

**Home Work PHY 554 #13.**

**Due Nov. 8, 2021**

**HW 1 (5 points):** Show that the electric field of an ultra-relativistic charged particle with charge  $q$  is given by (Hint: you do not need to derive the delta function, just justify the coefficient.)

$$\vec{E} = \frac{q\hat{r}}{2\pi\epsilon_0 r} \delta(z - ct)$$

**HW 2 (5 points):** Show that the longitudinal and transverse impedances satisfy the following relations

$$Z_{//}^*(\omega) = Z_{//}(-\omega)$$

$$Z_{\perp}^*(\omega) = -Z_{\perp}(-\omega).$$