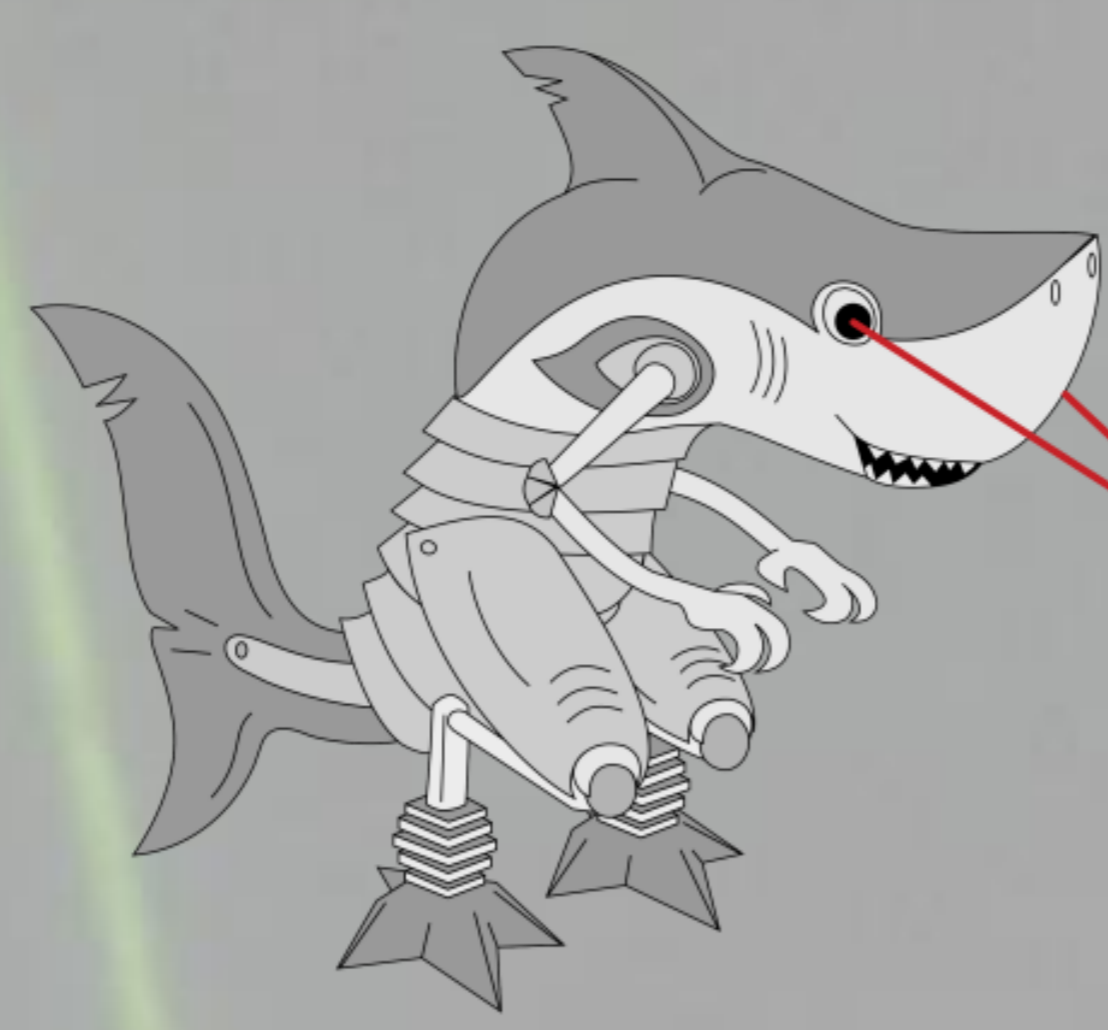


LASER



OPTICA

Student Chapter

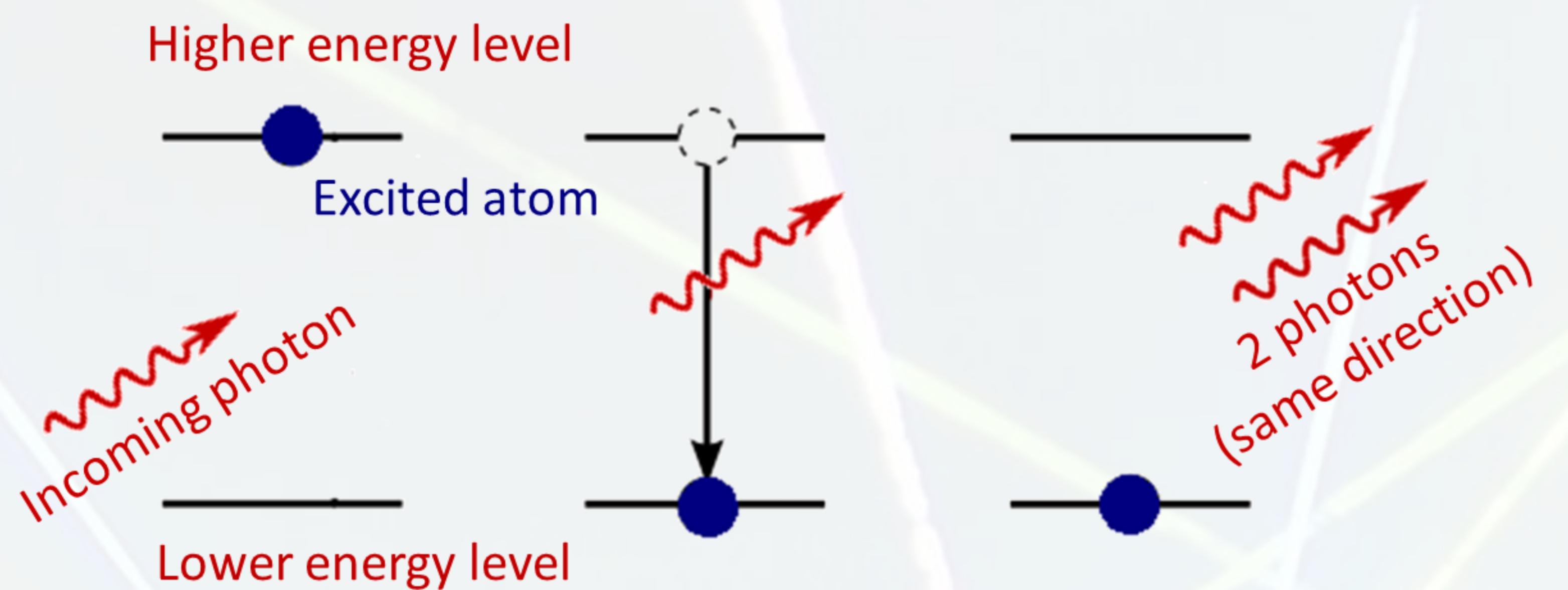
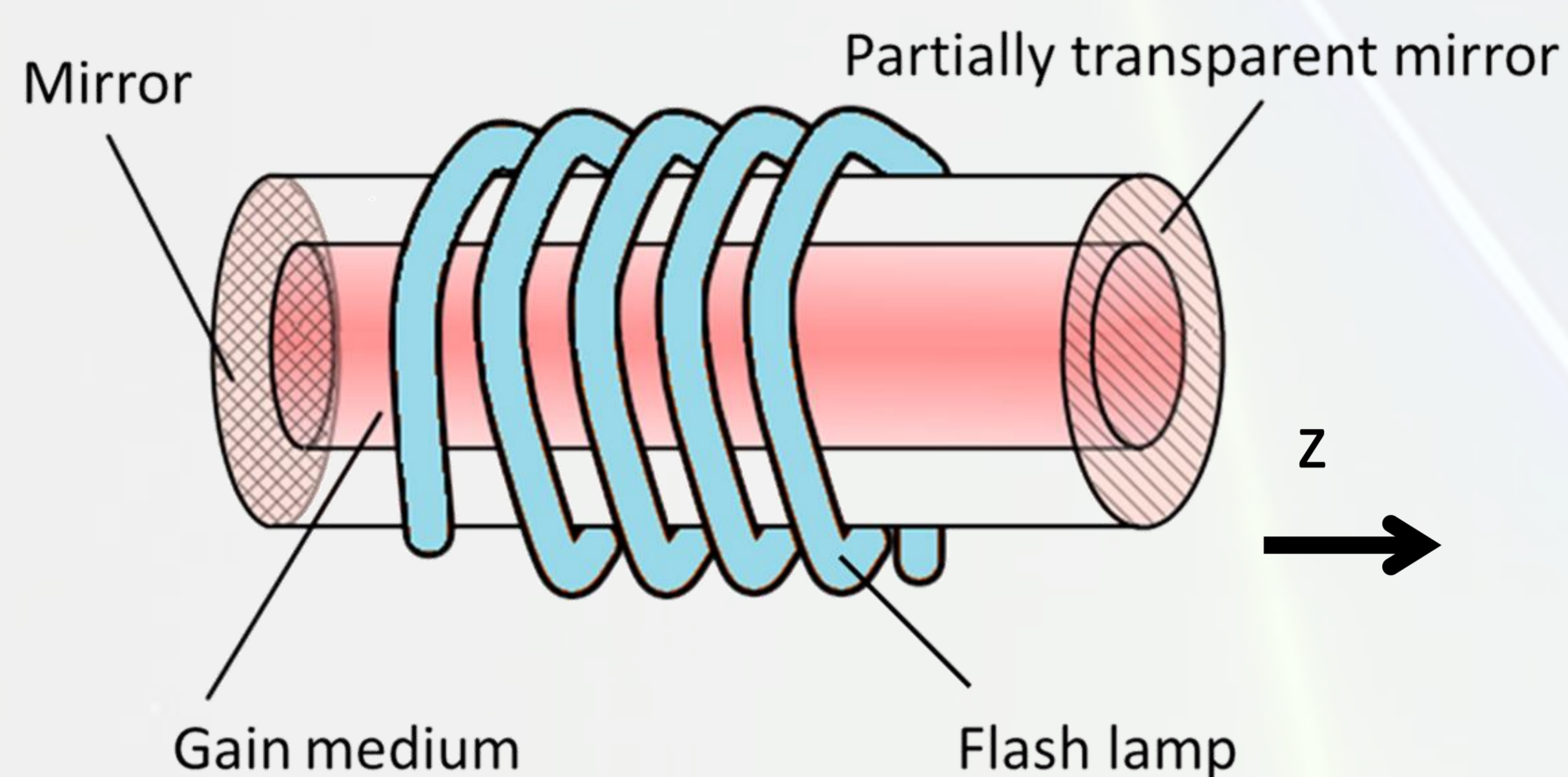
at the University of Kent



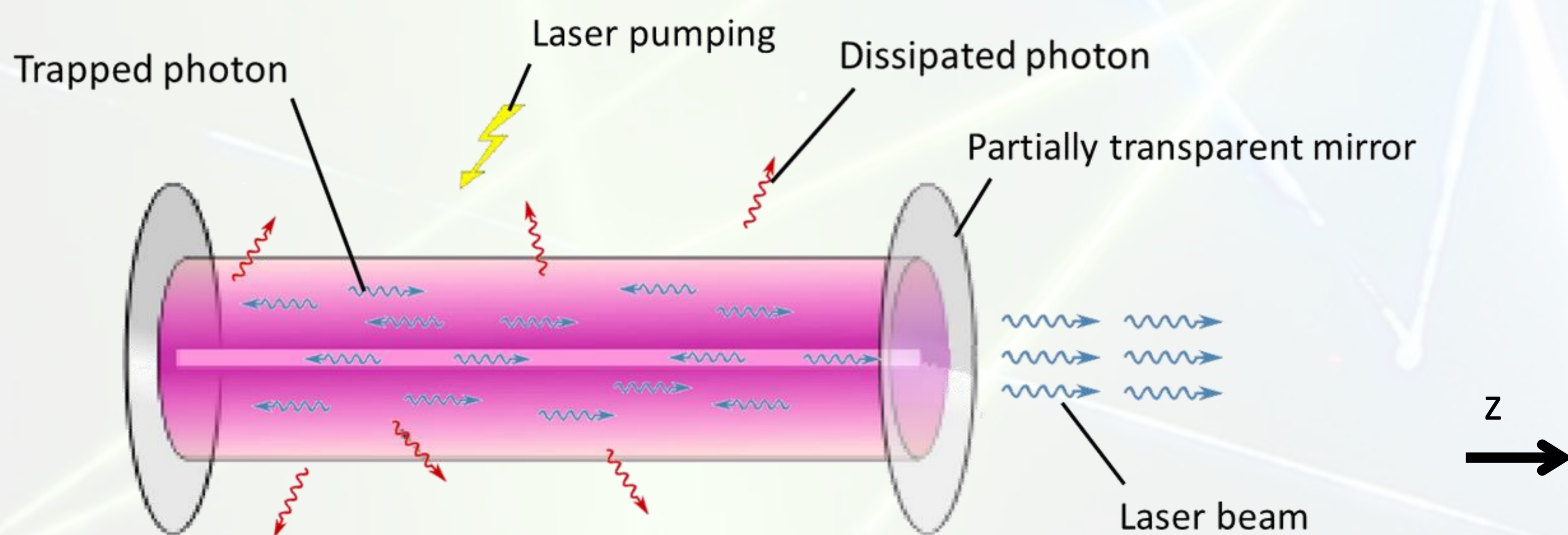
Canterbury, UK

A laser is a source of coherent light – emitted light waves are of the same frequency with a constant phase shift. For visible light this basically means a narrow beam with single light colour. Laser is an acronym for *Light Amplification by Stimulated Emission of Radiation* which implies the way this special type of light is being created. There are a large number of applications, and laser technology is being used in almost any branch of human activity.

A simple laser source consists of resonator and an energy source. The resonator is comprised of a gain medium bordered with mirrors from two sides - one of them is partially transparent. The gain medium can be either liquid (e.g. helium and neon mixture) or solid (e.g. sapphire crystal), its properties define the laser wavelength (colour). The energy source can be demonstrated by a flash lamp surrounding the gain medium.



Once enough energy is transferred from the flash lamp to the gain medium (laser pumping), the molecules are excited - and the electrons jump to higher energy level. This state is, however, very unstable, and the electrons shortly drops to the stable lower energy level. During its return, the atom emits the excess of energy in the form of photon in a random direction. This is called spontaneous emission. If the newly emitted photon interacts with an excited atom of the gain medium, the photon forces it to drop to the lower energy level and emit a photon of the same frequency and **in the same direction** to the interacting photon - stimulated emission (see above).



The majority of photons leave the resonator. However, photons parallel to z axis are trapped between two mirrors, which reflect them back to the gain medium. This causes an avalanche effect of stimulated emission which leads to the formation of a strong current of photons of the same frequency parallel to the z axis. Thanks to the partially transparent mirror, part of the photons leaves the resonator and forms a laser beam.