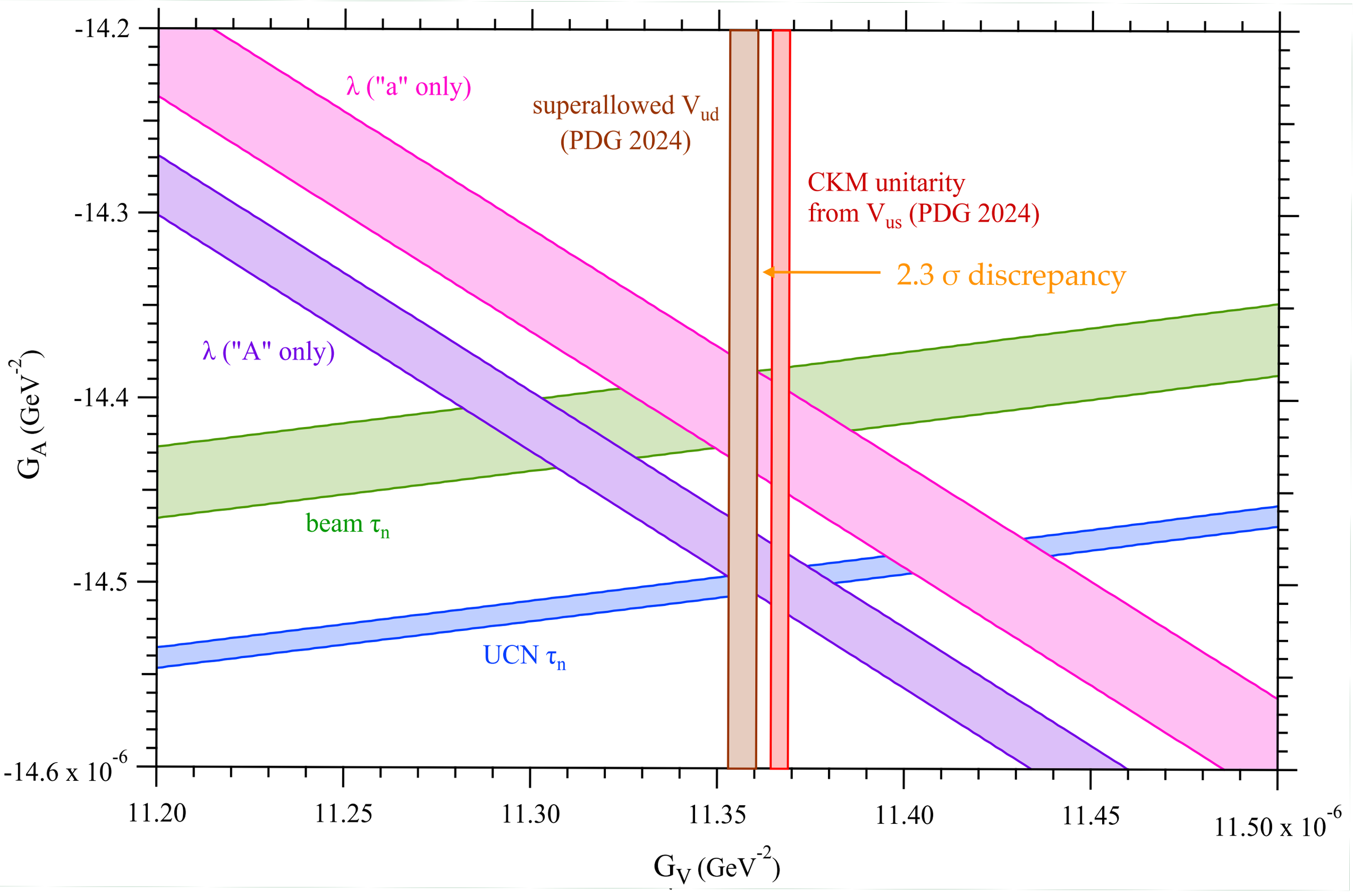
"dead"

"living"

Exotic n decays are possible, but are constrained by "V-A"….



Wietfeldt


-14.2
-14.3
-14.4
-14.5
-14.6 x 10^-6
11.20
11.25
11.30
11.35
11.40
11.45
11.50 x 10^-6
G_A (GeV^-2)
G_V (GeV^-2)
λ ("a" only)
λ ("A" only)
superallowed V_ud (PDG 2024)
CKM unitarity from V_us (PDG 2024)
2.3 σ discrepancy
beam τ_n
UCN τ_n

Thursday, June 12: Joint Session with HF-CKM

David Mack

Physics with the Helicity-flip Suppressed, Transverse Asymmetries in Bhabha Scattering

New probes of light (~25 MeV) new scalars!

Richard Hill (Peter Vander Griend)

Renormalization of beta decay at three loops and beyond

Sam Novario

Nuclear-Structure Corrections in Superallowed Beta Decay

Evan Combes

Radiative corrections to proton-proton fusion in pionless EFT

rad corr
to β decay…

Three Puzzles (re β-decay)

1st row CKM unitarity? τ_n? Is "V-A" enough?

→ Much recent theoretical progress!

Traditionally….

$$\mathcal{F}t \equiv ft(1+\delta'_R)(1+\delta_{\rm NS}-\delta_C) = \frac{K}{2G_V^2(1+\Delta_R^V)},$$

Contains Fermi function (Dirac eqn.)

New! Analysis in EFT! For $\delta_{\rm NS}$ Novario (Dekens)

New factorization formula! Fermi function as a QFT object! Hill, Vander Griend

Impact on SA analysis! Stay tuned!

Thank you to all of our speakers
— and participants!