Problems Lecture 1: Linac Basics

1) Calculate the relative longitudinal motion of two particles with an energy of $9\,\mathrm{GeV}$ and a difference of 3% over a distance of $21\,\mathrm{km}$.

2) Calculate the solutions to Hill's equation for $K(s) = K_0 > 0$.

3) Calculate the solutions to Hill's equation for $K(s) = 0$ assuming $\beta(s = 0) = \beta_0$ and $\beta'(s = 0) = 0$.

4) How much energy is roughly stored in one ILC cavity at nominal gradient?

Problems Lecture 2: Lattice Design

1) A transport lattice with no acceleration consists of FODO cells with quadrupole spacing $L = 10\,\mathrm{m}$ and focal distance $f = 10\,\mathrm{m}$. How large is the phase advance?

2) Estimate the RMS beam jitter at a position with $\beta(s_2) = 1\,\mathrm{m}$ if one quadrupole jitters 450° upstream with a focal length $f = 7\,\mathrm{m}$ and $\beta(s_1) = 10\,\mathrm{m}$. The quadrupole jitter amplitude has an RMS of $1\,\mu\mathrm{m}$.

3) Calculate the average beta-function in a thin lens FODO lattice as a function of $\hat{\beta}$, $\check{\beta}$ and L/f

How much does a cavity with tilt $\theta \ll 1$ deflect the beam?