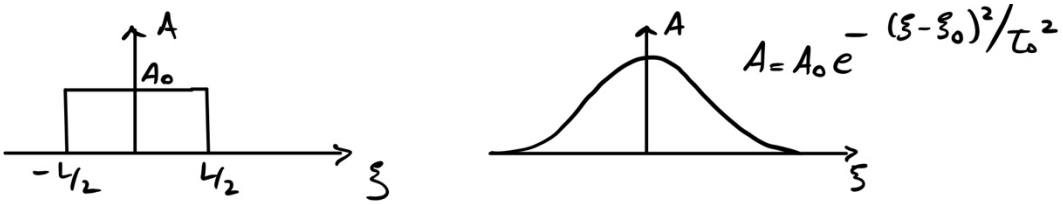
Homework 7
Due: *Monday, April 18, 2020*

1. Find the wake function ψ for a linear laser pulse with a top hat profile and a Gaussian profile. Note that for the linear response, $A_0 << 1$



2. (not graded) Show that the Green's function given by

$$G = \eta(\xi - \xi_0)\sin(\xi - \xi_0)$$

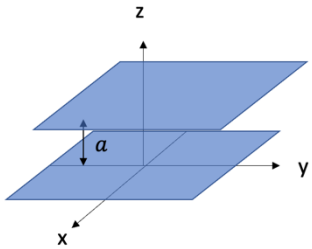
satisfies the Green's equation for wake function:

$$\frac{d^2G}{d\xi^2} + G = \delta(\xi - \xi_0)$$

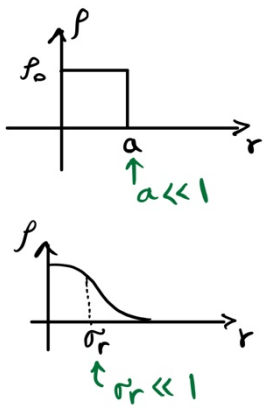
Here, η is the Heaviside step funciton

3. Find the solution to the transverse Green function equation for a 2D slab geometry, i.e. two infinite parallel plates placed at $x = 0$ and $x = a$.

$$(\nabla_\perp^2 - 1)\, G_{x_{\perp b}} = \delta(x_\perp - x'_\perp)$$



4. Evaluate R(0) for a particle beam for the case of
(a) flat top profile: $\rho = \rho_0\ (r < a)$
(b) Gaussian profile: $\rho = \rho_0 \exp(-r^2/2\sigma_r^2)$
Assume cylindrically symmetric beam



Jupyter Notebook

5. With notebook in linear-pwfa folder, scan the peak Λ of the bi-Gaussian driver beam to find out the rough parameter range corresponding to the linear regime, quasi-nonlinear regime (where the sinusoidal wave starts to distort) and the highly nonlinear regime. Submit your results for the representatives of the three regime and the relevant Λ values.

6. With notebook in lwfa-basic-notebook folder, what's the typical transformer ratio of laser-driven wakes (linear regime, and driven by a longitudinally symmetric laser pulse)? Will the transformer ratio change if using a longitudinally asymmetric laser ($t_{rise} \neq t_{fall}$)? If so, how does it change?