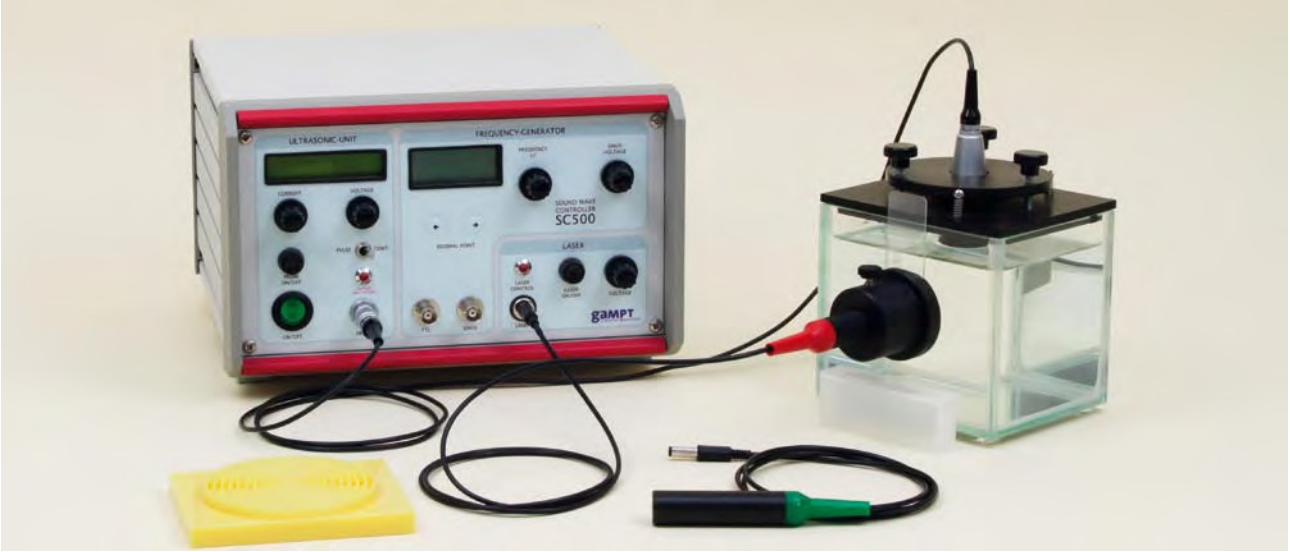
PHY12 Projection of standing waves

In the experiment a standing ultrasonic wave in a liquid is imaged by means of divergent laser light. The dependence of the brightness modulation of the projection images produced upon the wavelength of the light and the frequency of the ultrasonic wave is investigated and the sound velocity in the liquid (water) is determined.



Related topics

Sound wavelength, sound velocity, standing and travelling wave, divergent monochromatic light, refraction indices, focal length of an optical lens

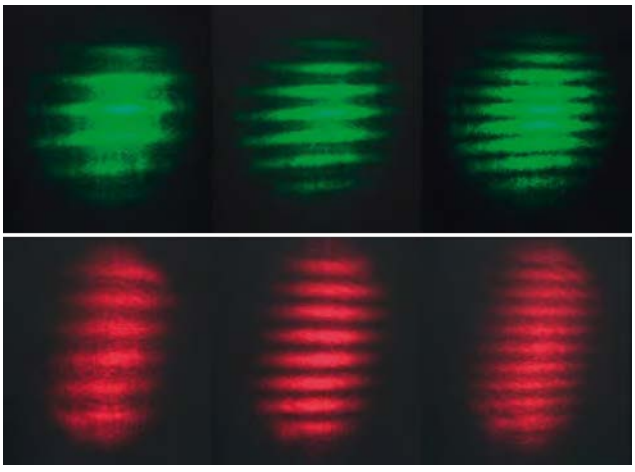
A standing ultrasonic wave in a liquid can be imaged by means of divergent monochromatic light. Due to the standing wave, sound pressure differences are produced in the liquid which are periodically repeated along the sound axis. The localised differences in density caused in this way result in locally differing and periodically repeating refraction indices along the sound axis. When monochromatic light is used, the projection of the standing wave therefore shows a light-dark modulation with periodically repeating brightness maxima which correspond to the density differences. The spacing of these brightness maxima can be used to determine the sound wavelength and thus the sound velocity in the liquid.

Equipment

cw generator SC600	20100
Debye-Sears set	20200
Laser module (green)	20211
- optional: laser module (blue)	20212
Projection lens	20230
Acoustic absorber	20227

Results

The projection images of standing ultrasonic waves in water (here at 2.8 MHz, 3.5 MHz and 4.5 MHz) obtained with green and red laser light show the reduction of the spacing of the brightness maxima to be expected with increasing sound frequency. The difference between green and red laser is here caused by the wavelength dependence of the refraction indices.



Related experiments

PHY11 Debye-Sears effect
PHY17 Acousto-optical modulation at standing waves