Difference between photoelectric, Compton, Thompson effects and core level photoemission

Abstracted from physics forums:

http://www.physicsforums.com/showthread.php?t=431727

“The main difference is that the photoelectric effect deals with electrons bound in matter, whereas the Compton effect deals with free electrons. So in the photoelectric effect the matter can "absorb" energy and momentum whereas in the Compton effect only two particles are involved.

If the photon has energy and momentum (E, p) = (E, E/c) you can't explain why you observe electrons with (E-W, -k) w/o taking into account something that absorbs energy and momentum in order to guarantuee energy-momentum conservation.

Microscopically both effects are identical (electron-photon scattering), but whereas in the Compton effect there is only this fundamental process, in the photoelectric effect the additional interactions must not be neglected.”

…

“Thompson scattering is elastic scattering of **classical** electromagnetic radiation, whereas both the photoelectric effect and the Compton effect [are] quantum mechanical processes. Thompson scattering is the classical limit of Compton scattering”

…

“I would amend Tom Stoer's statement to read that "the Compton effect deals with almost-free electrons" or better, "the Compton effect deals with electrons whose binding energies are much smaller than the incident photon energy."

As you probably know, the basic analysis of the Compton effect assumes that the electron is "free" initially. This is of course not actually true for an electron bound in an atom! Nevertheless, the binding energy of the "outermost" electrons is on the order of a few eV, whereas for Compton scattering we use at least X-ray photons (a few tens of keV) or gamma-ray photons (hundreds of keV or even more). In those situations the electrons are "approximately free" as far as the incoming photons are concerned.”

“Compton scattering deals with *free or quasi-free* electrons. It means the QED scattering process where *one single photon interacts with one single electron*. Whether the electrons are bound in atoms, molecules or metal doesn't matter, as long as the binding energy is small compared to the photon's energy.”

“The standard photoelectric effect is **not** equal to core level photoemission.”