Quantum Optics P572 Teaser Question Jan. 20, 2015

Question: An atom in an excited electronic state in free space spontaneously emits photons with some rate. What does the probability of being in the excited state look like as a function of time? (A qualitative drawing suffices.) The probability of an emitted photon existing in the electromagnetic field? (You can assume an initial vacuum state for the electromagnetic field.)

Consider putting an atom in a cavity (a system that allows only a single electromagnetic energy mode to exist within some frequency range). What is the probability of being in the excited state as a function of time? Of finding a photon in the cavity?