RAINBOW:APPEARANCE AND SIGNIFICANCE*

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A rainbow is a meteorological phenomenon that is caused by reflection, refraction and dispersion of light in water droplets resulting in a spectrum of light appearing in the sky. It takes the form of a multicoloured circular arc. Rainbows caused by sunlight always appear in the section of sky directly opposite the sun.

Objective: This research reveals the physics behind the creation of rainbows and to find out "Is the artificial creation of rainbows help full in any way when it comes to our understanding of ways in which light works.

I. INTRODUCTION

The classical Greek scholar Aristotle (384-322 BC) was first to devote serious attention to the rainbow.According to Raymond L. Lee and Alistair B. Fraser, "Despite its many flaws and its appeal to Pythagorean numerology, Aristotle's qualitative explanation showed an inventiveness and relative consistency that was unmatched for centuries. After Aristotle's death, much rainbow theory consisted of reaction to his work, although not all of this was uncritical. Isaac Newton demonstrated that white light was composed of the light of all the colours of the rainbow, which a glass prism could separate into the full spectrum of colours, rejecting the theory that the colours were produced by a modification of white light. He also showed that red light is refracted less than blue light, which led to the first scientific explanation of the major features of the rainbow.Newton's corpuscular theory of light was unable to explain supernumerary rainbows, and a satisfactory explanation was not found until Thomas Young realised that light behaves as a wave under certain conditions, and can interfere with itself.

A. Explanation

When sunlight encounters a raindrop, part of the light is reflected and the rest enters the raindrop. The light is refracted at the surface of the raindrop. When this light hits the back of the raindrop, some of it is reflected off the back. When the internally reflected light reaches the surface again, once more some is internally reflected and some is refracted as it exits the drop. (The light that reflects off the drop, exits from the back, or continues to bounce around inside the drop after the second encounter with the surface, is not relevant to the formation of the primary rainbow.) The overall effect is that part of the incoming light is reflected back over the range of 0 to 42, with the most intense light at 42.This angle is independent of the size of the drop, but does depend on its refractive index. Seawater has a higher refractive index than rain water, so the radius of a "rainbow" in sea spray is smaller than a true rainbow. This is visible to the naked eye by a misalignment of these bows.

The reason the returning light is most intense at about 42 is that this is a turning point light hitting the outermost ring of the drop gets returned at less than 42, as does the light hitting the drop nearer to its centre. There is a circular band of light that all gets returned right around 42. If the sun were a laser emitting parallel, monochromatic rays, then the brightness of the bow would tend toward infinity at this angle.But since the sun's brightness is finite and its rays are not all parallel (it covers about half a degree of the sky) the brightness does not go to infinity. Furthermore, the amount by which light is refracted depends upon its wavelength, and hence its colour. This effect is called dispersion. Blue light (shorter wavelength) is refracted at a greater angle than red light, but due to the reflection of light rays from the back of the droplet, the blue light emerges from the droplet at a smaller angle to the original incident white light ray than the red light. Due to this angle, blue is seen on the inside of the arc of the primary rainbow, and red on the outside. The result of this is not only to give different colours to different parts of the rainbow, but also to diminish the brightness.

II. FURTHER PLANS

Our team has decided to study and find out the reasonable solutions of the following questions:

A.What is the rainbow's distance?

B.Why is the rainbow so frequently seen during summer and so seldom during winter?

C.Why are rainbows so rarely seen at noon?

D.Do two people ever see the same rainbow?

E.Can the same rainbow be seen by reflection as seen directly?

F.What are the different types of rainbows?

G.Why is the sky brighter inside the rainbow?

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III. OUR APPROACH

Along with our theoretical approach our team is trying to make an artificial rainbow which will enhance our understanding regarding the formation and significance of rainbows.

Some of the other reasons for creating an artificial rainbow are:

A.The rainbow can be added to images in post processing.

B.The rainbow can be used on its own in photographs or products.

C.It beats waiting around for a thunderstorm to pass.

So far,this is exactly our plan of approach.Further research might bring to our notice any better understanding.