THE GREEN FLASH

Explore this elusive, mysterious, and colorful atmospheric phenomenon.

By Michael Tinnesand

It was the predawn hour, and our expedition ship was en route from Bora Bora to Raratonga in the South Pacific. I was waiting at the rail off the ship's bridge to see "the green flash", certain that I was looking foolish. The previous night some naturalists described a phenomenon known as the green flash as a momentary flash of green, observed just as the Sun first came over the horizon at sunrise or slipped below the horizon at sunset. I was fairly certain this was a shipboard prank pulled on unsuspecting vacationers; but there I was, standing at the rail just before sunrise the next morning.

I was not the first to be skeptical—over the years many speculated that the green flash was an illusion or fantasy. In 1882, Jules Verne created renewed interest in the phenomenon in his novel *Le Rayon vert (The Green Ray)*, where he described the green "flash" as it is commonly known today.

Explaining the green flash

The most basic explanation of the effect is that the atmosphere acts as a prism, bending the sunlight and spreading it into the component colors of the spectrum. The amount of bending when the Sun is very low on the horizon is significant—about a half degree, or roughly the same as the angular diameter of the Sun as you view it in the sky. Although the Sun is actually below the horizon, the atmosphere bends the light enough so that you can still see it. Because the component colors of light (red, orange, yellow, green, blue, and violet) have different wavelengths, they bend by different amounts. Violet, with the shortest wavelength, bends the least, and red, with the longest wavelength, bends the most.

Given this description, you might expect to see several "suns" with their images overlapping—a red sun on the bottom, followed by orange, yellow, green, blue, and violet stacked on top. The actual result, however, is not this simple. The sun images overlap a great deal; ozone and other substances in the atmosphere filter out much of the orange color, and the shorter wavelengths (blue and violet) are scattered—that's what makes the sky appear blue. So, as the Sun disappears below the horizon, the last sliver of light appears green to your eye for just an instant of time, resulting in the elusive green flash (see figure).

Thus, as I stood on the deck of the ship, watching the horizon brighten, I was rewarded with a pleasing burst of green, lasting less than a second, but no less memorable for its brevity. Exotic, beautiful, and real...the green flash can be explained by understanding the nature of light and the atmosphere in which we live.

The green flash is sometimes claimed to be an afterimage effect of light on the retina, because staring at a bright red light and then looking at a white screen causes a green afterglow. However, afterimages affect vision only and cannot be photographed. The green flash is real and can be photographed—photographic images are not subject to afterimages.

At sunrise and sunset, as sunlight passes through the Earth's atmosphere, it is slightly bent. This light is dispersed and separated into the different colors of the spectrum. The results are colored upper and lower edges on the Sun's disk.

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