Beginner's guide to chasing rainbows

A little knowledge can go a long way in helping you find, understand and photograph rainbows, explains *Yoav Daniel Bar-Ness*

We are hardwired to appreciate colour, and there are few sights as wondrous as a bright rainbow shimmering across the sky. There are many variations of this atmospheric phenomenon, including the sky-arc, shimmer, halo and sundog, but let's start with the most familiar: the 42-degree arc.

This is the rainbow of myth and legend; a promise after the Great Flood, a bow for Indra the Rain Lord and the narrow pathway to heaven. These are easy to find when the conditions of water vapour and sunlight are correct. Look in the opposite direction of the sun, imagining a line from the star to your eyes and continuing through towards a point below the horizon. A rainbow will be seen above the horizon at a 42-degree angular distance from this anti-solar point. A fainter rainbow may sometimes be seen at 51 degrees, and together these make a double rainbow.

No matter how far the rainclouds, sprinkler, or waterfall, the rainbow will always be in this same relative position; you will never see an arc rainbow to the north in the southern hemisphere.

The biggest rainbows will be seen at sunrise or sunset when the sun is low, or when you are looking downwards from high above the ground. The temperate latitudes will also generally have more intense rainbows than the tropics because the sun spends more time at a low angle. So if you are on the ground at the equator, you will never see a rainbow at midday; the sun is directly overhead and the anti-solar point will be at your feet.

With a bit of foresight and practice, you can up your chances of photographing rainbows. If you see a dark cloud with the sun shining on to it, for example, the conditions are potentially right for a rainbow. If you are hoping to see a rainbow splash into the ocean at the beach in Sydney, it will be at sunset. If you'd like to see a rainbow over the Indian Ocean at Perth, it will be in the morning.

Waterfalls are excellent places to study and photograph rainbows on a clear day. If you can find the right position relative to the sun and water, you'll find the rainbow. It's a true delight to come across the elusive colours in such a dependable way.

The moon, with its silver light, can also form rainbows in the same position as a sunlight rainbow, although far fainter to the human eye. These can be captured more effectively in a long exposure shot.

Rainbows can appear in low fog, seawater or in clouds containing ice crystals too. On the abundant coastal trails of Australia, you'll see a rainbow dancing in the waves if you time it right. It helps to be on a small rise above the water or actually in the water between the waves.

There are also stranger varieties of colourful atmospheric phenomena.

If you are above the clouds, on a mountaintop or in an aeroplane, you may look beneath to see the rare Brocken spectre or bow. Named for a mountain in the Hartz Region of Germany, this is a small ring of colours between five and 20 degrees with your shadow appearing in the centre. On a mountain, you will see your own shadow merging with the shadow of the mountaintop, surrounded by a rainbow halo. On a plane, you will see the shadow of the aircraft in the centre. These spectres, so long the prize of the mountaineer, are now surprisingly common for the midday air passenger.

When there are ice particles high in the sky it's common for a complete ring of colours to appear around the sun or bright moon, though this is rarely noticed. The apparent radius of the halo is 22 degrees, and its colours are muted relative to the arc rainbows. On very rare circumstances, haloes appear at 18 or 20 degrees, and smaller rings of colour can appear around the moon. A corona appears as a much smaller, fuzzy halo, close enough to the moon that it can appear to be a single disk.

There's actually an intriguing link between the orientation of ice crystals in clouds, the presence of these haloes and the global climate. Murray Hamilton, associate physics professor at the University of Adelaide, says: "The puzzle is why some cirrus clouds, which on account of their altitude must be ice, do not form halos at all. The reflectivity of the clouds, and therefore the amount of heat on the planet, is the result of still-unknown process of cloud formation."

He continues: "This seems to be linked to the life cycle of the clouds, where possibly the ice surface roughness increases with repeated sublimation [*solid becoming gas*] and deposition [*gas becoming solid*]." Scientists study how clouds scatter light, and therefore radiation back into space, when compiling climate models.

At sunrise or sunset, parhelia or 'sundogs' may appear as companions to the sun. These bright arcs extend outwards horizontally from the 22-degree halo. Only visible for a short time, sundogs are caused by the vertical alignment of ice crystals in the atmosphere, which refracts light along the horizontal plane. First described by Aristotle, sundogs have frequently been recorded as little suns in their own right.

There are many more arcing and sometimes colourful atmospheric phenomena that are rarely spotted, including iridescent shimmering clouds, circumscription arcs, circumzenithal arcs, fourth-order rainbows, parhelic circles, Lowitz arcs, supralateral arcs, 46-degree halos, subhelic arcs, tricker arcs, Wegener arcs, tangent arcs, sun pillars, tertiary rainbows, quaternary rainbows, dewbows, reflection bows, cloudbows, fogbows, twinned bow and supernumerary rainbows.

In Australian conditions, however, the vast majority of rainbows you'll spot are the familiar 42-degree anti-solar arc and the 22-degree halo.

3 PROMISING SPOTS FOR RAINBOW SEEKERS

- Albany, WA: A south-facing coastline means you'll see midday rainbows over the Southern Ocean
- Mount Wellington, TAS: You can drive to the summit and see evening rainbows over Hobart to the east
- Blue Mountains, NSW: An abundance of waterfalls and wide, open vistas offers a happy hunting ground for bright colourful arcs

For more about atmospheric optics:

Atoptics.co.uk
Weatherscapes.com
Meteoros.de/indexe.htm


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Capturing rainbows with a camera becomes much easier when you know where to look. Remembering the rainbow types and their angular distances means that, with a bit of practice, you'll find you can predict a rainbow before you actually see it. The following experiences of mine may inform your own rainbow-hunting excursions.

1. SALTWATER WAVEBOW

The south-western corner of Australia is not only blessed with a globally significant diversity of flower species but is also an excellent area to see morning rainbows over the ocean. Walking on the Cape to Cape Track, along the limestone cliffs, I was surprised and delighted to find a bright rainbow appearing rhythmically in the saltwater waves of the Indian Ocean.

2. FOGBOW

A rainbow over cold fog can be encountered on snowfields or on cold mornings. A crisp and bright morning snowshoe in the Australian Alps can bring you into patches of fog hanging in depressions, where these fogbows sometimes appear.

3. DOUBLE BOW

On the road through the Australian Alps, when the clouds were bringing rain in isolated pockets, a brilliant double rainbow splashed down from the sky. As one cloud drifted away, leaving me in sunshine, the raindrops falling from the cloud nearby refracted the light strongly so I could see the difference in colour orientation
between the two bows.

4. SOLAR HALO

There must have been a region of ice crystals high overhead between the mid-morning sun and where I stood when I spotted this 22-degree halo and photographed it from beneath a grass tree.

5. AT RAINBOW'S END

An afternoon bushwalk on Mount Wellington west of Hobart will often provide bright rainbows dropping down towards the city and Derwent River. These rainbows are oftem cut off abruptly when strong afternoon sun dips behind the summit.

6. SUNDOG

Looking westwards at sunset from the coastal escarpment at Nightcliff in Darwin, I photographed a rare evening sundog near the horizon and level with the sun. While its colours were faint compared to the brightness of the sunset, the arcing shape and the angular size revealed a fragment of a 22-degree halo. When sundogs are exceptionally strong, horizontal beams radiate outwards from the halo. W