1- THE RAINBOW PHENOMENON - THE BUNDLE OF COLOURS

On the morning of my departure from Zurich airport, I make my way to my gate after passing through the endless line of controls. Just then, something beyond the large, imposing windows strikes me with its delicate beauty: in the distance, behind the queues of planes, a beautiful rainbow can be seen. I immediately think of the fact that this riot of colour is often understood as a sign of good luck and this, in view of my departure, makes me smile. Seeing a rainbow in the sky on the same morning that I am about to take off for the Faeroes, where I will be carrying out research on colour, seems like a beautiful coincidence. And yet, looking at it, my curiosity is aroused: how come in this case it is only possible for me to see a small part of that famous arch while at other times it is possible to see it in its entirety? What makes one rainbow different from another?

Scientific explanation

The rainbow is an optical phenomenon produced by water droplets acting like many small prisms that give rise to an almost continuous spectrum of light in the sky, where the sunlight itself passes through the droplets in suspension. The sunlight scatters and is reflected and refracted within the water droplets. We can see the result, the rainbow when our eyes intercept the various coloured rays. However, it is only possible to observe the rainbow under one condition: we must be at an angle of 40/42° with respect to the direction of the rays hitting the drops. In fact, we can only see the rainbow if the Sun is positioned behind us, not if it is in front of us. Precisely because, in order to observe it, we have to be in a specific position, the rainbow is a phenomenon without a physical location, therefore called "evanescent". The amount of light refracted depends on its wavelength, to which a colour is associated. Shorter waves are typical of blue light, which is refracted at a greater angle than red.

The Sun's ray, which appears white and arrives from the light source (Sun) positioned behind our backs, reaches the drop, enters it and is broken down into its various colours. The blue colour will be refracted (or more commonly bent) more than the red colour, therefore at a smaller angle. At this point both rays are partly reflected as in a mirror inside the drop itself and it passed through the drop again coming out at a different angle. The blue ray will have an angle of 40° to the initial white ray and the red ray 42°. Because of this different angle the red light will appear higher in the sky, forming the colours that are outermost in the arc.

The size of the drops determines whether and to what extent each colour is present. If it has rained a lot, the drops are larger and will therefore form a reddominated arc. We can see a semicircle because the location of the points where what we have just described happens is geometrically symmetrical with respect to us. The secondary rainbow has slightly different characteristics: it is darker, larger and more visible outside the primary arc and, as the light loses energy with each reflection, it appears more attenuated. This 'second rainbow' is due to a double reflection of sunlight inside the raindrops, and appears at an angle of 50°-53°. In this case the colours are reversed because of the extra reflection: blue on the outside and red on the inside.