Light, Subsonic and Ultrasonic waves

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Abstract

In this article we will know the differentiation between light, subsonic, and ultrasonic waves and the properties of each one.

Introduction

Sound travels through a medium by wave motion. although sound waves and electromagnetic waves used in the propagation of radio and radar differ, both types of waves have many of characteristics. studying the principles of sound wave motion will help you understand the actions of both sound waves and the more complex radio and radar electromagnetic waves. The major differences between sound waves and light waves are their frequencies , their types , the mediums through which they travel and the velocities at which they travel.

Definition of each waves (light , sub sonic and ultra sonic)

Light waves A light wave is an electromagnetic wave which travels through the vacuum of outer space. Light waves are produced by vibrating electric charges., An electromagnetic wave is a transverse wave which has both an electric and a magnetic component**.**Electromagnetic waves exist with an enormous range of frequencies. This continuous range of frequencies is known as the electromagnetic spectrum.

Sub sonic waves sometimes referred to as low status sound , describes sound waves with a frequency below the lower limit of human audibility (generally 20 Hz). Hearing becomes gradually less sensitive as frequency decreases, so for humans to perceive infrasound, the sound pressure must be sufficiently high. The ear is the primary organ for sensing low sound, but at higher intensities it is possible to feel infrasound vibrations in various parts of the body.

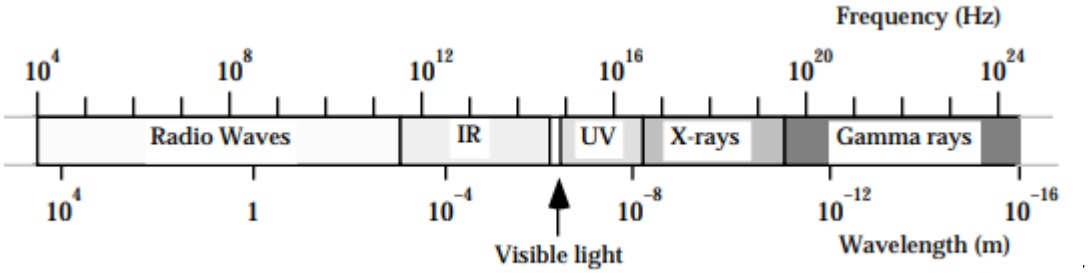
The study of such sound waves is sometimes referred to as infrasonic, covering sounds beneath 20 Hz down to 0.1 Hz (and rarely to 0.001 Hz). People use this frequency range for monitoring earthquakes and volcanoes, charting rock and petroleum formations below the earth, and also in ballistocardiography and seismocardiography to study the mechanics of the heart.

Ultra sonic waves is a wave of sound with a frequency greater than the human hearing limit. Ultrasonic is considered an energy form generated by a longitudinal mechanical wave with one-dimensional propagation and frequency of vibration above 20,000 cycles per second (20 kHz).

Properties of each waves (light , sub sonic and ultra sonic)

Properties of light wave

1- **Frequency , wave length and the speed :** The speed of light (c) in a vacuum has been measured at 3.00×10^8 m/s . In any material other than vacuum light travels at a speed less than c.



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4- **Reflection:** is possibly the most well known property of light, as it enables us to see our reflection in a mirror. Suppose a plane wave falls on a plane reflecting surface as is shown in Figure 2a. The angle q between the ray1 and the normal to the reflecting surface is called the angle of incidence. The wave has some velocity vector v in the medium as is shown in Figure 2b. The velocity vector can be resolved into components parallel and perpendicular to the surface. Theory predicts that the velocity component perpendicular to the surface is reversed upon reflection. The other component remains unchanged in a manner shown in Figure 2c. Thus the angle of reflection equals the angle of incidence. This is sometimes referred to as the Law of Reflection.

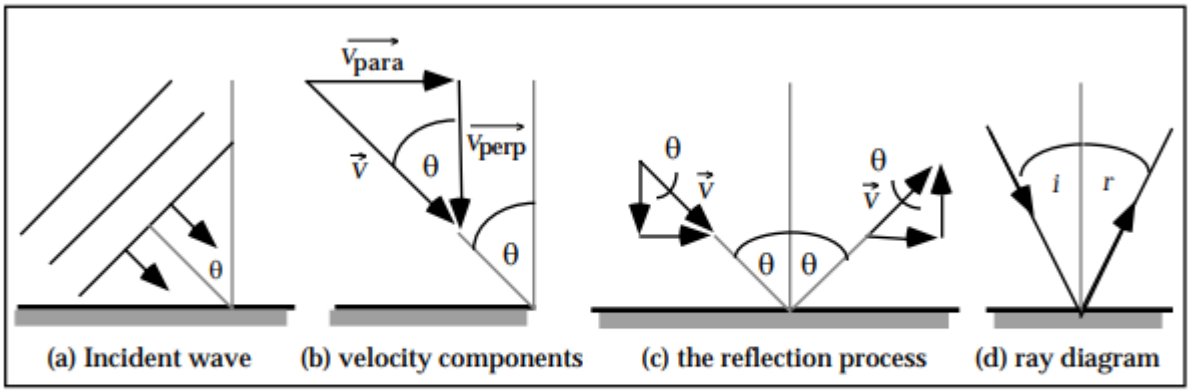
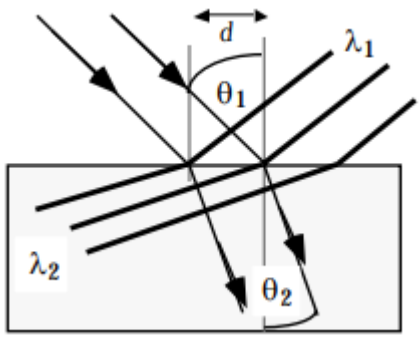


Figure 2. *Reflection of a plane wave at a plane surface. The direction of motion of the wave is described by a line or ray drawn perpendicular to the wave's leading surface. Angle i = angle r.*

5- **Refraction** is also a property commonly observed almost every day. If we look through a window an object is often seen to be "displaced" from its normal position.
Defining the index of refraction n of a medium as n = c/v, where c is the speed of light in a vacuum can be written.

n1 sin Θ1 = n2 sin Θ2



Properties of sub sonic wave

- Clear infrasonic signals generate in the loading process of coal samples, and they can be collected by non-coupling methods. Moreover, the variation of the

infrasonic signals shows significant periodic characteristics in time-frequency domain, which are consistent with the deformation of coal samples, and can be used to predict and invert the deformation of coal samples.

- With the proceeding of loading process, the variation of the relative energy of infrasonic waves shows periodic characteristics, which can effectively distinguish the elastic and plastic deformation of coal samples. The characteristics are significant and easy to be recognized, which can be used as the precursory failure recognition characteristics of coal samples for predicting coal sample failures;

- The precursory failure infrasonic characteristics for coal samples easy to be recognized are determined, a new prediction method for coal sample deformation and failures based on the variation characteristics of infrasonic waves is established.

Properties of Ultra sonic wave

- Ultrasonic waves vibrate at a frequency greater than the audible range for humans (20 kilohertz).
- They have smaller wavelengths. As a result, their penetrating power is high.
- They cannot travel through vacuum.
- Ultrasonic waves travel at the speed of sound in the medium. They have maximum velocity in a denser medium.
- In a homogeneous medium, they travel at a constant velocity.
- In low viscosity liquids, ultrasonic waves produce vibrations.
- They undergo reflection, refraction and absorption.
- They have high energy content. They can be transmitted over a large distance without much loss of energy.
- They produce intense heat when they are passed through objects.
- Like sound waves, ultrasonic waves are longitudinal waves that produce alternate compressions and rarefactions.

Conclusion

	Lightwave	**Subsonic wave**	**Ultra sonic wave**
Definition	**Light waves** A light wave is an electromagnetic wave which travels through the vacuum of outer space.	**Sub sonic waves** sometimes referred to as low status sound , describes sound waves with a frequency below the lower limit of human audibility (generally 20 Hz).	**Ultra sonic waves** is a wave of sound with a frequency greater than the human hearing limit. Ultrasonic is considered

<table>
<tr><td></td><td></td><td></td><td>an energy form generated by a longitudinal mechanical wave with one-dimensional propagation and frequency of vibration above 20,000 cycles per second (20 kHz).</td></tr>
<tr><td>Frequency</td><td><table>
<tr><th>Color</th><th>Wavelength</th><th>Frequency</th></tr>
<tr><td>Violet</td><td>380-450 nm</td><td>668-789 THz</td></tr>
<tr><td>Blue</td><td>450-495 nm</td><td>606-668 THz</td></tr>
<tr><td>Green</td><td>495-570 nm</td><td>526-606 THz</td></tr>
<tr><td>Yellow</td><td>570-590 nm</td><td>508-526 THz</td></tr>
<tr><td>Orange</td><td>590-620 nm</td><td>484-508 THz</td></tr>
<tr><td>Red</td><td>620-750 nm</td><td>400-484 THz</td></tr>
</table></td><td>lower limit of human audibility (generally 20 Hz).</td><td>frequency of vibration above 20,000 cycles per second (20 kHz).</td></tr>
<tr><td>Speed</td><td colspan="2">3.00 x 10^8 m/s</td><td>373 m/s</td><td>1,200 m/s</td></tr>
</table>

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