
① Introduction

This chapter deals with the special case of HeNe lasers that have their frequency actively regulated either directly, or indirectly via control of intensity. Their output is generally either a single longitudinal mode (single optical frequency), a pair of adjacent longitudinal modes (two optical frequencies separated by 600 MHz to 1 GHz typical), or a pair of optical frequencies close together produced by Zeeman splitting of a single longitudinal mode (250 kHz to 8 MHz typical) or an Acousto-Optic Modulator (AOM) generating a sideband of a single longitudinal mode (20 MHz typical).

In almost all cases, these apply specifically to HeNe lasers operating on the so-called red transition around 633 nm (although when stabilized, there may be many many places to the right of the decimal point). HeNe lasers on other wavelengths can also be stabilized, though not all the same techniques can be used. This chapter deals almost exclusively with stabilized red HeNe lasers producing one or two linearly polarized single frequency components. There is some information on Zeeman lasers, though much more on their principles and characteristics can be found in the chapter: [Commercial Stabilized HeNe Lasers](#) mostly in the sections on Hewlett Packard/Agilent/Keysight stabilized HeNe lasers. HP practically created that industry, which still flourishes to this day and is likely to continue to do so for the foreseeable future.

General information on HeNe lasers as well as a brief introduction to stabilized HeNe lasers and typical locking schemes may be found in the chapter: [Helium-Neon Lasers](#). Here, we delve into the topic in more detail.

However, it is not intended to be an all encompassing treatise on stabilized laser with all the gory details including hairy math. :) For that, refer to the scientific literature, most from the 1960s or 1970s. Only a few references are included here, but Web searches will turn up numerous research papers, many of which are in the public domain. For those that are not, affiliation with a major university or other academic institution may be required to access them for free.