

Physics 5456 – Problem set 5

1. In computing the transition rate for spontaneous emission of a single photon in Schwabl section 16.4, only the first term in

$$V(t) = \int d^3x \left[-\frac{e}{c} \vec{j}(\vec{x}) \cdot \vec{A}(\vec{x}, t) + \frac{e^2}{2mc^2} \rho(\vec{x}) \vec{A}^2(\vec{x}, t) + e\rho(\vec{x})\Phi(\vec{x}, t) \right]$$

was used.

- (a) Explain why the second term does not contribute to the amplitude for emission of a single photon.
- (b) Compute the transition rate for simultaneous spontaneous emission of two photons of frequencies ω_1, ω_2 , for large times t , when an electron drops from state $|m\rangle$ to $|n\rangle$, using the second interaction term.