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## Rayed Arcs and the 'Rory Bory Aylis': Primary World Aurorae and Tolkien's 'Father Christmas Letters'

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Rayed Arcs and the 'Rory Bory Aylis': Primary World Aurorae and Tolkien's *Father Christmas Letters*

*Expanded from a portion of a keynote address delivered at the 50<sup>th</sup> Tolkien Society Oxonmoot.*

On September 9, 1898, a brilliant display of the Northern Lights could be seen over much of Europe, as far south as Paris and Rome. Multiple eyewitness accounts appeared in British newspapers and magazines, describing “streamers” and an “arch of yellowish light” (Corder 1898, 25-6), with red and orange tones visible at some locations (Jago 2001, 53). The display started soon after sunset and eventually became so bright southwest of London that it covered the entire northern half of the heavens and was “sufficiently strong to cast shadows and to show large print distinctly” (Russell 1898, 496). On that night, six-and-a-half-year-old John Ronald Reuel Tolkien and his younger brother Hilary would have been able to see this wondrous display from their home near Sarehole Mill in the outskirts of Birmingham, assuming skies were clear and their mother allowed them to stay up past their bed time.

To the best of my knowledge, we have no evidence that Tolkien witnessed this particular celestial wonder; if he did, he apparently left no written record in the public domain. But we know from his own admission that at that age he “liked many other things as well, or better” than fairy-stories, “such as history, astronomy, botany, grammar, and etymology” (*OFS* 56). It is also clear from the level of astronomical detail in his legendarium (and other writings) as well as his artwork that he had often observed the night sky and had a more than passing knowledge of its details. For example, not only are real-world constellations clearly represented in Middle-earth (e.g., Getty 1984; Quiñonez and Raggett 1990; Manning 2003), but the sequential rising of the winter stars and constellations (including the Pleiades [Remmirath], Orion [Menelvagor/Menelmacar], and Sirius [Helluin, Gil]) (*FOTR*, I, iii, 91; *BOLT II* 281)<sup>1</sup> is accurately described. The curious apparent motion of Arcturus (Morwinyon) – noted by Classical authors to set quite slowly in the West due to its position near the Big Dipper – is transformed by Tolkien into a star that always remained in the Western sky (*BOLT I* 114).<sup>2</sup> The early poem “Kortirion Among the Trees” (1915) correctly describes the late fall/early winter appearance of the full moon near the Pleiades (*BOLT I* 35) and the seasonal motion of the Big Dipper as it swings around the North Star (*BOLT I* 33, 35).<sup>3</sup>

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<sup>1</sup> For more discussion, see Larsen (2005) and Larsen (2022).

<sup>2</sup> For more discussion, see Larsen (2010).

<sup>3</sup> For more discussion, see Larsen (2018).

In the etiological mythology<sup>4</sup> of Middle-earth, heavenly battles routinely invoke astronomical events such as eclipses, becoming either signs of Melkor's marring of the world or mighty weapons in his arsenal of destruction. For example, solar eclipses are caused by the unrequited desire of Tilion, the driver of the moon, for the brilliant Arien, who drove the sun, causing him to deviate from the heavenly motion that was appointed to him by Varda. Because of this, "at times it will chauce that he comes so nigh that his shadow cuts off her brightness and there is a darkness amid the day" (*Sil* 101). Lunar eclipses are caused by Morgoth's hostility towards the great heavenly lights; thus he "assailed Tilion, sending spirits of shadow against him" (*Sil* 101). Tolkien was therefore well-versed and well-practiced in the use of etiological myths in his world-building activities. But we should remember that Middle-earth was not his sole Secondary World; in fact, one of the most interesting can be found at Tolkien's version of the North Pole (Larsen 2023a).

In December 1920, a three-year-old John Francis Reuel Tolkien questioned his father about Father Christmas and his home. To the child's delight, a letter subsequently arrived from the North Pole, penned by Father Christmas himself in his shaky handwriting (due to his advanced age), accompanied by exquisite hand-drawn illustrations (Tolkien Estate 2022).<sup>5</sup> Letters continued to arrive from the North Pole through 1943, as the four Tolkien children grew up and in succession eventually became too old to hang up a Christmas stocking.<sup>6</sup> While the first few letters were brief, in Tolkienian fashion they "grew in the telling" (*FOTR*, Foreword, 5), becoming increasingly mythological. The extant letters (including the text, illustrations, and images of the envelopes and hand-drawn stamps) were published after Tolkien's death, edited by his daughter-in-law, Baillie Tolkien, first in abbreviated form in 1976 and then more completely in 1999.<sup>7</sup> As Dimitra Fimi (2017) explains, etiological myths sprang up within the letters (involving battles between Christmas elves and goblins, and the misadventures of the well-intentioned but rather clumsy Polar Bear – Father Christmas' chief companion). These became explanations for why the children might not receive exactly what they asked for in their stockings that particular year.

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<sup>4</sup> Etiological myths explain some natural event, such as earthquakes, thunderstorms, meteors, or rainbows.

<sup>5</sup> Many illustrations from the letters are reproduced on the Tolkien Estate website, specifically under a discussion of paintings made for children (<https://www.tolkienestate.com/painting/for-children/>). The reader is encouraged to visit this website whenever it is referenced in this article (as 'Tolkien Estate 2022') in order to view an image of the work in question. No illustrations made by Tolkien are reproduced in this article.

<sup>6</sup> The 1921 and 1922 letters are lost (Scull and Hammond 2017b, 420).

<sup>7</sup> Citations in this paper refer to the pagination of the Centenary edition (2020).

Christina Scull and Wayne Hammond point out a particular etiological myth in the letters that was motivated by the same real-world astronomical event that inspired a similar scene in Tolkien's whimsical children's book *Roverandom*. In 1927 the Man-in-the-Moon visited Father Christmas, and under the influence of brandy fell asleep and was rolled under the couch by Polar Bear. In the Man's absence the moon dragons created "an awful smoke and bother" resulting in the moon "going out," namely causing a lunar eclipse (*FC* 45). Similarly, in *Roverandom* (which Scull and Hammond note was also written down around Christmas 1927 [2017c, 111]) the Man saves the mischievous eponymous dog and his companion, the moon-dog, from their foolish awakening of the Great White Dragon by throwing a "dark, black spell that looked like jellified tar and honey" at the dragon, causing him to neglect his duties and making the next eclipse "a failure" (*Rov* 35-6). As Scull and Hammond (*Rov* xiii) point out, a real-world lunar eclipse was spoiled by cloudy weather in England on December 8, 1927; it should be noted that this was the second "failure" of an eclipse in England that year, as the June 29, 1927 total solar eclipse was likewise largely spoiled by clouds along the path of totality (Marriott 1999, 138).<sup>8</sup>

But eclipses are not the only astronomical references in the *Father Christmas Letters*. The moon, stars (including a brilliant, isolated star that could reference the famed Christmas star or Star of Bethlehem),<sup>9</sup> a comet, and especially aurorae light up the otherwise dark Christmas-time skies of the North Pole. Priscilla Tolkien (1992, 9) observed that "[m]uch astronomy is brought into the fantasy," which was not surprising to her because astronomy was "of great interest to my father and I can recall how my brother Christopher and I were encouraged to learn about the stars and planets and eclipses of the sun and moon.... These references give a great sense of reality to Father Christmas's world." It also gives the reader a window into the role of astronomy in the Tolkien household; in the 1938 letter Father Christmas shares with Priscilla that he is bringing Christopher several gifts that year, including "a small astronomy book which gives a few hints on the use of telescopes – thank you for telling me he had got one" (*FC* 164). As might be expected of Tolkien the impressive collection of astronomy in the letters is largely scientifically accurate, especially concerning the aurora borealis, the northern lights. This paper summarizes the instances of auroral references (in text and illustration) in the *Father Christmas Letters* and connects them to real-world auroral displays visible in England, demonstrating how closely Tolkien's depictions follow scientific reality despite their whimsical nature.

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<sup>8</sup> For more discussion on eclipses in Tolkien's writings, see Larsen (2019).

<sup>9</sup> For more on Tolkien's possible uses of the Christmas Star in his writings, see Larsen (2023b) and Yates (2008). In addition, Hammond and Scull (2000, 78) note that Tolkien's drawings often contain "one large star in the sky."

Famed seventeenth century astronomer Galileo Galilei is given credit for the origin of the name *boreale aurora* – northern dawn – referencing the often reddish-pink appearance of the aurora as seen from lower latitudes, evocative of the dawn sky (Jago 2001, 18-9). This literal glow generated by molecules in our atmosphere (now termed the *aurora borealis* or *aurora australis* depending on the hemisphere) is created by an intricate interaction between our planet’s magnetic field and the solar wind (an outrushing of high energy particles – mainly electrons and protons – from the sun). The result is a stream of high energy particles that “precipitate down along geomagnetic field lines into the polar regions of the Earth” (Australian Space Academy). Their energy is imparted to air molecules, exciting their electrons; when the electrons de-excite they give back the borrowed energy in the form of light of specific colors (depending on the electron energy levels of that particular gas).<sup>10</sup> The net result is that aurorae can take on myriad colors and forms, from a simple glow low on the horizon to arcs, pillars of light, or flickering curtains. The various colors are typically produced at different altitudes in the atmosphere, for example with red emissions due to oxygen occurring above 300 km, more than twice the altitude of green oxygen emissions (Blanc and Mäkinen 1994, 599-601).



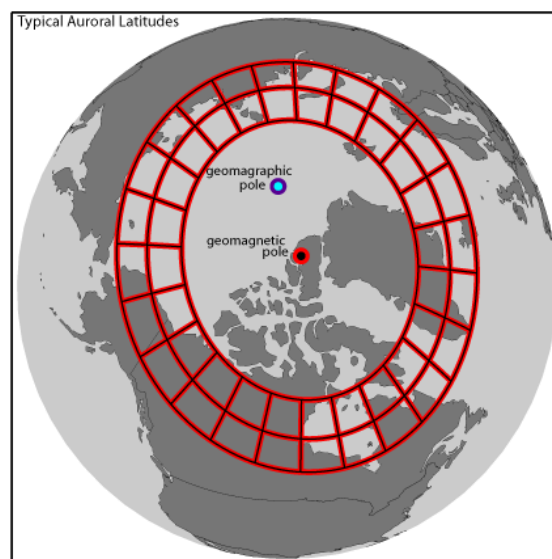
A green and purple “curtain” aurora. Credit: Martincco. CC-BY-SA-4.0.

When the Earth’s magnetic field is in a quiescent state there are relatively few particles bombarding the atmosphere; for this reason, auroral displays are most

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<sup>10</sup> The interested reader is directed to the following NASA video for more information on the formation of aurorae: <https://www.youtube.com/watch?v=HJfy8acFaOg>.

common in a specific region relative to the north or south geomagnetic poles in the so-called auroral ovals. In the northern hemisphere this extends between approximately  $65^{\circ}$ - $75^{\circ}$  magnetic latitude under quiescent conditions. During conditions of enhanced solar activity,<sup>11</sup> the auroral oval expands, and aurorae can be seen at more equatorward magnetic latitudes. Historical records suggest that the overall likelihood of viewing aurorae increases dramatically if you are poleward of  $40^{\circ}$  magnetic latitude. Also note that the highest incidence of aurorae is not at the geomagnetic poles themselves. However, since aurorae occur hundreds of kilometers above the surface, observers at the poles can see outbreaks in the auroral oval, as can observers equatorward of the oval (Kataoka and Nakano 2021, 2).<sup>12</sup> Observe that the previous discussion describes locations by their *magnetic* latitude, which is relative to the geomagnetic poles. These are distinct from the geographical poles (the basis for establishing the standard latitude and longitude most people are familiar with from geography class). The two sets of poles are currently offset by about  $10^{\circ}$ , as shown in the diagram below:



Typical location of north auroral oval (between geomagnetic latitudes 65-75 degrees). Note the offset between the geographic (here called geomagrapic) and geomagnetic poles. Credit: Eric Donovan, University of Calgary. CC-BY-SA-3.0.

<sup>11</sup> Specifically, the emission of a coronal mass ejection with a magnetic polarity (orientation) the opposite of that of the Earth's magnetic field and emitted in the direction of the Earth.

<sup>12</sup> Interestingly, during severe geomagnetic storms the aurorae are sometimes more easily observed *away* from the geomagnetic poles than *near* them. For example, on January 25, 1938, a red auroral outburst was seen in southern Europe but observers in Tromso in Northern Norway saw no aurora at all (Bone 2007, 88).

For this reason, despite the fact that London is 10° of geographic latitude farther north than New York, both locations currently have a similar annual occurrence of aurorae because the auroral oval is currently offset in the direction of New York as compared to London (Bone 2007, 83).<sup>13</sup>

A rich treasury of cultural myth and folklore has grown up around the aurora in those lands where it is observed with some regularity, including northern cultures whose languages Tolkien well knew. For example, in Finland an etiological myth explained the aurorae as the torches of warring angels. Similarly, in Estonia the aurora became a sign of heavenly battles (Brekke and Egelund 1983, 2-4). A proverb from Lista in Norway warned that when the so-called “Blood Lights” appear, “it is an omen of coming war” (Brekke and Egelund 1983, 6). Recall that red aurorae occur at higher altitudes in the atmosphere; this means that reddish aurorae can often be seen at lower latitudes (both geomagnetic and geographical) than other colors, albeit low on the northern horizon and, of course, at reduced frequency than closer to the poles. It is therefore no wonder that in Southern Europe aurorae were often considered heavenly fires (in the literal sense), leading to their connection with war, plagues, and other earthly calamities (Jago 2001, 10). For example, an association between aurorae and war can be found in the Norse tradition of Ragnarök (the Twilight of the Gods). The final battle is said to begin with Loki leading an army including dragons and flame giants to attack the gods’ home of Asgard. It is prophesized that the heavens would be “rent asunder, and through the fiery breach” will ride the flame giant Surtr “with his flaming sword,” easily interpreted as a reference to red aurorae (Guerber 1992, 333).

References to aurorae can also be found in *The Anglo-Saxon Chronicles*, *The Chronicles of Scotland*, and *The Irish Chronicles*, works which certainly found themselves inserted into Tolkien’s “Cauldron of Story” (*OFS* 44). Historians of astronomy have keyed in to the first of these in particular, noting numerous references to eclipses, aurorae, comets, and bright meteors, often presented as ominous omens (e.g., Brazell 1991; Härke 2012). For example, the following three references to aurorae in *The Anglo-Saxon Chronicles* are frequently presented as exemplars:

[CE 978/9] That same year a bloody cloud was often seen in the likeness of fire, and especially it was revealed at midnight, and it was formed in various shafts of light. When day was about to dawn, it disappeared....

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<sup>13</sup> It is important to note that there is a third set of poles, the magnetic poles, to which compasses point. The geomagnetic poles represent the approximate central axis of the Earth’s magnetic field, if one pictures it as like the field of a dipole magnet. A discussion of the three poles can be found at <https://www.earthdate.org/episodes/triple-north-pole> .

[CE 1098] Before Michaelmas the sky looked as if it was burning all night. This was a very oppressive year because of all sorts of excessive taxes, and great rains that did not cease throughout the year; nearly all the cultivation perished on marshland....

[CE 1130/1] This year, after Christmas, on a Sunday night at first sleep, the sky in the north was all as if it was a burning fire, so that all who saw it were afraid as they had never been before – that was on 11 January. In the course of this same year, there was such a great cattle plague all over England as had never been before in the memory of man. (Härke 2012, 36-8)

The fiery appearance of a red aurora (especially as seen low in the sky from more equatorward latitudes) led to instances in which they were literally confused with terrestrial fires, even as late as the mid-twentieth century. For example, in 1709 residents of Copenhagen were frightened by what they were convinced was a fire approaching their town from the North (Eather 1980, 92). A particularly vivid display of a red aurora in London led to a general panic on September 15, 1839, and the dispatching of fire-fighting resources toward the north side of the city (Brekke and Egelund 1983, 7). Similarly, the Windsor fire brigade was sent out to Windsor Castle on January 25, 1938, in the erroneous belief that it and half the city was on fire (Eather 1980, 92). Shortly before the Pearl Harbor attack in 1941 an auroral display witnessed in Washington, D.C. was thought by many to be a “new weapon being tested by the Army.” Similarly, a World War II blackout in Los Angeles had the unintended consequence of allowing city residents (whose view of the night sky was normally hindered due to light pollution) to witness the aurora for the first time, leading to widespread rumors of forest fires in the mountains above the city (*Ibid.*).<sup>14</sup>

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<sup>14</sup> For discussion on the increase in light pollution over Tolkien’s lifetime, see Larsen (2011).





A red auroral display. Credit: David Stern, CC-BY-SA-3.0.

Astronomers and historians have also collaborated in using the chronological and geographical distribution of auroral records to reconstruct both solar activity and the wandering of the Earth's geomagnetic poles. For example, historical records (in concert with the measurement of the production of so-called cosmogenic isotopes in the atmosphere)<sup>15</sup> have allowed for the reconstruction of changes in overall solar activity beyond its normal roughly 11-year periodic ebb and flow (as measured by the sunspot cycle). In particular, the existence of four named Grand Solar Minima (extended times of low solar activity and hence low auroral activity) – the Maunder (c.1645-1745 CE), Spörer (c.1460-1550 CE), Wolf (c.1280-1350 CE) and Oort (c.990-1071 CE) minima – has been established (Usoskin 2017, 49). The existence of the Oort minimum in particular, coupled with historical evidence for changes in the geographic visibility of aurorae in the Middle Ages, can be used to explain literary references to aurorae (or a lack thereof) during this time period. For example, the *Poetic Edda* (probably written in southern Norway c. 1000-1100 CE, during the Oort minimum) contains no discernable references to the aurora (Brekke and Egeland 1980, 431), while the didactic, anonymously written Old Norse work *The King's Mirror* (*Konungs Skuggsjá*, c. 1200 CE) – a conversation between a father and son – does. However, the latter work clearly suggests that while aurorae were common in Greenland at that time (and as we have previously noted, were often compared to the appearance of fire),

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<sup>15</sup> The interested reader is directed to Usoskin et al. (2021) for more information.

they were not widely observed in Norway despite the return of normal solar activity:

But as to that matter which you have often inquired about, what those lights can be which the Greenlanders call the northern lights, I have no clear knowledge. I have often met men who have spent a long time in Greenland, but they do not seem to know definitely what those lights are.... In appearance they resemble a vast flame of fire viewed from a great distance. It also looks as if sharp points were shot from this flame up into the sky; these are of uneven height and in constant motion, now one, now another darting highest; and the light appears to blaze like a living flame. (Larson 1917, 149-50)

At least one early 20<sup>th</sup> century translator of *The King's Mirror* recognized that this passage (and others within the work voicing similar personal unfamiliarity with aurorae) suggests that aurorae were “not prominent in Norway in the thirteenth century. There seem to be periods when these ‘lights’ are less in evidence than at other times,” an insightful observation decades before the connection between solar activity and aurorae was firmly established (Larson 1917, 146). The detail with which the natural world is generally described in the work has led scientists to treat it with particular interest, as a measure of the scientific understanding of the place and time of its writing (e.g., Whitaker 1985, 615). In 1980 Brekke and Egeland (431) argued that these references in *The King's Mirror* demonstrate that the auroral oval had covered a different geographical region in the 13<sup>th</sup> century compared to its current location. Kataoka and Nakano (2021, 6-7) used computer models to confirm this fact: “the auroral zone rapidly moved ~3° to the north in Norway from 1000 AD to 1150 AD, while the auroral zone did not change in Greenland. Such a difference may solve the discrepancy of the relative disappearance of aurora in Norway in ‘The King's Mirror’.” While I have not come across any direct evidence that Tolkien publicly commented on *The King's Mirror*, as a well-known example of the ‘advice to kings’ genre he should have been familiar with it, especially given that his friend and collaborator at the University of Leeds, E.V. Gordon, wrote a review of Laurence M. Larson’s translation for the 1924 volume of *The Yearbook of the Viking Society for Northern Research* while they were colleagues (cited in Brook 1954, 101).<sup>16</sup>

There were certainly other references to aurorae percolating in the English scholarly community of the early 20<sup>th</sup> century that Tolkien may have been familiar

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<sup>16</sup> A detailed discussion of descriptions of the natural world in *The King's Mirror* can be found in Bagge (1994).

with to varying degrees. Perhaps the most fundamental of these was an ongoing debate among scientists as to the direct cause of auroral outbreaks, and whether or not (and to what extent) the sun was directly involved. Chief among the protagonists were Norwegian physicist Kristian Birkeland and British mathematician and geophysicist Sydney Chapman. Chapman and colleagues – generally known as the “British school” – were openly critical of Birkeland’s 1908-1913 model of “field-aligned currents” that he claimed were related to solar activity and connected the Earth’s magnetosphere to the upper atmosphere (Anderson 1978 381-2; Egeland 2009, 1753). The existence of what we now call Birkeland currents was only established via satellite observations in 1967.

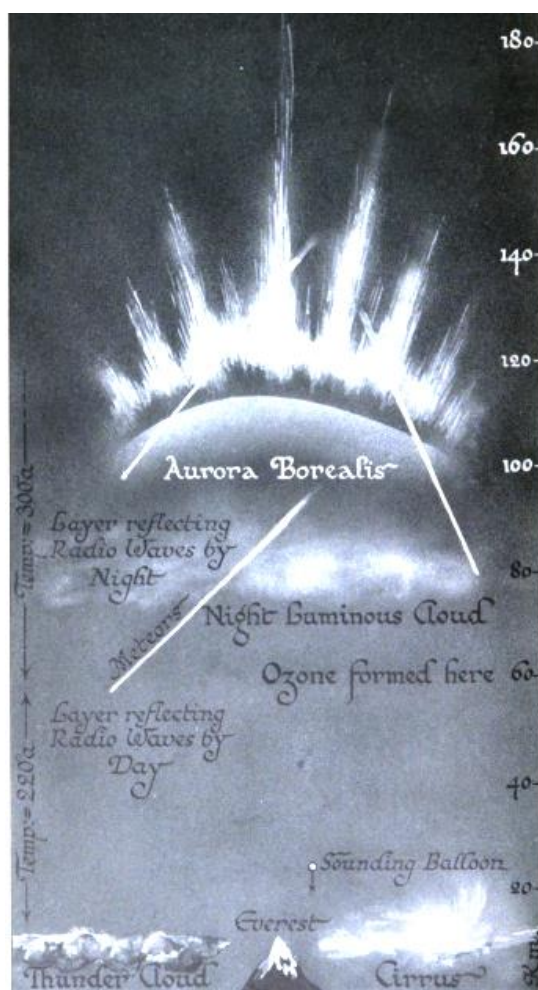


Plate from Dobson (1926) showing the altitude of various atmospheric phenomenon and processes. Note that the appearance of the aurora included here is what is termed a rayed arc. Public domain.

While it is perhaps unreasonable to assume that Tolkien was aware of this particular scientific skirmish (especially given that Chapman did not receive a chair at Oxford until 1946), on May 5, 1926, Oxford lecturer in Meteorology G.M.B. Dobson delivered the prestigious Halley Lecture on the topic “The Uppermost Regions of the Earth's Atmosphere.” Established in 1910 (in celebration of the return of Halley's Comet), the Halley Lecture brought eminent speakers to Oxford for public lectures on a topic in astronomy or geophysics (H.S.J. 1937, 266). Dobson's offering, described by a reviewer as providing an overview of “the present state of our knowledge of the constitution of the upper atmosphere and of the chief natural phenomena” (including aurorae and meteors) was soon after published as a brief booklet by the university press, and hence was readily accessible (“The Uppermost Regions” 1926, 221; Dobson 1926).

A final (but admittedly late) possible real-world scientific ingredient in the auroral Cauldron of Story was the Oxford University Arctic Expedition of 1935-36, which documented aurorae (and other natural events) for fourteen months from a camp at 80°N latitude on Nordaustlandet (North-east Land), an island in the Svalbard archipelago (Glen 1937, 10; Hamilton 1936, 1059). While articles on the expedition certainly appeared in the scientific press, it is unknown how widely it was discussed on campus. However, we cannot discount the possibility that it may have been one of many references to aurorae swirling around Tolkien's sphere of influence during this period. Having established the scientific knowledge, cultural relevance, and historical significance of aurorae that Tolkien had to draw upon, we next turn to three probable etiological usages of auroral outbreaks in the legendarium before turning to the *Father Christmas Letters* in particular.

The common connection between aurorae and battles and fires in myth and folklore alert us to the possibility that Tolkien might use similar etiological myth in the legendarium. For example, in *The Silmarillion* it is described how shortly after the awakening of the Elves the Valar attacked Melkor's stronghold in the North in order to protect the Quendi, who “knew nothing of the great Battle of the Powers, save that the earth shook and groaned beneath them, and the waters moved, and in the north there were lights as of mighty fires” (*Sil* 51). The literary parallels between this passage and northern myths and descriptions of aurorae are clear.

A second instance of a red aurora is found in descriptions of the Fall of Gondolin. In the briefer version (*The Silmarillion*), it is said

The host of Morgoth came over the northern hills where the height was greatest and the watch least vigilant, and it came at night upon a time of festival, when all the people of Gondolin were upon the walls to await the rising sun.... But the red light mounted the hills in the north and not in the east; and there was no stay in the advance of the foe until they were beneath the very

walls of Gondolin, and the city was beleaguered without hope.  
(*Sil* 242)

The longer version (published in *The Book of Lost Tales Part II*) recounts that

The sun had sunk beyond the hills and folk array them for the festival very gladly and eagerly – glancing in expectation to the East. Lo! even when she had gone and all was dark, a new light suddenly began, and a glow there was, but it was beyond the northward heights.... Then wonder grew to doubt to dread as men saw the snow upon the mountains dyed as it were with blood. And thus it was that the fire serpents of Melko came upon Gondolin. (*BOLT II* 172)

Again, there are clear parallels with Primary World descriptions (including Galileo’s etymological connection with the dawn).

A third, albeit subtle, reference to a red aurora appears in discussions of the Big Dipper or “Valacirca, the Sickle of the Valar,” specifically created by Varda as a sign of Melkor’s eventual downfall (*Sil* 48). For example, in “The Later Quenta Silmarillion” it is explained that “[m]any names have these stars been given; but in the North in the Elder Days Men called them the Burning Briar” (*MR* 160). While the name does not appear in *The Silmarillion* as published, it is repeated (including in the antiquated form *Brynebrér*) in several earlier iterations of the legendarium (e.g., *SOME* 84, 286; *LR* 111, 212). In particular, the name persists through numerous revisions of “The Lay of Leithian” (*LOB* 167, 251, 345, 349), including the following representative example:

and over all the silver fire  
that once Men named the Burning Briar,  
the Seven Stars that Varda sat  
about the North were burning yet,  
a light in darkness, hope in woe,  
the emblem vast of Morgoth’s foe. (“The Lay of Leithian” version B, lines 2666-2671, *LOB* 251)

In his commentary to the poem, Christopher Tolkien admitted that he could “cast no light at all on the name Burning Briar” (*LOB* 170); elsewhere I have suggested that “Burning Briar” could refer etilogically to a red aurora seen in the Big Dipper when it is low on the northern horizon and thus appearing as a red smoking pipe (Larsen 2005, 49-52).

Interestingly, a possible connection between the Big Dipper (or rather the entire constellation, the Great Bear)<sup>17</sup> and an aurora can be found in the *Kalevala*. In Runo X, Väinämöinen the magician sings the moon into existence at the top of a mighty fir tree “[a]nd the Great Bear in the Branches” (line 42, Kirby 1985, 105). The blacksmith Ilmarinen subsequently rides on the shoulders of the Great Bear far north to the “gloomy land of Pohja” (line 168, Kirby 1985, 109) to obtain a wife. In Runo XLIX, after the sun and moon are stolen, and artificial versions fail to illuminate the sky, Väinämöinen travels north to Pohja where they have been taken (not unexpected, given the darkness of that land) and lights a fire to announce his arrival that is seen low on the horizon, possibly homage to a red auroral display (lines 59-140, Kirby 1985, 622-4). A more obvious literary reference is found in John Addington Symonds’ 1862 essay “Clifton and a Lad’s Love,” included in the 1893 collection *In The Key of Blue and Other Prose Essays*. The highly evocative passage reads in part as follows:

Low on the horizon, beyond Durdham Down, were streaks of white light, wavering spokes and flaring lines and streamers, flushing into faint rose-pink.... Soon, by quiverings and motions in these signs – for the west darkened, and flames burst forth among the topmost stars, and toward the east ran swords, stealthily creeping across the heavenly spaces – I knew that this was an Aurora Borealis. The pageant rapidly developed, and culminated with dramatic vividness. At the very zenith, curving downward to the Great Bear, there shone a nebulous semi-circle – phosphorescent, with stars tangled in it. From this crescent of light were effused to north and west and east rays, bands, foam-flakes, belts, spears, shafts of changeful hues, now rosy red, now brightening into amethyst, now green, now pale as ashes.... In the midst of all the glow and glory sparkled Ursa Major, calm and frosty. (Symonds 1893, 162-3)

The relative location of the Big Dipper near to the North Star, Polaris, means that this grouping is circumpolar as seen from all latitudes north of about 41°N. Therefore, the Big Dipper is visible every night of the year, all night long, and never sets below the horizon, although as noted near the start of this paper at certain times of the year it will appear in different positions relative to the North Star at a given time of night. For example, the Big Dipper will appear most like a burning pipe in the early evening sky when immersed in a red aurora when it lays low across the

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<sup>17</sup> The seven stars of the Big Dipper mark only the tail and hips of the constellation Ursa Major, the Great Bear. While the two names are often used interchangeably, technically the Big Dipper is an asterism, a familiar grouping of stars that is not synonymous with one of the official 88 constellations.

northern horizon, which is during the autumn. This is why in *The Fellowship of the Ring* (I, ii, 187), at the Prancing Pony Frodo sees the “Sickle” (what Tolkien in a footnote calls “The Hobbits’ name for the Plough or Great Bear”) “swinging bright above the shoulders of Bree-hill” hours after sunset on a late September evening.

Clearly the Big Dipper is an important grouping of stars in the legendarium. Given its location in the northern sky, and bright appearance, it is also not surprising that it shows up numerous times in the *Father Christmas Letters*. In the 1924 letter addressed to Michael, the North Polar Bear (who is often referred to as simply Polar Bear or PB) adds a postscript as well as a sketch of the Big Dipper, which he calls “his stars” (FC 24).<sup>18</sup> In his 1927 letter Father Christmas explains that the “Great Bear” is PB’s “cousin (and distant friend),” who shines “extra bright” over the North Pole that year to help Father Christmas prepare for the holiday (FC 42). This action is necessary due to the absence of aurora that year due to PB’s mischief of the previous year (as will be explained later in this paper). The 1927 letter contains an illustration of the North Pole and Father Christmas’ cliffside house, the Big Dipper and North Star prominent in the sky (Tolkien Estate 2022). The letter’s hand-drawn stamp similarly focuses on the literal North Pole, Big Dipper, and Polaris. The 1932 letter contains a four-tiered illustration; Hammond and Scull (2000, 73) describe one of the night scenes as featuring “the North Pole under the constellation of the Little Bear.” In reality, the shape of the stars is of a backwards Big Dipper, not the Little Dipper or Little Bear (Tolkien Estate 2022). Tolkien’s frequent use of the Big Dipper and North Star in his illustrations for the *Father Christmas Letters* makes a great deal of sense, given the stars’ association with the northern sky. There is, however, one interesting consistent astronomical error in these depictions. Tolkien draws the stars as they would be viewed from Oxford (with the North Star approximately 50 degrees above the northern horizon) not as they would appear from the North Pole (where Polaris would be 90 degrees above the horizon, at the zenith). Either Tolkien was unaware of the appearance of the night sky at the North Pole (unlikely given his well-known statement in *The Fellowship of the Ring* concerning the latitudinal differences in the night sky – that in the southern lands of Harad “the stars are strange” [*FOTR* II, ii, 261]), or, more likely, that he was drawing the night sky of Oxford that his children would have recognized.

The following table lists all definitive and possible references to aurorae in the *Father Christmas Letters*; illustrations reproduced on the Tolkien Estate (2022) website are noted in the first column with an asterisk after the year:

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<sup>18</sup> John received his own letter this year, and although it included a postscript from PB, the picture was a self-portrait of PB himself and there was no mention of the stars (FC 21).

Year	Type of Reference	Page in Centenary edition
1924	Stamp (John's letter)	19
1924*	Stamp (Michael's letter)	23
1926	Detailed description in letter	32, 36, 38
1926*	Illustration to letter	34
1927	Mention that there were no aurorae due to PB	42
1928	Possible mention of aurorae in letter	47
1928	Illustration to letter	52
1929	Stamp (possibly a setting sun instead)	59
1929	Brief mention in letter	59
1932*	Illustration to letter (possible aurora engulfing part of the backwards Big Dipper)	98
1933*	Illustration to letter	123
1936	Illustration to letter	147
1936*	Stamp	149

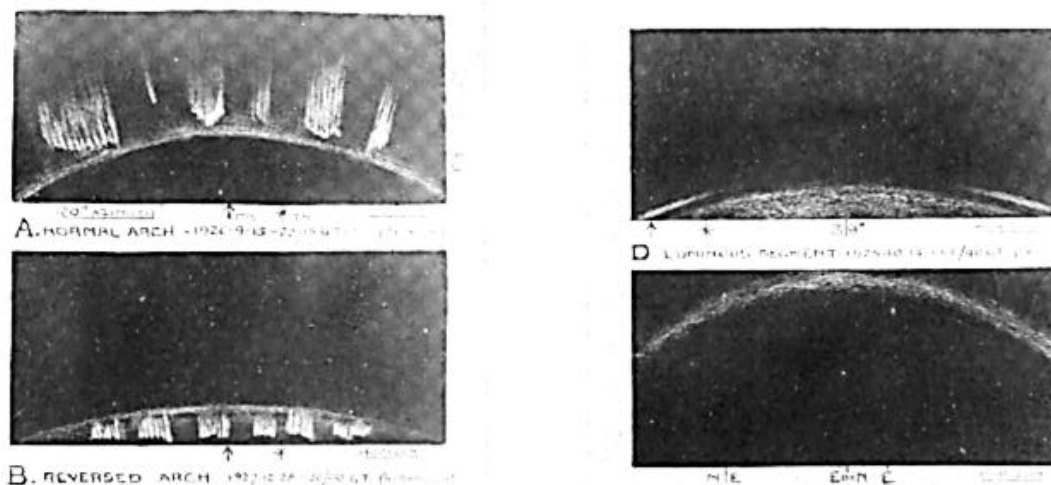
Before examining his individual illustrations and textual mentions in detail, it is important to review the common forms of aurorae, especially as observed in the lower British Isles.

We should acknowledge that a single auroral display often changes over its duration. For example, outside of the normal auroral oval an aurora

may begin with a glow along the poleward horizon. The glow then rises from the horizon and forms one or more quiet and mostly homogeneous bows of light (arc), oriented approximately east-west. An 'arc' may remain relatively quiescent for hours, drifting slowly towards north or south. Suddenly it may brighten here and there and 'rays' begin to appear across the arc. The arc is then likely to fold and so to lose its regular bow shape and to form an irregular 'band'. If the rays are very long, the band assumes the appearance of a great 'drapery,' waving like a curtain in the sky. Rapidly moving and fading irregular forms may appear and disappear all over the sky. As the display dies down, waves of light may surge upwards from the horizon in quick succession causing existing auroral forms to brighten as the waves pass over them (flaming aurora). (Hultqvist 1964, 6-7)



According to W.B. Housman, Director of the British Astronomical Association Aurora Section in the 1930s, in his experience the most common type of aurora seen in the UK during the 1920s were what he termed “archs” (named ‘arcs’ above) and “rayed arches,” with other forms less often seen (1931, 89).



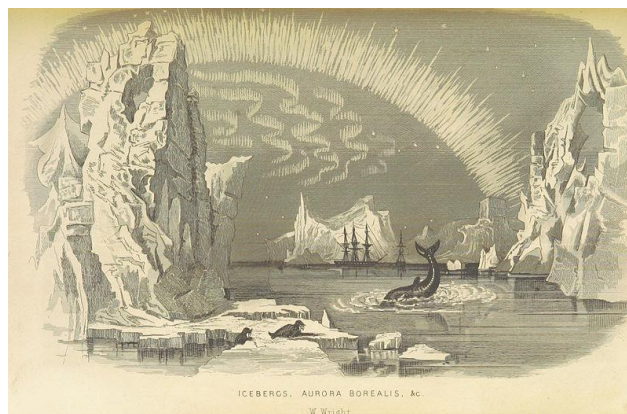
Excerpt of a plate from Housman (1931). The upper left drawing is a rayed arc aurora (called a “normal arch” by Housman). Public domain.

The first standardized classification system of auroral display forms was created by Størmer in his *Photographic Atlas of Auroral Forms* (1930), which included a dozen different morphologies divided into forms with rays, forms without rays, and flaming aurorae. The first two are subdivided into numerous subclasses; arcs with rays are designated class RA, while broad bands with rays are designated RB (Rigby 1932, 196). For the sake of discussion, the normal arch of Housman and Størmer’s classes RA/RB will be treated synonymously. It should be noted that Housman observed from Seaton, on the south shore of England, several degrees of latitude (both geographic and geomagnetic) further south than Leeds or Oxford. Therefore, any display (or trend in displays) visible to Housman would have been similarly noticeable to Tolkien, given favorable weather conditions and an interest in making such an observation. A modern study of more than three decades of UK auroral reports conducted by Ron Livesey (one of Housman’s successors) suggests that observers in southern England can view, on average, five auroral displays per year (Bone 2007, 88). While this is clearly a fraction of the frequency at more northerly latitudes, it is certainly not trivial, and is far greater than the frequency of eclipses (for example) viewed from the same location, as previously noted a type of astronomical event clearly referenced within the etiological myths of the legendarium.

Størmer often opined that arcs and bands with rays were “among the finest of all auroral forms” (Egeland and Burke 2012, 52), and as Housman noted, these were also relatively common at mid-geomagnetic latitudes such as central and southern England. A perusal of late 19<sup>th</sup> and early 20<sup>th</sup> century aurora-based artwork found on the internet provides support for both Størmer’s assessment and Housman’s observation. A representative sample of such depictions of RA aurora is shown below.



“The Aurora Borealis,” a colored wood engraving by Charles Whymper (1846). Credit: Wellcome Trust, CC-BY-4.0.



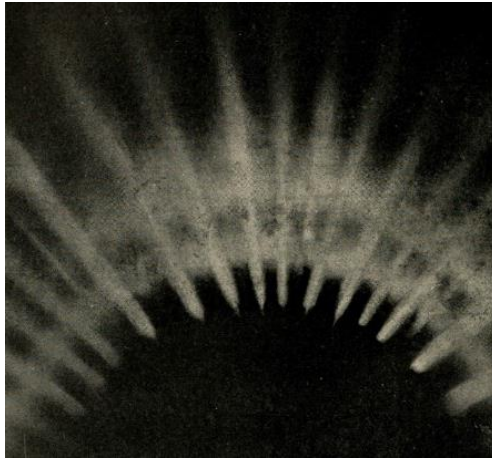
“Icebergs, Aurora Borealis, & c.,” W. Wright (1852). Public domain.



Illustration from *Our Earth and its Story: A Popular Treatise on Physical Geography* (1887). Public domain.



*Aurora Borealis* (1872), Étienne Léopold Trouvelot. Credit : Crystal Bridges Museum of American Art, CC0 1.0 Universal Public Domain.



*Sheldon Jackson, Pathfinder and Prospector of the Missionary Vanguard in the Rocky Mountains and Alaska, 1908 by Robert Laird Stewart. Cropped by author; Public domain.*

More modern photographs of RA/RB auroral displays can be seen at the *Grant Ordelheide*,<sup>19</sup> *Let's Go Ireland*,<sup>20</sup> and *Rove Me*<sup>21</sup> websites, for example.

A perusal of the *Father Christmas Letters* in total (or the Tolkien Estate website [2022] as a sample) clearly demonstrates that Tolkien's aurorae are nearly always of the rayed arc (RA) variety, and while perhaps exaggerated and whimsical, nevertheless reflect the general structure of this common form of display. They also feature various shades of yellow, along with some reds and occasionally green, blue, and purple. Interestingly, Housman similarly noted that the aurorae he viewed in southern England were "normally, a golden yellow or primrose tint, and occasionally, crimson, orange and green" (Housman 1931, 90). Therefore, Tolkien's illustrations of auroral displays in the *Father Christmas Letters* unequivocally align with both scientific observations and artistic representations of the aurora borealis from prior to and during the years of the letters' creation. The remainder of this paper now focuses on a close examination of all illustrations or textual mentions of aurorae in the letters and their alignment with real-world auroral displays of the same year.

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<sup>19</sup> An Iceland RA/RB aurora can be seen here:

<https://www.grantordelheide.com/photo/auroraarch/>.

<sup>20</sup> An Ireland RA/RB aurora can be seen here: [https://www.letsgoireland.com/wp-content/uploads/2022/09/Northern\\_Lights\\_Dooey\\_Beach\\_Ireland\\_Rita\\_Wilson\\_Failte\\_Ireland-768x512.jpg.webp](https://www.letsgoireland.com/wp-content/uploads/2022/09/Northern_Lights_Dooey_Beach_Ireland_Rita_Wilson_Failte_Ireland-768x512.jpg.webp).

<sup>21</sup> A Montana RA/RB aurora can be seen here:

[https://images.rove.me/w\\_1920,q\\_85/uvggzydbbkbxjbm9e7au/montana-northern-lights-in-glacier-national-park.jpg](https://images.rove.me/w_1920,q_85/uvggzydbbkbxjbm9e7au/montana-northern-lights-in-glacier-national-park.jpg).

The initial letter was sent in 1920 and did not mention aurorae, and as previously noted the letters from 1921 and 1922 are no longer extant. The first auroral images appear in 1924, with the envelopes for John and Michael's individual letters adorned with different stamps depicting distinct aurorae. John's stamp appears to be a view from inside a structure (perhaps a cave) with icicles along the arched entrance. The North Pole – always depicted as a literal pole with a pointed top, usually white – stands in front of a rayed arc display, a yellow arc with rays of mainly red, blue, and green (*FC* 19). Michael's stamp (Tolkien Estate 2022) is similar, although it lacks the icicles on the entrance and the aurora is far simpler (as perhaps befits a younger child). The relatively early entrance of aurorae into the mythos of the letters is understandable, given the natural connection in most people's minds between the Northern Lights and the North Pole; however, as previously noted, while aurorae are often seen at very high latitudes outside the auroral oval because of the altitude of the display in the atmosphere, technically the North Pole is not the point of "best" visibility of the aurorae.

There is another reason why vivid auroral displays would be early introductions into the letters, a great solar storm on May 13-16, 1921, that had serious repercussions across much of the Northern Hemisphere. The resultant geomagnetic storm created vivid aurorae, disrupted radio communications, and induced currents in telegraph wires (the internet of the day), causing fires in communications centers in Brewster, New York, and Karlstad, Sweden. In the US aurorae were seen as far south as Texas and Arizona, while in the UK reports came in from Cambridge, Wales, Surrey, and East Anglia, among other locations (Hapgood 2019, 954-62). At the time Tolkien was in Leeds, 2° further north than Oxford, and the aurora should have been easily visible (weather permitting). In terms of 1924 itself, a display on January 29 was visible from Perthshire in Scotland down to Falmouth in Cornwall in the southwest tip of Great Britain (Housman 1931, 88).

The first detailed etiological myth concerning aurorae appears in the 1926 letter. Father Christmas' nerves are frazzled because PB had been rummaging around in the basement of the old house (the house that PB had accidentally destroyed in his escapades of the previous year) and turned on the tap for the "Rory Bory Aylis fireworks," setting off two-year's worth of the Northern Lights. As Father Christmas explains to the children "[i]t was the biggest bang in the world, and the most monstrous firework there ever has been" (*FC* 32). Father Christmas further notes that he has "tried to draw a picture of it; but I am too shaky to do it properly and you can't paint fizzing light can you?" (*FC* 36). Said illustration shows Father Christmas standing out in the snowy landscape, a magnificent rainbow-colored rayed arc of an aurora seen behind the North Pole. The connection with fireworks hearkens back to real-world folklore of aurorae as heavenly fires.

In their *Chronology* volume, Scull and Hammond (2017a, 148) note that the “solar magnetic storms in 1926 are notably strong, producing spectacular auroral displays in many places in the northern hemisphere,” perhaps an understatement.<sup>22</sup> Housman’s report for the British Astronomical Association contained three sequences of outbursts visible in Great Britain that year. On March 9, a “short and brilliant outburst of the aurora” was visible in England while a greater display was noted in the Shetland Islands (Housman 1931, 88). In Salzburg, Austria, the fire department was called to put out fires that turned out to be red auroral displays (“Salzburg” 1926). On the evening of September 15-16, a “brilliant aurora” was seen in the North of England and in the Shetland Islands, and over October 14-16 a “long continued aurora of varying intensity with frequent outbursts of great splendour, and beautiful coloured light” was visible in England (Housman 1931, 88). In the US the same October geomagnetic storm ceased telegraph and cable transmissions, and slowed the communication of “market transactions between Wall Street and London” (“Aurora Interferes” 1926). It even caused the failure of a radio broadcast of American President Calvin Coolidge’s speech from the International Oratorical Contest (“Say Aurora Borealis” 1926). While it is hoped that the Tolkien family was able to view at least one of these displays, it is also likely that they were aware of the worldwide interruptions they caused through newspapers headlines, making the inclusion of an etiological myth almost necessary in the 1926 letter.

In the 1927 letter (dated the Winter Solstice, December 21), Father Christmas complains how dark his home is due to PB’s release of two years’ worth of aurorae the year before. He predicts that there will be no aurorae “until the end of 1928,” and as previously noted, he is relying on the increased light of the stars of the Great Bear (*FC* 42). Father Christmas’ seeming reliance on the aurorae for light brings to mind a Lapp tradition that the aurorae were a gift from God “to compensate for the disappearance of the sun” in the winter (Jago 2001, 48). While the sun is technically absent from the skies of the North Pole from about the Autumnal through Vernal Equinoxes (roughly September 22 – March 22), the skies

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<sup>22</sup> As noted by Scull and Hammond (2017a, 143), c.1926-1930 “a series of Icelandic au pair girls will live with the Tolkien family and entertain the boys with stories about trolls.” This dating is aligned with the recollections of one of the girls, Arndís Þorbjarnardóttir, who was interviewed about her experiences in the Tolkien household in 1999 (Þorkelsson 2010). While one might be tempted to suggest that the Icelandic girls influenced the inclusion of aurorae in the letters (especially considering the mention of “somebody from Iceland” staying with the Tolkiens and the inclusion of Iceland in Father Christmas’ discussion of his flight path in the 1927 letter [*FC* 45-6]), the early inclusion of the aurorae in the 1924 stamps and the first mention of the au pair in the 1927 letter argue against this.



are only truly dark after astronomical twilight has ended (when the sun is more than 18 degrees below the horizon), roughly November 13-January 29 (Rao 2010).

Father Christmas also explains that he had just “hired a comet to do my packing by, but it doesn’t work as well – you can see that by my picture” (*Ibid.*). The relevant illustration (*FC* 45) depicts a dark landscape, with the Big Dipper and Polaris seen in the sky (as previously noted). There is also a drawing of a comet in the lefthand side of the illustration. Comet Skjellerup-Maristany was discovered with the unaided eye that year and became so bright that it could be seen in broad daylight on December 18, 1927, when it was only 5° from the sun (Yeomans 2007). It was therefore quite reasonable for Tolkien to have included a comet in this letter.



Sketch of Comet Skjellerup-Maristany, by E.C. Slipher (December 17, 1927).  
*Astrophysical Journal* 86: 345. Public domain.

While Father Christmas’ prediction that there would be no aurorae visible until late 1928 makes etiological sense within the Secondary World of the letters, it does not quite mesh with reality. For example, Housman observed a “fine aurora” from his home in Seaton on the southern English coast on January 7, 1927, as well as a “beautiful arch coloured green, orange and crimson” on December 28, 1927 (Housman 1931, 88). Hopefully these displays were not obvious from 22 Northmoor Road, Oxford, as one would have hated Father Christmas to be proven wrong.

Fortunately for Tolkien (and Father Christmas), there was a “short and brilliant aurora seen in England and Shetland” on November 13, 1928, as the 1927 letter had predicted (Housman 1931, 88). The December 20, 1928, letter includes an illustration of the full moon smiling down upon a pale white and yellow arc with

minor rays, pictured behind the North Pole as usual, certainly simplified relative to other depictions of aurora in the letters but still identifiable as such (FC 52). There is a possible reference to aurorae in the letter itself, with Father Christmas explaining that he is feeling “well” and “not quite so shaky” because they “have got all the lighting and heating right again after the cold dark year we had in 1927” thanks to the supposed lack of aurorae (FC 47).

The 1929 letter more clearly addresses aurorae, opening “It is a light Christmas again, I am glad to say – the Northern Lights have been specially good” (FC 59). Father Christmas was certainly correct in this regard, with several intense solar storms during the year creating numerous auroral outbursts. On February 27 an “unusual and striking display of aurora” was visible across Great Britain (as far south as Devonshire) in which some observers noted “streamers of pale light ascended from the horizon to considerable heights and were traceable at the zenith” (“Our Astronomical Column” 1929, 387). A number of other displays were recorded, including one in mid-March and two in October (Housman 1931, 91; H.W.N. 1930, 77-9). A particularly interesting display was seen on November 2, 1929, which again included vivid ‘streamers’ of light. For more southerly observers in Seaton (on the southern coast of England), the streamers were seen near the horizon while at Haroldswick in the Shetland Islands the streamers rose to the zenith (directly overhead) (Housman 1931, 91). It is worth noting that Tolkien consistently drew his aurora as rising up from the horizon, again mirroring what he and the children could have observed from Leeds or Oxford rather than the North Pole itself.

But the ‘streamered’ displays could explain the curious stamp that accompanied the 1929 letter, as well as others of Tolkien’s illustrations. Similar auroral displays have been previously reported, as reflected in the following illustration from an 1896 popular-level work:

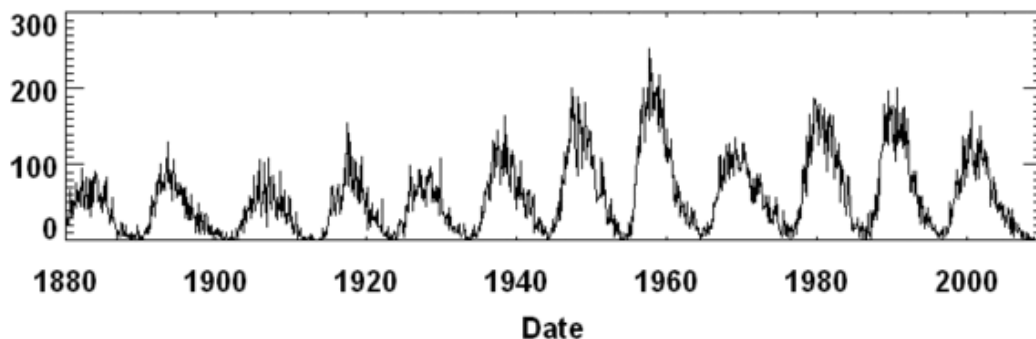


Illustration from *The Half Hour Library of Travel, Nature and Science for Young Readers*, 1896. Public domain, courtesy British Library.



The 1929 stamp depicts what looks like the setting sun set against a black sky, with rays emerging upward from the reddish-orange disk (*FC 59*). A similar picture by PB in the 1931 letter clearly shows a setting or rising sun with shadows streaming down landscape, although this later illustration has a feeling of light/daylight rather than the black night seen in the 1929 stamp (*FC 87*). Hammond and Scull (2000, 78) note that a 1925 drawing “almost certainly made for *Roverandom*” labelled “lunar landscape” features the sun “rising or setting behind mountains. Here the Sun resembles the aurora borealis in the ‘Father Christmas’ art and is casting a pink warmth upon the peaks and slopes opposite.” Therefore, it is not clear whether we should interpret the 1929 stamp as the sun or the aurora, or perhaps some interesting amalgam between the two (as in the case of the false dawn in Gondolin perhaps harkening back to the etymology of the term *aurora borealis*).

There are no clear mentions of the aurora in the 1930-31 letters; the 1932 letter includes the aforementioned illustration of the backwards Big Dipper, and the bowl of the asterism is immersed in a vague purplish glow that might be a weak auroral display (Tolkien Estate 2022). This lack of aurorae accurately reflects the real-world skies of these years. Housman observed of 1930-1 that the “Aurora was not so conspicuous in great displays as in the previous season,” and even in the Shetland Islands aurorae were “seen with about the normal frequency, but without great intensity” (Housman 1931, 91). Speaking of 1933, Housman summarized that it “probably corresponds very closely in time to the Sunspot minimum period. Aurorae have been infrequent, and generally of a faint order” (Housman 1934, 21). As noted in the figure below, this was certainly the case; since solar activity typically follows the general pattern of the sunspot cycle, periods of sunspot minimum are normally also associated with subdued geomagnetic activity and less frequent auroral activity, especially equatorward of the auroral oval.



Sunspot activity, 1880-2010. NASA, Public domain.

While sunspot activity was indeed much reduced in 1933 – the technical minimum<sup>23</sup> of solar cycle 17 occurring in September of that year – there were auroral arcs viewed in England, Scotland, and Norway on September 13 and December 9 (Housman 1934, 21). In particular, the December 9 display was described as Housman as “a great outburst of bright golden-hued streamers [that] shot upwards from an arc at horizon level” as seen from his location on the south shore of England (Housman 1934, 22). Interestingly, the illustrations included in the 1933 Father Christmas letter include the depiction of an aurora that is a very close analog to Housman’s description (Tolkien Estate 2022).

The final reference to an aurora appears in the December 23, 1936, letter, five months before the sunspot maximum of solar cycle 17. The stamp depicts a pale golden rayed arc set behind the North Pole (*FC* 149) and one of the illustrations is of a rainbow-colored rayed aurora similarly situated (Tolkien Estate 2022). While Housman’s report for this year was not available to this author due to an archiving error in the Smithsonian Astrophysics Observatory Astrophysics Data System, during 1936 vivid aurorae were seen in Montana (January 28 and April 17) and North Dakota (July 21), locations that are only a few degrees northerly of Oxford in geomagnetic latitude (Brooks 1936; Davies 1936a, 1936b). In addition, aurorae were seen in southern Norway on April 20-22, and October 16-17 (Størmer 1937, 584).

It is not clear why Tolkien ceased including aurorae in the letters after 1936, although he certainly continued to mention astronomy in general (including the aforementioned description by Father Christmas of the book he was giving Christopher in 1938 to aid in the use of the boy’s telescope). Beginning in 1938 the letters were mainly for Priscilla’s enjoyment alone, which Tolkien might have thought necessitated making changes; for example, the 1938 letter included a long poem written specifically for Priscilla rather than copious detailed illustrations. As Scull and Hammond reflect, beginning in 1939 “the tone of the letters became sombre, as the ‘horrible war’ in the real world intruded even at the North Pole” (2017b, 423).

Regardless of the reasons for this shift, the previous letters include sufficient details to draw the following conclusions:

- 1) Tolkien was clearly interested in aurorae and understood their traditional connection with polar latitudes, including relevant folklore;
- 2) There are interesting parallels between the real-world displays of aurorae as seen in southern England between 1921-1936 and their

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<sup>23</sup> The actual months of minimum and maximum for all previous sunspot cycles can be found at <https://www.sidc.be/SILSO/cyclesminmax> .

depictions in the text and illustrations of the *Father Christmas Letters* from the same years;

3) These parallels strongly suggest that he was reasonably well-versed in not only the actual appearance of aurora in the night sky, but their appearance over this time period, possibly through his reading, his knowledge of related artistic depictions, personal observations, or some combination of the three;

4) He was aware that the frequency of auroral displays varied from year to year, and incorporated this knowledge into his etiological mythology within the letters.

Taken in total, these facts add to the accumulation of evidence that Tolkien's self-described childhood interest in astronomy carried throughout his lifetime, and further demonstrate how Tolkien's careful and intentional usage of real-world astronomy in his world-building activities adds significant depth to the immersive 'reality' of his Secondary Worlds.

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