Refraction in Nature

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1. Formation of Rainbow

A rainbow is a natural spectrum appearing in the sky after a rain shower. It is caused by dispersion of sunlight by tiny water droplets, present in the atmosphere. Rainbow is always formed in a direction opposite to that of the Sun. The water droplets act like small prisms. They refract and disperse the incident sunlight, then left it internally, and finally refract it again when it comes out of the raindrop. Due to the dispersion of light and internal reflection, different colours reach the observer's eye.



2. Atmospheric refraction

We can observe the apparent random wavering or flickering of objects seen through a turbulent stream of hot air rising above a fire or a radiator. The air just above the fire becomes hotter than the air further up. The hotter air is lighter than the cooler air above it, and has a refractive index slightly less than that of the cooler air. Since the physical conditions of the refracting medium (air) are not stationery, the apparent position of the object, as seen through the hot air, fluctuates. This wavering is thus an effect of atmospheric refraction on small scale in our local environment. The twinkling of stars is a similar phenomenon on a much larger scale.

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Twinkling of a star: The twinkling of a star is due to atmospheric refraction of starlight. The starlight, on entering the earth atmosphere, undergoes refraction continuously before it reaches the earth. That atmospheric refraction occurs in a medium of gradually changing the practice index.

Since the stars are very distant, the approximate point- sized sources of light. As the path of rays of light coming from the star goes on varying slightly, the apparent position of the star fluctuates and the amount of starlight entering the eye flickers- the star sometimes appear brighter, and some other time, fainter, which is the twinkling effect.



Why don't the planets twinkle?

The planets are much closer to the earth, and thus seen as extended sources. If we consider a planet as a collection of a large number of point- sized sources of light, the total variation in the amount of light entering our eye from all the individual point- sized sources will average out to zero, there by nullifying the twinkling effect.

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3. Advance sunrise and delayed sunset

Advance sunrise and delayed sunset the Sun is visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction. By actual sunrise, we mean the actual crossing of the horizon by the Sun. Figure shows the actual and apparent positions of the sun with respect to the horizon. The time difference between actual sunset and the apparent sunset is about 2 minutes. The apparent flattening of the Sun's disc at sunrise and sunset is also due to the same phenomenon.



Advance sunrise and delayed sunset :-