

1. The distance from the Earth to the Moon is measured by reflecting electromagnetic waves from corner reflectors placed on the Moon by the Apollo astronauts in the early 1970s. (a) What is the average round-trip travel time of a light signal that reflects from the Moon? (b) The uncertainty in the measurement of the distance between the Earth and Moon is about 2 cm. What is the corresponding uncertainty in measuring the round-trip time for the light beam?
2. The light from a He-Ne laser has a wavelength of 632.82 nm. Because of the Doppler effect, the wavelengths have a range (called the linewidth) of about 0.01 nm about this central value. Find the central frequency and the frequency linewidth of a HeNe laser.
3. A laser beam is traveling along the axis of a cylindrical pipe that is 1.61 km in length. What is the difference in travel time through the pipe when it is filled with air at standard temperature and pressure and when it is evacuated?