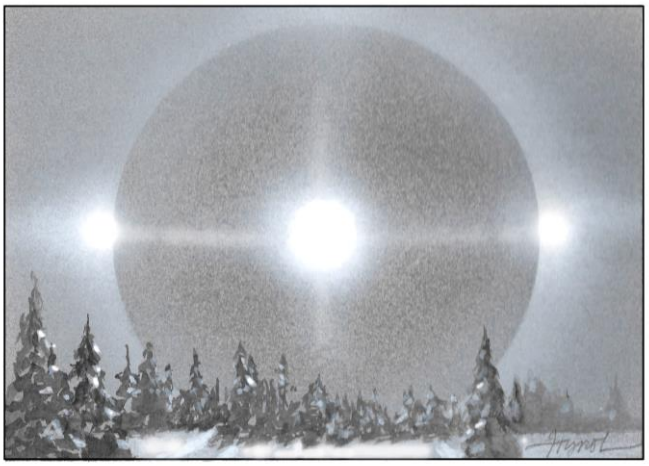
The Outside Story



Sundogs and Halos and Glitter – Oh, My!

By: Meghan McCarthy McPhaul

Had a unicorn pranced across the trail in front of me, I wouldn't have been surprised.

It was one of those sparkly winter days, when snow drapes fir trees and glints across the landscape. I was at the top of Cannon Mountain in New Hampshire's Franconia Notch, and an undercast made it seem as if the summit were a sunny island above a sea of clouds. To add to the wonder, there was something magical happening in the sky, which shimmered with color and light.

All around me, skiers stopped to take photographs and exclaim at the sky show. It turns out there were several sky phenomena on display that day, including two commonly seen in winter: sundogs, where mock suns flank the real sun, and a 22-degree halo. Both derive their magic from simple ice crystals.

The coldest season, it turns out, is a great time to look for wonder in the sky.

"Halos and sundogs are commonly seen in the winter, as light from the sun passes through ice crystals," said Tom Padham, a meteorologist and education specialist with the Mount Washington Observatory. This is due not only to the fact that there are more ice crystals present during the cold of winter, but also because of the low angle of the sun.

These ice crystals are tiny bits of frozen water that remain suspended in the atmosphere. As Padham explains it, the hexagonal crystals form when temperatures high in the sky are super cold – generally below -22 degrees Fahrenheit. When the sun's light passes through the crystals, it is refracted. Light rays are bent twice – once entering through one side of the crystal, and again exiting through another side. Because the crystals' sides, or faces, are inclined 60 degrees from each other, the refraction deviates the ray by about 22 degrees.

Usually this happens when there are thin cirrus or stratocirrus clouds high in the sky. These clouds are composed of a multitude of tiny ice crystals and tend to be thin enough that the sky appears mostly clear – as it did that day at the top of the mountain. As the sun's light passes through all those crystals and refracts, a halo – or full ring of light – appears around the sun.

A sundog – more scientifically known as a parhelion – appears like a glowing spot to one or both sides of the sun, about where the 3 and 9 are oriented on an analog clock face. Sundogs form when those hexagonal ice crystals are oriented so their broad sides are horizontal as they fall through the sky. They're most easily spotted when the sun is close to the horizon. Sundogs can be mostly white or have a rainbow of colors, with red closest to the sun and blue on the outside.

"Really, the higher the density of ice crystals in the air, the better the chance for enough individual crystals to be lined up properly," said Padham. "We're only seeing those that are at particular angles to a light source, but there are many more that are not seen by the naked eye. All you need is cold weather, some moisture in the air, and the right angle from the sun."

While sundogs and halos are relatively common – and can appear even during warmer months, since the temperature high in the sky can be cold enough for clouds to have ice-crystals – what made that day at Cannon extra sparkly was the presence of diamond dust. Also known as clear sky precipitation, diamond dust consists of tiny ice crystals that form near the ground and then float slowly in the air. It looks like glitter suspended in space.

Because of this close-to-the-ground, clear sky precipitation, the halo – normally best seen when the sun is high in the sky – was visible even as the sun sank toward the horizon, since there were crystals both in the high cirrus clouds and close to the ground.

There was more happening in the sky that day, including a parhelic circle, an upper tangent arc (like an inverted partial rainbow at the top of the halo), a rare Parry arc (above the upper tangent arc), a superlateral arc (a rainbow above the halo), and a circumzenithal arc (curving upward from the superlateral arc). The only thing missing was that unicorn I kept expecting to trot past.

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