Sterile neutrino searches with the BeEST

Contact: Leendert Hayen (hayen@lpccaen.in2p3.fr)

INTRODUCTION

Sterile neutrinos are a popular dark matter candidate, as something that couples to Standard Model fields only through oscillations with the three active neutrino fields. Nuclear β decays show tremendous sensitivity through a variety of probes, in particular after electron capture. The latter is a two-body process, with a recoiling nucleus on the order of several tens of eV. Spectroscopy of the recoiling ion can directly probe the nature of the neutrino and set bounds on general sterile neutrino scenarios.

The BeEST experiment is a pioneering experiment using cryogenic quantum sensors, called superconducting tunnel junctions, to perform spectroscopy on recoiling ions following ^{7}Be electron capture. Results obtained so far include improvements of several orders of magnitude in sterile neutrino windows, precise L/K capture fractions, and the wave packet size of the neutrino.

DESCRIPTION OF THE WORK

The project consists of using experimental data taken to perform parts of the analysis of the Phase-III data taking campaign. This includes the calibration of the laser system and the response to recoiling ion. This can encompass development of sophisticated simulation efforts of the superconducting sensor response.

REQUIREMENTS

Python, nuclear physics and notions of particle physics.