Light is an electromagnetic wave and the wave properties largely define how we perceive it. For example, the wavelength of light tells us its colour (red is relatively long, ~600nm, while blue is shorter ~400nm). Polarization is another important property of light waves, though it is one we are often less aware of in everyday life. Polarization describes the way in which the wave ‘wiggles’! For example, if a light wave travelled from left to right across this page and the electric field was confined to the plane of the page, it might be described as vertically polarized, see below.

Most light isn’t polarized – it wiggles in random directions. However, there are some special cases where polarization is an important factor:

- Light reflected from surfaces of water or scattered by the sky is partially linearly polarized (fishermen wear Polaroid® sunglasses to cut out glare, and cameras use polarizing filters).
- Some insects, fish and birds can see polarized light. This helps them to navigate (polarization of the sky) or feed (easier to see some small animals in polarized light).
- Some brightly coloured beetles reflect circularly polarized light due to liquid crystal coats.
- Polarization is important in technology; lasers are polarized, polarizers are vital in liquid crystal displays and circularly polarized glasses are used for viewing modern 3-D films.

Some materials transmit light differently depending on its polarization. Such materials are known as birefringent – they transmit light polarized in perpendicular directions at different speeds (they are have two different refractive indices). The birefringent calcite crystal in the photograph splits the light into two perpendicularly polarized rays, the ordinary and extraordinary rays. Since these light rays also travel at different speeds, they are bent by different amounts (the amount of refraction depends on the refractive index). Therefore two separate images of the lines and words can be seen. A polarizer will allow each ray to be viewed separately.

Liquid crystals are birefringent materials – their refractive indices are different along and across the direction of the molecules. This is a vital property for their use in display devices because, as can be seen for calcite, birefringent materials interact with polarized light.

More information on how displays work is available on a separate handout.