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The Fierz interference term and recent PERKEO III measurements

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Neutron beta decay is an excellent system to test the Standard Model theory of the weak interaction and the structure of the charged weak interaction. The Fierz term is one of these parameters to study and as such is sensitive to hypothetical scalar and tensor interactions. These interactions are currently most strongly constrained by combining measurements of λ, τ and super-allowed nuclear decays.
In the past, experiments at the ILL have determined the ratio of axial-vector and vector coupling constants λ=g A /g V and the CKM matrix element V_ud in the decay of free neutrons with measurements of the β-asymmetry parameter A and of the neutron lifetime τ. The aim of the current measurement presented in this poster by PERKEO III, which was conducted until recently, is the determination of the Fierz interference term b with a precision of 5×10 -3 from the spectrum of the electrons directly.
The signature of a hypothetical non-zero Fierz term in neutron beta decay is an extra energy-dependent phase-space contribution. Major systematic effects are hence related to the detector response: calibration, temporal stability, spatial uniformity and non-linearity. With the latest measurement at ILL, we aim to obtain for the first time competitive neutron data with an existing and proven instrument, improving on the only previous result by UCNA (Los Alamos) by a factor of 20, and also establishing the necessary understanding of systematics for future measurements with PERC at the FRM II.

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