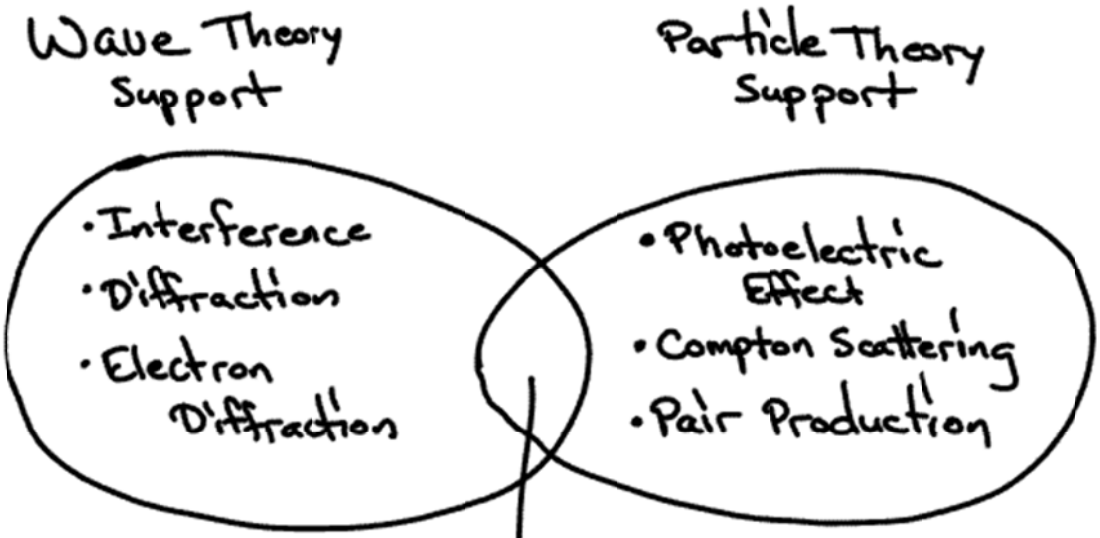
AP Physics - Modern Physics - The Wave-Particle Duality

Note Title 4/13/2008

By the 1920s, physicists were struggling with two different definitions of light: wave vs particle. How could light be both. Niels Bohr solved the problem with his "principle of complementarity": In order to understand a given phenomenon, one must use either the wave or the particle theory, but not both.



we must accept both models and admit that the nature of light is not describable in terms of a single, classical picture.

Radio Waves: Low frequency
Long wavelength
Low photon energy

→ Takes many low-energy photons to create a signal → Radio frequencies appear as a continuous wave.

Visible Light: Higher frequency
Short wavelength
→ Sometimes behaves like a wave (Young's Experiment)
Sometimes behaves like a particle (Photoelectric Effect)

X-Rays: Very high frequency
Extremely short wavelengths
High energy
→ Fewer photons are needed for a signal → Photons tend to act more like particles (Compton Scattering)
→ It is possible, but much more difficult to detect interference of x-rays.