Panel discussion

Uncovering the Mechanism of $0\nu\beta\beta$

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What if $0\nu\beta\beta$ is measured?

Can we pinpoint the responsible mechanism?

- A measurement in a single isotope could be due to any operator
  - Large number of possible operators at d = 5, 7, 9
  - Need additional measurements to single out the responsible term

Handles in $0\nu\beta\beta$ measurements

- Decay rates of multiple isotopes
- Angular/energy distributions of the outgoing electrons

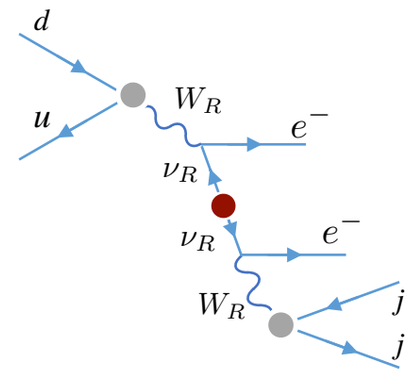
  - Mainly sensitive to the leptonic structure that the operators induce
  - Can disentangle several of the complete set of operators
    - Namely, $C^{(6)}_{VL,VR}$

What if $0\nu\beta\beta$ is measured?

Can we pinpoint the responsible mechanism?

Other observables

- Collider (LHC) signatures
  - Sensitive to the same operators that induce $0\nu\beta\beta$
  - Sensitive when $E \sim \sqrt{s} \sim \Lambda$, expected breakdown of the EFT



- LNV meson decays, e.g. $K^+ \to \pi^- l^+ l^+$
- Charged lepton flavor violation, e.g. $\mu \to e\gamma, \quad \mu \to e$ conversion
  - Some of these are very sensitive probes
  - Induced by independent couplings in the EFT

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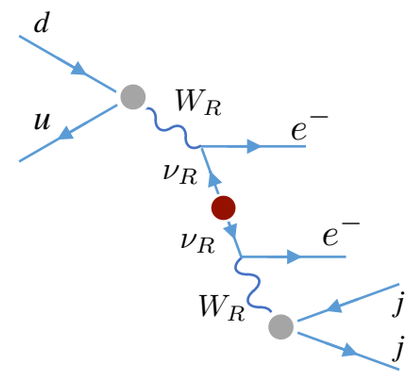

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Connecting these probes to $0\nu\beta\beta$ requires

- Flavor assumptions/explicit models that go beyond the pure EFT

- Knowledge of NMEs / LECs
  - Improved NMEs/LECs would help falsifying/verifying BSM models

Related LOIs

$0\nu\beta\beta$ and LHC signatures in simplified models

Snowmass2021 - Letter of Interest

Neutrinoless double beta decay in effective field theory and simplified models

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Determination of $0\nu\beta\beta$ NMEs / LECs

Nuclear Matrix Elements for BSM Searches from Lattice QCD

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Bridging particle and nuclear physics for neutrinoless double beta decay with EFTs

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