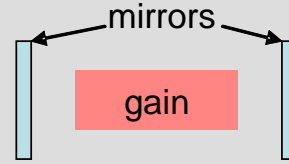


III. How a mode-locked laser works

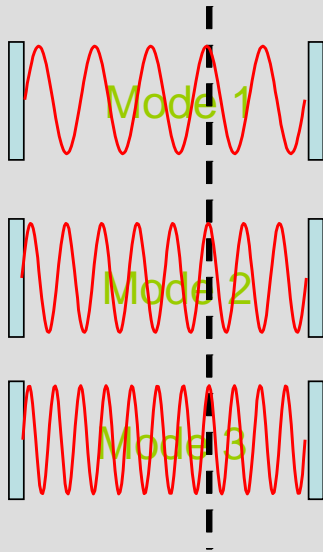
How a mode-locked laser works

As for any laser, the two essential components of a mode-locked laser are a gain medium and mirrors that recirculate the light. Only frequencies for which the distance between mirrors is an integer multiple of the wavelength can lase and are known as “modes”. A mode-locked laser is designed such that multiple modes lase simultaneously. If the phase between these modes is locked, the interference between them results in the output being a pulse train.

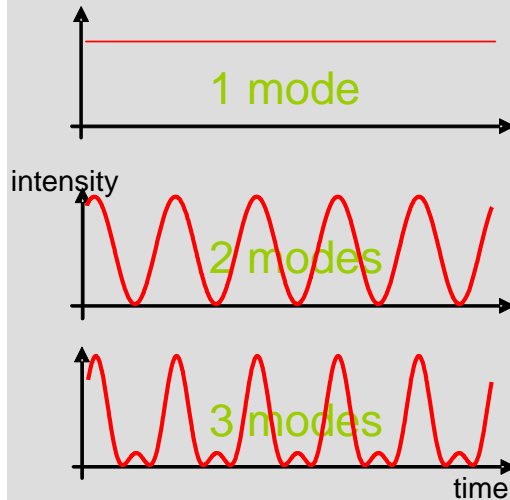


In addition to the components common to all lasers, a mode-locked laser also incorporates a “mode-locker” and typically dispersion compensation

3 possible modes are shown, these are phased such that they add coherently at the position of the dashed line



The output intensity of the laser is an average over one cycle of the square of the mode. For a single mode, the output is constant in time; for multiple modes, interference forms a pulse train.



For many modes, the correct phase relationship must be established, i.e. the modes must be “locked” to produce a pulse train. In this example, there are 30 modes, shown locked (red) and with random, unlocked phases (blue).

