

**Question:** *Do a little math:*

The gauge field in the Coulomb gauge satisfies

$$-\nabla^2 \mathbf{A} + \frac{1}{c^2} \partial_t^2 \mathbf{A} = 0 \quad (1)$$

and we use the Fourier transform convention

$$\mathbf{A}(\mathbf{r}, t) = \frac{1}{\sqrt{\epsilon_0 V}} \sum_{\mathbf{k}} \mathbf{A}_{\mathbf{k}}(t) e^{i\mathbf{k} \cdot \mathbf{r}}. \quad (2)$$

Show that

$$\mathbf{A}_{\mathbf{k}}(t) = \mathbf{c}_{\mathbf{k}} e^{-i\omega t} + \mathbf{c}_{-\mathbf{k}}^* e^{i\omega t} \quad (3)$$

where  $\mathbf{c}_{\mathbf{k}}$  are complex vectors.

(Teaser was verbally communicated in class.)