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Longitudinal beta-decay vector coupling of nucleons and nuclear isospin doublets

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We study the longitudinal vector component of the weak vector current in nucleon and nuclear isospin doublets in order to determine the remaining last unknown longitudinal vector coupling g_s of the β -decay vertex. Using the Ward identity, we establish relationships between the longitudinal form factors and the experimentally known Dirac form factors. These relations involve the scalar form factor of the particle, which encodes its scalar charge and scalar mean-square radius. For nucleons, these quantities are evaluated within the MIT bag model and the nonrelativistic oscillator quark model. The approach is then extended to nuclear isospin doublets, where scalar densities are calculated using the Deformed Relativistic Hartree–Bogoliubov model in the continuum (DRHBc). The resulting scalar charges and radii allow to evaluate the coupling g_s for nucleons and nuclei.

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