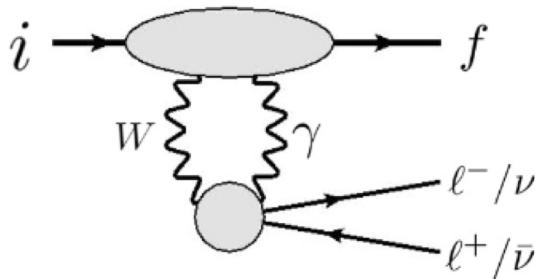
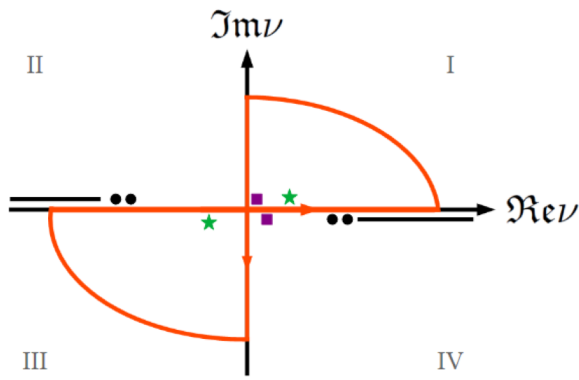


Objectives

- We analyze the axial γW -box diagram correction to the superallowed nuclear beta decay amplitude and provide a dispersion representation of the nuclear-structure correction δ_{NS} to the beta decay rate.



The γW -box diagram in nuclear beta decays.



The “Wick rotation” that relates the radiative correction amplitude to nuclear response functions.

Impact

- Our analysis provides a solid theoretical foundation for δ_{NS} , including physics in the energy-independent and energy-dependent pieces not properly accounted for in existing shell-model-based calculations.
- Our formalism serves as a perfect starting point for ab-initio studies of δ_{NS} with fully-controlled theoretical uncertainties through the computation of the parity-odd nuclear structure function F_3 .
- The improved determination of δ_{NS} may reduce the major theory uncertainty in the extraction of the Cabibbo-Kobayashi-Maskawa (CKM) matrix element V_{ud} , and may set more stringent constraints on physics beyond the Standard Model (BSM) through the test of the first-row CKM unitarity
- We also identified a highly nucleus-dependent contribution to δ_{NS} in superallowed decays of light nuclei stemmed from the existence low-lying intermediate states. It may significantly impact the search of BSM scalar currents.

Accomplishments

Publication: C.-Y. Seng and M. Gorchtein ,

[Phys.Rev.C107\(2023\)3,035503](https://arxiv.org/abs/2208.12345) (*Editors' suggestion*)