What is a Dark Sky?

Dr. Larry Field

The author viewing astronomical targets with large binoculars under a dark sky, which includes the Large Magellanic Cloud at lower right.

In July 2022 the Kaikōura Dark Sky working group made a major step forward with the signing of the Trust Deed to become the Kaikōura Dark Sky Trust. Dr. Larry Field, one of the seven Trustees, said that this will allow the group to make substantial progress in fulfilling the requirements to become an International Dark Sky Reserve. The aims include protecting, enhancement and preservation of the exceptional night skies of Kaikoura District. Ultimately this should set the scene for boosting the local economy by encouraging astrotourism in local businesses.

While a major aim is to protect dark sky, in the public's mind this term can easily be misinterpreted. A dark sky does not mean that Kaikoura becomes a dark town (as misunderstood by our local cartoonist). Instead, 'Dark Sky' is a term used by astronomers. It means, "**A pristine night sky with no artificial light pollution**." Looking up at a dark sky, one should see that the background is very dark, and the Milky Way stands out in high contrast. The sky should be filled with stars, and constellations should be easily visible. We should be able to see both Magellanic Clouds, our closest neighbouring galaxies, which are unique to the Southern night sky. By contrast, in light polluted environments, the atmosphere is illuminated by scattered or direct artificial light from below, and the sky contrast is lost along with the stars. A good example of this kind of light pollution is found in Christchurch, Wellington and Auckland.

Typically about 6000 stars are visible to the human eye in a dark sky, and these available to us in the excellent dark skies of Kaikoura. Also unique to our skies are many outstanding deep sky objects not visible in the Northern Hemisphere. These include immense glowing nebulae comprising clouds of hydrogen, many star clusters including the largest globular cluster discovered in our galaxy; it is over 10 billion years old and contains around 10 million stars compacted into a spherical structure held together by gravity. We can also

see many galaxies which are far beyond the bounds of our own Milky Way galaxy, at distances measured in millions of light years. These celestial objects can be viewed with binoculars and telescopes and they attract astronomical enthusiasts from around the world to the dark skies of the Southern Hemisphere.

Dr. Field said that a critical part of qualifying as a Dark Sky Reserve is providing proof of the darkness of the night sky. We are doing this by using five extremely sensitive scientific grade photometers. When one of these Sky Quality Meters (SQMs) is held in the hand and pointed overhead at the night sky, it can spend up to 80 seconds gathering starlight. It then gives a measurement for the amount of light per square arc second of sky (1/60 of 1/60 of one degree square; 1 degree is twice the full moon diameter). It is amazing to realize that this meter can pick up photons of light that have left stars and galaxies thousand to millions of years earlier, travelled through the universe to finally hit the sensor of the SQM. Even the nearest star to us gives off light that has to travel for 4.2 years over 41 million million km before reaching Earth and entering the lens of our photometer. It is an interesting irony that if we aim the SQM at the Milky Way, its light is bright enough to register as light pollution against the dark background of the cosmos on either side!

The results of our measurements since 2021 show that Kaikoura has exceptionally dark night skies. This gives us a solid basis for our efforts to gain the International Dark Sky Reserve status. However, our dark skies are still threatened by light pollution. All towns and cities give off artificial light at night which shines up into the sky, and Kaikoura is no exception. Our challenge is to shield these lights so they don’t allow upward emission (as done by the District Council recent retrofit of streetlights). Currently we are working with the Waka Kotahi NZTA to install new shielded LED lighting along Highway 1 in order to remove the major upward light pollution currently seen each night. An added benefit should be a reduction in the strong light spill onto private residences along Churchill St and Beach Rd.

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