

Answer to the in-video Quiz (Week 2, Lecture 2)

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15th December, 2021

1 We know that light (Electromagnetic Radiation) behaves like a Wave and has Polarization Properties. So if an electron behaves like a wave, what about it's Polarization Properties?

Polarization in light waves can be described easily, because Electromagnetic Radiation can be described by a vector field, and the polarization of this wave can be thought of as the relative orientation of the direction of propagation, the Electric Field, and the Magnetic Field.

However, polarization in electron waves cannot be described so easily, as an electron wave is a complex valued scalar wave. In fact the polarization of an electron wave corresponds to an intrinsic property of electrons known as spin. Electrons have 2 possible spin states, spin $+\frac{1}{2}$ and spin $-\frac{1}{2}$. These spin states correspond to different polarization states of the electron wave.

Even in light, the spin of a photon corresponds to its polarization state. Photons can have spin +1 or spin -1. These correspond to the 2 different forms of circular polarization of light (Left and Right Polarization).