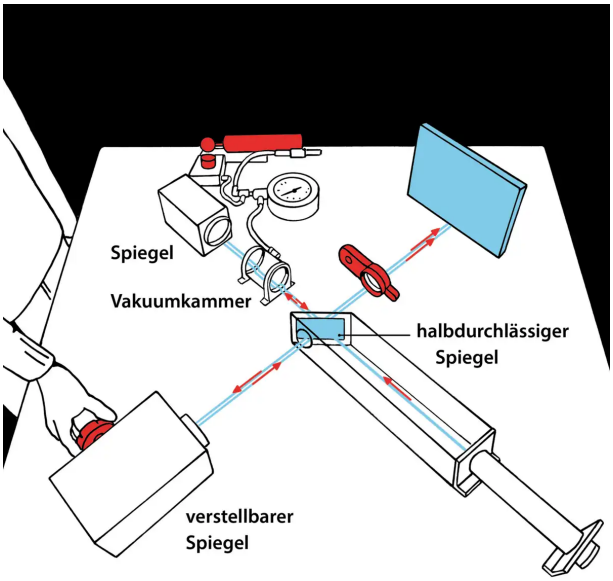
Ruler Made Of Light

How can light be used to measure distances?



Look at the pattern of red lines at the screen.

Turn the black knob on the clear box one to two millimetres and watch how the pattern changes.

Use the pump to suck air out of the vacuum chamber.

Watch the pattern as you press down the knob next to the pump to slowly let the air back in.

This seemingly complicated instrument, known as Michelson interferometer, uses the wave-like properties of light to measure extremely small distances. Light from the laser is split by a semitransparent mirror into two beams that each bounce off a mirror before recombining on the screen to form a so-called interference pattern of lines.

The pattern moves if the distance that one beam travels increases, e.g. when you move one of the mirrors. Every time the mirror has moved about 0.0003 mm, the pattern grows or shrinks by the thickness of one line. The pattern also moves if the speed of light for one beam changes. This can be done by sucking air out of the vacuum chamber because light travels slightly faster in a vacuum than in air.