

Homework Problems VIII

Accelerator Physics

1. Write down the general solution for the K-V envelope equation for a drift region when $X = Y$. Show that for solutions initially converging that the beam size at maximum compression is bigger than if there is no space-charge term.
2. Calculate using rough estimation Touschek Lifetime for flat electron beam in a ring. Use the lattice parameter given in table, assuming constant twiss parameters and ignoring dispersion and it's derivative(use $D(\xi) = 0.1$).

Quantity	Variable	Unit	Value
Beam energy	E	GeV	9
Path Length	L	m	1000
Equilibrium Horizontal emittance	ε_x	m	4.1×10^{-9}
Vertical emittance	ε_y	m	$\varepsilon_y/5$
Bunch length	σ_s	m	5×10^{-3}
Initial number of particles	N_0		3.1×10^{10}
Effective $\beta_{x,y}$	$\beta_{x,y}$	m	3
Momentum Acceptance	δ_{acc}		0.001