Project for the final oral examination of PHY981

Studies β decay of ^{6}He

The aim of this project is to perform shell-model calculations of the nuclei ^{6}He and ^{6}Li, studying the low-lying excited states and perfoming β-decay studies using Alex Brown's shell-model program NushellX.

The explicit task is thus to

1. Give a survey of β-decay experiments performed in this mass region. Motivate the importance of studies of β-decay in this mass region.

2. Perform shell-model studies of low-lying states of the above nuclei using both the $0p$ and the $1s0d$ shells. You may need to perform truncations of the basis by leaving out specific single-particle states (for example the $0d_{3/2}$ state.

3. Go through the details in chapter 7.5 of Suhonen and convince yourself about the approximations and correctness of equations (7.118)-(7.123). Present also eventual other theoretical studies.

4. Calculate thereafter, based on your shell-model states, the relevant β-decays. Give a critical analysis of your results and compare with existing theoretical studies and experiments.