STS 2024: Science Photography

Aurora Australis

Aim:

To capture images that display the beauty of the Aurora Australis and different auroral forms.

Introduction:

I saw a photo of an Aurora when I was 6 years old. I really liked the big green glowing beams, and it made me want to see an Aurora in person. While I have been hunting an aurora, I have learnt about the science behind the distinct colors of light seen in the Aurora and how different auroral forms are created. The Aurora Australis is something more people should see.

Methods:

I used an iPhone app (Glendale App – https://aurora-alerts.uk) to follow the space weather. I saw there was a strong chance of an Aurora on 11 May 2024.

To get the best chance of seeing an aurora I went to Sorrento (VIC), where there were clear skies with a view to the south and no light pollution.

I set up a Sony A7iii camera with a Sony FE 16-25mm f/2.8 G lens on a tripod to stop the camera moving when I took long-exposure photos, so the photos would not be blurry.

I manually focused on a star. I set the aperture to f/2.8, the highest aperture, to optimise the amount of light captured. I varied my iso and exposure throughout the night to get a variety of photos and to adapt to the changing conditions.

I did not use photo editing software.

Discussion of scientific content:

1. Solar storms.

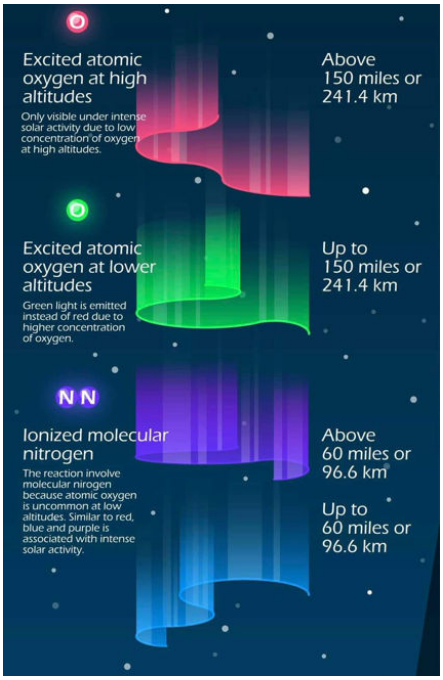
   The aurora australis can be produced by space weather events known as solar storms.

   Solar storms occur when there is a magnetic eruption from the sun, known as a solar flare. Solar flares can emit a huge burst of energy, known as a coronal mass ejection, or CME. CMEs are made up of charged particles that get thrown into space and carried away from the sun as solar wind. When a CME is directed towards Earth, charged particles can interact with atoms in our atmosphere to produce an aurora (NASA Science 2023).

2. Colours of the Aurora: Light emission in the Earth's atmosphere, caused by a solar storm.

   When a CME reaches the Earth's atmosphere, most charged particles get deflected by the Earth's magnetic field. Some, however, enter the Earth's magnetic field near the North and South Poles. When the particles collide with oxygen or nitrogen in our atmosphere, it excites them. When ionised particles react with oxygen, green light is emitted at low altitude and red light at high altitude. When nitrogen is excited, it can produce light that is purple or blue (CSA 2014). These lights are what we see in an aurora (Figure 1). Photos 1-4 all show the changing colours and light intensities seen during a single aurora event on 11 May 2024.

Figure 1. Colours of an Aurora (CSA 2014)



3. Forms of the aurora.

Lights of the aurora can take various forms when seen from Earth. I have presented four photos because they each demonstrate unique auroral forms, colours and patterns during the same aurora event.

Diffuse aurora

A diffuse aurora occurs when the charged particles enter the earth's atmosphere over a large area. This aurora appears hazy and foggy. Photo 1 shows a diffuse green aurora above and below the bright band of light (auroral arc) in the middle of the frame (NASA science, date unknown).

Auroral arc

An auroral arc is a band of light that appears as a continuous curved line (an arc) in the sky. It occurs when the aurora moves further from the magnetic poles (ie. a lower latitude). This is stronger than a diffuse aurora (Hunter, date unkown). An auroral arc can be seen in photo 1 as a bright band of green light in the middle of the frame. It is also seen clearly in photo 2, and with less clarity in photos 3 and 4.

Beams

Auroral beams occur when aurora becomes stronger (Hunter, date unkown). They look like vertical rays of light coming up from the arc. Beams are demonstrated in photos 2, 3, and 4.

Dune aurora

Dune auroras are rare. They occur when solar wind particles rain down onto a type of gravity wave disturbance called a ‘mesospheric bore’. Light emitted from the aurora illuminates the atmospheric rippling structure, giving the appearance of sand dunes in the sky (Grandin, Palmroth, Whipps, 2021). This phenomenon is seen in photo 1 on the right-hand side of the frame, in line with the auroral arc, just above the clouds.

Acknowledgements:

I would like to thank my mum for driving me to Sorrento, proofreading my report and helping me write my references.

Word count: 699 words

Oral Presentation:

My oral presentation can be accessed online at these two publicly accessible links:

https://drive.google.com/file/d/1QM7-Tfbit9SX2SHrt2Vw34uc4Ok_Q-72/view?usp=sharing

AND

https://www.dropbox.com/scl/fi/tt786ic2fxp9a9mw169z4/Video_JellisOliver_AuroraAustralis_PF-1-657.mov?rlkey=k4m67g7m2smwhvm23ml35fq8i&st=r4ketrg0&dl=0

References:

CSA Canadian Space Agency (2014), Colours of the Northern Lights, https://www.asc-csa.gc.ca/eng/astronomy/northern-lights/colours-of-northern-lights.asp. Accessed July 12, 2024.

Grandin, Palmroth, Whipps et al. (2021), Large-Scale Dune Aurora Event Investigation Combining Citizen Scientists' Photographs and Spacecraft Observations, *AGU Advances*, 2(2). https://doi.org/10.1029/2020AV000338. Accessed July 12, 2024.

Hunter D (Date unknown), Aurora types. https://www.huntergeophysics.com/aurora-types/. Accessed July 12, 2024.

NASA Science (Updated 15 June 2023), What is an Aurora?, https://spaceplace.nasa.gov/aurora/en/. Accessed 3 June 2024.

NASA Science (Updated 7 August 2017), Layers of the sun. https://www.nasa.gov/image-article/layers-of-sun/. Accessed 10 July 2024.

NASA Science (Date unknown), Different types of auroras. https://svs.gsfc.nasa.gov/vis/a000000/a004900/a004934/Different_Types_of_Auroras.pdf. Accessed July 12, 2024.