KeV Neutrino Search in Tritium β-Decay
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Motivation

5% Baryons
27% Dark Matter
68% Dark Energy

Right handed (sterile) neutrinos are theoretically well motivated
Sterile neutrinos can mix with active neutrinos, forming new mass eigenstates
Neutrinos in the keV mass range could contribute to cold and warm dark matter

Imprint of keV Neutrinos on β-spectrum

A neutrino in the keV range leaves a kink signature in the β-spectrum
Cosmological constrains: \( \sin^2 \Theta < 10^{-7}, 2 \text{ keV} < m_{\text{heavy}} < 50 \text{ keV} \)

Expected Sensitivity

Source of high stability and luminosity (\(10^{11}\) decays/sec)

Impact of experimental uncertainties

Construct realistic covariance matrix to investigate experimental uncertainties in a generic way
Uncorrelated errors affect the sensitivity: require calibrations, simulations, and good understanding of correlations

Spectral fit approach

Fit β-decay spectrum
Leave theoretical corrections free to fake a keV neutrino signal
Smooth corrections do not prevent detecting a kink-signature down to \(\sin^2 \Theta > 10^{-7}\)

Wavelet approach

Use wavelet transformation to detect „kink“ feature in the spectrum
Kink search independent of exact knowledge of the spectrum shape
Good energy resolution (=100 eV) required

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