Lecture 3.1b Unclear Points:

p.24 When you say "there's very little energy that's radiated by means of ejected photons," do you actually mean "ejected electrons?"

No, ejected photons only include characteristic x-rays, which deposit very little energy. Also, there may be some Bremsstrahlung generated by the ejected electrons, but very little.

Ignoring Compton scatter, is there significant heat produced in the vicinity of photoelectric absorbers due to ejected photoelectrons, auger electrons, and atomic recoil?

Heat is produced by interactions of secondary electrons, in this case photoelectrons, interacting with outer shell electrons in tissue. A radiation dose of around 5 Gy results in a temperature rise of around 0.01 degree Celsius.

Is the photoelectron angle relative to incident photon relevant to dosimetry or imaging purposes? How?

Not relevant to imaging, since we are mainly interested in photons reaching the detector, and not the secondary electrons. Relevant to therapy as it governs spatial extent of dose distribution.

In this lecture, we learned that the photoelectron is ejected at a 90° angle relative to the incident photon at low energies, but the photoelectron is ejected in a more forward direction at higher energies. In a previous lecture, we learned that x-rays produced at higher energies in an x-ray tube are forward peaked, while x-rays produced at lower energies in an x-ray tube are emitted more isotropically. Are these two effects related?

In all cases, we must conserve momentum as well as energy.

If a photon doesn’t have enough energy to eject an electron but does have enough to raise it to another energy level, can the photon be absorbed? If so, what happens to the excess energy of the photon since the electron energy levels are discrete?

Excitation of target atoms can lead to chemical changes as well as heat.

When you say to assume that all of the photon’s energy goes into the electron collision (neglecting recoil of nucleus), does it mean that the energy of the incoming photon is much higher than the binding energy?

Not necessarily. It just means there is no scattered photon.

The characteristic x-ray can go downstream and ionize additional atoms. In tissue, that’s not really very much of an issue, because the energy of the characteristic x-ray is going to be fairly low, so most of the energy is going to be deposited locally. Could you please elaborate further?
We are basically interested in whether energy is deposited locally or downstream.