

7.0: What you should know and be able to do after studying this chapter

- Know the special properties of laser sources.
- Understand the optical resonator and why it is needed.
- Understand the role of the amplifier and explain what the gain curve is.
- Explain the principle of population inversion and how it can be achieved.
- Explain how single frequency operation can be obtained.
- Understand what transverse modes are and how they can be prevented.

In the early 1950s a new source of microwave radiation, **the maser**, was invented by C.H. Townes in the USA and A.M. Prokhorov and N.G. Basov in the USSR. Maser stands for "Microwave Amplification by Stimulated Emission of Radiation". In 1958, A.L. Schawlow and Townes formulated the physical constraint to realise a similar device for visible light. This resulted in 1960 in the first optical maser by T.H. Maiman in the USA. This device was since then called **Light Amplification by Stimulated Emission of Radiation** or **laser**. It has revolutionised science and engineering and has many applications, e.g.

- bar code readers,
- compact discs,
- computer printers,
- fiberoptic communication,
- sensors,
- material processing,
- non-destructive testing,
- position and motion control,
- spectroscopy,
- medical applications, such as treatment of retina detachment,
- nuclear fusion,
- holography.

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