② Difference Between Stabilized and Unstabilized HeNe Lasers

The popular conception of a laser is that it is a light source of a single specific color or wavelength. While such a description is good enough for most Mark I eyeballs (at least where the wavelength is in the visible spectrum), the output from real lasers is usually not so perfect.

The behavior of any laser is determined by many factors but the most important two are:

- **Lasing gain medium:** When "pumped" by a suitable excitation source, it provides amplification by stimulated emission for photons over a specific range of wavelengths.

  For the red HeNe laser, the gain medium is a mixture of helium and neon gases at low pressure excited by an electrical discharge. The helium helps with the excitation while the neon actually provides the gain. The 633 nm red wavelength is only one of several that HeNe lasers can use, but nearly all HeNe lasers that are actively stabilized are red. :)

- **Laser cavity or resonator:** A structure usually consisting of mirrors to provide optical feedback at the desired laser wavelength.

  For most stabilized HeNe lasers, a Fabry–Perot configuration is used with the gain medium between a pair of precisely aligned mirrors. These are all part of the sealed HeNe laser tube.

The useful output of most stabilized HeNe lasers is either a (ideally) single optical frequency, or a pair of optical frequencies separated by anywhere from a few 10s of kHz to hundreds of MHz. And in some applications, multiple frequencies (usaully 2 but it could be more) that are locked to a reference may be useful.