

The Green flash

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Fascinating and colourful optical phenomena in the atmosphere are a source of delight when you know what to look for and a demonstration of varied aspects of the science of light, painted large on the canvas of the atmosphere. Rainbows, haloes and glories are three classes of these phenomena, occurring under differing atmospheric conditions. Our textbook devotes a chapter to these appearances, a chapter not formally covered in the lectures. An even more elusive phenomenon is 'the green flash'. The green flash can be seen 'under suitable conditions' when the Sun is rising or setting over a distant horizon. It's mainly described as a setting Sun phenomenon but I live in a house with a clear view of the winter Sun rising over the cold North Sea. I could perhaps see it on holiday beside some west coast and believe me I've looked often enough but during the day sufficient haze usually builds up in the atmosphere even in cloudless conditions that the Sun always seems to sink into the haze and not into a clear sea horizon. No green flash.

You'd think the rising Sun in winter would experience this problem much less. Apart from the fact that we live in a part of the world when cloudy days far outnumber clear days, there is a problem of seeing the green flash over the winter sea that I should have anticipated but didn't until I started looking. Our winter sea may be too cold to bathe in (as is the summer sea!) but it's warmer than the land. Convection clouds build up over the sea in winter even when the sky over the land is cloudless. On a typical cloudless pre-dawn sky, and there aren't many of these in any winter, look out to sea and you'll see cloud. What all this boils down to is that the green flash is an elusive phenomenon from all the places I've found myself in the world.

Others have found the green flash elusive too. It's been said half in humour that if anyone is stupid enough to look directly at the setting Sun then it would hardly be surprising if they saw green fairies in their eyes, never mind a green flash. Well, photographs of the green flash show that it is certainly a real, objective phenomenon. It occurs at the very last seconds of sunset or the very first seconds of sunrise, when a small fraction of the Sun's disc is visible and you won't do your eyesight any harm by looking then. Why would the Sun ever flash green? That, too has been debated. I'll leave you to look up a good meteorological optics textbook on the subject (indeed there is one book entirely devoted to the green flash) but the gist of the matter is that it is a dispersion phenomenon, arising because the atmosphere bends different coloured light by different amounts. It's the very same phenomenon that causes a prism to produce a spectrum but in the atmosphere the effect is very weak. Why is only the green sunlight left? In brief because the red component hits the Earth and the blue component is scattered away, but I'll leave you to look up the details. This isn't a course on optics.

Have I ever seen the green flash? Yes, on a few occasions from our house. The first time was the 30th of January 1997 and this was my experience.

Eureka! I've seen it! After a couple of years of looking on an occasional basis I pulled back the curtains today at about 0730 and saw in the pre-dawn sky a light painting of red on the horizon, beneath a deep, cold blue sky just bright enough to extinguish sight of the stars. To the south-east a half moon shone clearly through low cloud. I looked more closely. There were no clouds on the horizon, though distant grey smudges could be seen above it. By eight O'clock an arch of brighter orange suggested where the Sun would rise, just north of a

distant inshore fishing boat, seemingly stationary on the calm sea. At almost 0810 I thought it would be another five minutes to first Sun but I stayed to watch. In less than a minute I saw it – a brilliant green light just left of the fishing boat, turning white before becoming flame orange. About two seconds was all the time it took before the orange came and the Sun seemed to rush out of the sea. Two seconds to commit to memory the purity, brilliance and strangeness of the first sunlight: green and white, not orange. I had seen ‘the green flash’. I’d read what to expect, quite often in fact, but I was still left with a sense of astonishment. It really happens. I stood and watched the flattened sector of the red sun rising up, before leaving the window to sit down with the after-image of the Sun wandering in my eyes and the after-thoughts wandering through my brain. The after-image faded quickly but two hours later the after-thoughts are still here.

Since writing the above in 2008 I’ve had the pleasure in 2013 of staying with my nephew who now lives in San Diego near the promisingly named Sunset Cliffs Boulevard. His house has a roof-top patio (this is America) overlooking an expanse of the Pacific with terrific views of the setting sun. San Diego also has remarkably little cloud and a lot of sun. For the several days I was there we sat on his patio in the early evening and watched the setting sun sink rapidly beneath the waves. On the first night he said that many people he knew thought that the green flash was a myth, like the Loch Ness Monster. After some discussion aided by a nice Sauvignon Blanc (NZ not Napa Valley) the trouble seemed to be that people expected a flash, like green lightning, to suddenly illuminate the orange sky. The green flash isn’t a flash in that sense, it’s a flash mainly in time, a fleeting appearance of green sunlight as the dying rays of the sun are extinguished by the horizon. Where we were, the sun seemed to plummet into the sea pretty steeply, the angle being about 55°. At home it slides more gently beneath the waves, especially in winter. As the sun dived down, the last sliver of the Sun’s disk did appear green for just a fraction of a second. I wasn’t the same from day to day and was in truth more of a visual whimper than a visual bang. My companions were underwhelmed but I still thought it was pretty good. I tried to catch it on my point-and-shoot camera and the attached picture doesn’t quite do the greenness justice. Maybe the shutter clicked a fraction of a second too soon. The central dot of light looks rather white but it does at least show that the spot is tiny, for the image is only the middle section of the whole photograph. The inset circle top left shows the size of the sun on the same scale. The winter dawn flash at home was definitely a more convincing spectacle.

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