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# Closing Gaps in Traditional Sky Lore

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*A widespread motif in archaic cosmologies that has received little attention among scholars is the idea that the sky is formed of a solid substance and that it contains one or more openings, that enable “traffic” between the regions above and below. This article presents a cross-cultural documentation of this motif and argues that the notion of “sky holes” derived from observations of aurorae or “polar lights,” specifically from auroral arcs and coronae. The phenomenology of these types of aurorae also sheds light on a number of related beliefs—that the hole is situated on the horizon or near the celestial pole; that it frequently shuts and opens again; and that the sun or another light shines through it.*

## **A Hole in the Sky**

The study of traditional views about the structure and the workings of the cosmos remains a fertile field of exploration, as numerous apparently global motifs have not been recognised, let alone carefully documented or explained. One traditional cosmological idea whose practically universal geographic distribution has rarely been appreciated concerns the physical constitution of the sky. According to this extremely widespread motif, the sky is an impenetrable “sheet” or “dome” formed of a solid material, such as rock or metal, but contains one or more holes, which facilitate cosmic traffic.<sup>1</sup> The Maya of Chumayel, Yucatán, for instance, acknowledged the

Without the generous support of the Mainwaring Archive Foundation this article could not have been completed. I am also grateful to Ev Cochrane, Anthony Peratt, Renate Schukies and Wallace Thornhill for comments and help with publications that proved difficult to obtain, and to Yichiu Chen for assistance with Chinese orthography.

1. “The solid vault of heaven finds innumerable parallels everywhere as to its openings into the spirit world beyond.” Howitt 1884, p. 198, referring to Australia. The Dīēri people, of central Australia, relate that the solid-looking sky of ancient times “became one

existence of *bol caan* or “the hole in the sky.”<sup>2</sup> In a significant number of cases, the hole is expressly associated with the “navel,” “heart,” or geometric “centre” of the sky. Insofar as the north polar region of the sky appears as a natural centre to observers from the northern hemisphere, some cultures in that part of the world would specifically situate the hole there. This was the case in various parts of central and northeastern Asia as well as North America. For example, the Chukchi, of the far northeastern end of Siberia, held that “The house of the Polar Star stands in the zenith. Directly under it is a hole” (Bogoras 1904–1909, p. 307; cf. 1902, p. 590).<sup>3</sup> The Old Turks used to call the pole star “a smoke hole of the sky” (Bezertinov 2000, p. 91). The Lakota, of Dakota, identified the precise location of the hole as a former star in the constellation of Ursa Major: “Formerly, there was a star in the center of the the [sic] Big Dipper. Now, however, there is an opening or hole where the star was located” (Goodman 1992, p. 22). The Blackfeet, of southern Alberta and northern Montana, concur: “The ‘Star that stands still’ (North Star) is different from other stars, because it never moves. All the other stars walk round it. It is a hole in the sky” (McClintock 1992, pp. 499–500). The paradox of a star doubling as a “hole” does not exist in a more nuanced version, according to which an anonymous “child” metamorphosed into the pole star, stopping the opening through which it had come down from the sky earlier, along with its mother:

That evening when the stars came out, she looked up into the sky.  
A new star stuck in the hole from which she pulled the turnip.  
Then she knew what had become of her child. This is the way the  
Fixed Star came to be. . . . He will never move from that place, like  
the other stars, but will always be still.<sup>4</sup>

In mythology, the celestial hole marks a passageway between the cosmic realms above and below it, enabling traffic in either direction. The Chukchi regarded the “hole” directly beneath the “house of the Polar Star” as

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continuous hole; wherefore the sky is called ‘Puri Wilpanina’, which means the ‘Great Hole,’” Gregory 1906, p. 4; cf. Howitt 1891, p. 90, who spelled *Pūri Wilpanina*, “the Vast Hole.” This concept must be distinguished from the notion of holes contained *within* the sky.

2. Don Juan Josef Hoil, *Book of Chilam Balam of Chumayel* (1782 CE), 16 (68), trans. Roys 1967, p. 128. Perhaps this opening is identical to the *bol caane, yanil u bol paae*, “the door of heaven, where there is a gate in the wall,” 16 (69), trans. 1967, p. 129.

3. The Chukchi term for the pole star was *a<sup>l</sup>lkép-eñér*, “nail star,” and for the zenith *gInón-kanón*, “middle crown” (Bogoras 1902, p. 587).

4. Recorded between 1903 and 1907, in Wissler and Duvall 1908, pp. 59–60.

one “through which it is possible to pass from one world to another” (Bogoras 1904–1909, p. 307; cf. 1902, p. 590). With respect to the “opening or hole” in the constellation of Ursa Major, the Lakota believed that the *Wanaġi* or disembodied soul “comes up into the spirit world through this hole which was made when Fallen Star’s mother dug out the first wild turnip” (Goodman 1992, p. 22). And communities throughout the northern half of North America subscribed to a belief in “the hole of the sky,” at the bottom of the “land” in the sky, which featured in a variety of narrative contexts: through the hole, a supernatural woman—in some traditions the ancestress of mankind—was hurtled down before the earth had been created<sup>5</sup> or climbed down while homesick;<sup>6</sup> a band of legendary warriors entered the sky;<sup>7</sup> or a culture hero—such as Raven—flew up into the sky during the deluge or in order to obtain fire.<sup>8</sup> From the Skidegate group of Haida people, on the southeast coast of Graham Island, British Columbia, comes the story of *Nenk’ilsLasLiŋgai* or “Raven,” who, desperate to survive the flood, “flew through the smoke hole and reached the sky.”<sup>9</sup> The Bella Coola, of the central coast of British Columbia, related that four deities in the sky tore a hole into the “curtain” that shielded the earth from the light of the sun, enabling Raven to fly through:

Am Anfange gab es keine Sonne. Ein Vorhang war zwischen Himmel und Erde ausgespannt, so dass es hienieden immer dunkel war. Der Rabe wünschte die Sonne zu befreien, vermochte es aber nicht. Da ging er zu den Gottheiten *Masmasalā’niq*, *Yula’timōt* (= der Reiher), *Matlapē’eqoek* und *Itl’itlu’lak* (nach anderen *Matlapā’litsek*) und bat sie, die Sonne zu befreien. Sie zerrissen den Vorhang und die Sonne begann die Erde zu erleuchten. Sie schien aber noch nicht klar und hell, sondern wie durch einen dichten Nebel. Der Rabe flog durch den Riss, welchen die Gottheiten gemacht hatten, in den Himmel und fand dort eine endlose Ebene, die von den Vögeln bewohnt wurde. (*Nuskelu’sta*, in Boas 1895, p. 241)

5. e.g., the Seneca (Curtin and Hewitt 1918, pp. 410, 460), the Onondaga (Hewitt 1903, pp. 171–178), and the Mohawk (Hewitt 1903, pp. 283–284).

6. e.g., the Cheyenne (Grinnell 1921, p. 309; Schukies 1993, pp. 36–37) and the Skidġ Pawnee (Dorsey 1904, pp. 61–62).

7. e.g., the *Nlaka’pamux* (Teit 1913, p. 246 n. 2) and the *Pend d’Oreille* (Boas 1917, p. 118).

8. e.g., the *Tsimshian* (Boas 1916, pp. 60, 453–454).

9. *Da.a xiigang* alias Charlie Edenshaw (±1839–1920), chief of the *StA’stas*, to Franz Boas, in Swanton 1905, p. 142.

Often, the vertical journey through the celestial opening is completed along a material representation of the cosmic axis or *axis mundi*, such as a rope, a ladder, a tree, or a mountain. In many native Australian legends, “the sky dome is also envisaged as having an aperture, permitting two way access between the earth and the sky world above it. Many of the Ancestral Beings, and sometimes humans, climbed up to this aperture using a spear, a hair cord, a tree or a rainbow, to become individual stars or constellations” (Haynes 2000, p. 61). In the far south of the African continent, the Zulu stated that the ancestral pair of mankind had been exiled from their homeland in the sky to the earth along a rope that the supreme god, iNkosi, had let down through “a hole . . . in the floor (of the sky)”: “He (*iNkosi*) ordered that a hole be opened in the floor (of the sky). Then *iNkosi* himself tied *ithumbu* (lit. intestine) around the waist of the man. He was lowered to the earth through the opening” (Berglund 1976, p. 33).<sup>10</sup> His future partner followed suit, attached to the same rope. The Kwā’g’uʔ, one of the Kwakwaka’wakw tribes, of northern Vancouver Island, relayed the story of Līē’sElag’i’la, “Born-to-be-the-Sun,” alias Mink, a legendary child-hero who produced a chain of arrows that was magically transformed into a rope: “Then Born-to-be-the Sun climbed up the rope; and Mother held the end of the rope, so that it could not shake while her child was climbing up. Then Born-to-be-the-Sun reached the hole (in the sky).”<sup>11</sup> This hole equals “what is called the door of the upper world” and it was beyond it that the lad encountered his father, Lā’tōsElag’ilīsē or Walking-through-the-Heavens,” the sun. A neighbouring group, the Çatlō’ltq or Island Comox, relate how two brothers entered the sky through a similar hole positioned above the chain of arrows they had produced:

Als sie so eine Kette von Pfeilen gemacht hatten, die vom Himmel bis zur Erde herabreichte, schüttelte der ältere Bruder daran, um zu versuchen, ob sie stark genug sei. Da er sie fest fand, kletterten beide Brüder hinauf und krochen durch ein Loch im Himmelsgewölbe. (Boas 1895, p. 65)

Again, the Nisga’a, along the Pacific northwest coast of British Columbia, related that a father in search of his missing son produced a string of arrows suspended from *nānō’ōL lax-ba’* or “the hole of the sky”: “The arrow

10. A rivalling tradition viewed the moon as “a hole in the heavens” (Farrer 1879, p. 144).

11. Alē<sup>ε</sup> was to George Hunt (1854–1933), between 1900 and 1903, in Boas and Hunt 1908, p. 85.

hit the edge of the hole of the sky, and stuck there. He shot another arrow, which hit the nock of the first one. He shot again, and continued to do so for many days. Then the arrows came down, and reached to him.”<sup>12</sup> And the Sikuaní, of the Orinoco region of eastern Colombia, stated that the primordial beings formed the string of arrows directly below “something shaped like a door”:

Then he [Máva; MAS] told them to look up toward the sky, and when they did so they saw something shaped like a door. Híwinai, who saw it, said: “It is not that easy to go up.” Máva then said: “Since I come from the sky I will go on ahead and wait for you. From there I will help you. Meanwhile make steel points to throw at the door.” So they made the arrows. In those days the sky was not as it is now. Máva told them to shoot at one side of the door, the left side, and they did as he said. They shot three arrows and nothing happened, and the fourth arrow had no effect either. The fifth arrow did, however. It was Pumenérrua who hit the door. . . . The other brothers kept shooting at the door, one arrow after another, until the ladder made by the arrows nearly reached the earth, coming as close as a meter from the earth. (Jorge Chaveriano Alejandro, in Wilbert and Simoneau 1992, p. 100)

Mythical beings aside, mystics or visionaries are similarly prone to encountering cavities in the sky during their ecstatic journeys, though they do not always pass through them.<sup>13</sup> An example from classical Antiquity is the case of “a warrior bold” called “Er, the son of Armenius, by race a Pamphylian,” who was left for dead on a battlefield, but unexpectedly returned to life at the instant he was placed on the funeral pyre. During its celestial peregrinations, “his soul” had discerned *dý’* . . . *chásmata* or “two openings” side by side in the earth, that corresponded to a similar pair in the sky above and were associated with respectively an upward and a downward procession of souls.<sup>14</sup> Following a near-lethal fall from a height, the “intelligence” of Aridaeus or Thespesius of Soli, Cilicia, reputedly soared into the region occupied by the element of “fire,” just below the orbit of the moon, where it toured the various regions in the atmosphere associated with the “afterlife.” These included *chásma méga* or “a great chasm” that was “extending all the way down . . . called the place of

12. Moses Bell, interviewed in November and December 1894 in Gingolx, at the mouth of the Nass river, in Boas 1902, p. 88; cf. p. 93.

13. Van der Sluijs (2009a) views the visions of Er, Thespesius and Timarchus, discussed here, as examples of Near-Death Experiences or NDEs from Antiquity.

14. Socrates, apud Plato, *Republic*, 10. 13 (614B–D), trans. Shorey 1946, pp. 492–495.

Lethe”<sup>15</sup> and *kratēra mégan* or “a large crater” characterised by “streams pouring into it, one whiter than sea-foam or snow, another like the violet of the rainbow, and others of different tints, each having from afar a lustre of its own”; the latter was also styled a *chásma bathḗ tou periécbontos* or “deep chasm in the ambient.”<sup>16</sup> Again, Timarchus of Chaeronea (5th–4th century BCE) was a young student of Socrates, who provoked a vision by descending “into the crypt of Trophonius” and remaining “underground two nights and a day.” Having risen into the sky to a similar height as Thespesius had attained, Timarchus discovered *dýo . . . anastomóseis* or “two openings” that were “receiving rivers of fire”<sup>17</sup> as well as *chásma méga strongýlon* or “a great abyss, round,” which appeared . . .

. . . as though a sphere had been cut away; most terrible and deep it was, and filled with a mass of darkness that did not remain at rest, but was agitated and often welled up. From it could be heard innumerable roars and groans of animals, the wailing of innumerable babes, the mingled lamentations of men and women, and noise and uproar of every kind, coming faintly from far down in the depths, all of which startled him not a little.<sup>18</sup>

The presence of throngs of discarnate souls producing the clamour of multitudes identifies the chasms allegedly witnessed by Thespesius and Timarchus as the “underworld,” resonant with Hesiod’s earlier description of Tartarus as a *chásma még’* or “great chasm.”<sup>19</sup>

In Australia, meanwhile, “The sky-world beyond the dome was envisaged as containing a hole, a window or a fissure, through which the traditional healers could gain entry. They usually gained access by climbing or pulling themselves up a connecting cord. The cord was seen variously as being hair, string, a rainbow, lightning, a spear, a grass rope, a tree,

15. Plutarch, *Moralia: The Divine Vengeance*, 27 (565E), trans. Lacy and Einarson 1984, pp. 284–285.

16. Plutarch, *Moralia: The Divine Vengeance*, 28 (566B), trans. Lacy and Einarson 1984, pp. 286–287. Mead’s (1907, p. 27) translation of *chásma* as “vortex” suggests a spiralling geometry that lacks support in the text.

17. Simmias, apud Plutarch, *Moralia: On the Sign of Socrates*, 22 (590F), trans. Lacy and Einarson 1984, pp. 464–465. “Those who wished to consult the oracle of Trophonius, at Lebadeia in Boeotia, descended into a cave and waited there for the divine message to be revealed in a dream . . .,” (Lacy and Einarson 1984, pp. 460–461 n. a).

18. Simmias, apud Plutarch, *Moralia: On the Sign of Socrates*, 22 (590F), trans. Lacy and Einarson 1984, pp. 466–467.

19. Hesiod, *Theogony*, 740, trans. Most 2006, pp. 62–63. The interpretation of Timarchus’ two holes as “the intersections of the zodiac and the galactic circle” (Lacy and Einarson 1984, p. 465 n. h) is entirely speculative.

flames, a totem board and a turtle" (Johnson 1998, p. 14). "The ascent by a cord and the entrance, through a hole, into the sky country where the ghosts live, is in accord with the common belief in the powers of the medicine man" (Howitt 1904, p. 436). For example, the Wurundjeri people, in the vicinity of Melbourne, "believed that their wiraraps were instructed by the ghosts who conveyed them to the sky through a hole to *Bunjil*, from whom they received their magical powers" (Howitt 1887, p. 48).<sup>20</sup> A "renowned sorcerer" from the Dadi Dadi group, on the western border of Victoria and New South Wales, was lifted "up from the ground" by a *gumatch* or ghost who "took him to the sky, which is thought to be a solid vault. In the sky there was a hole or window guarded by a *gumatch*. The man procured admittance through this window, and was permitted to wander in the country beyond."<sup>21</sup> And a *Birraark* or "seer" of the Kurnai, of the Gippsland region, Victoria, claimed to have been conveyed by *Mrarts* or ghosts "through the clouds" on "a *Marrangrang*, which was described as being either like a rope or else something on which the *Birraark* can sit. . . . It is said that, when they reached the sky, the leading *Mrart* gave a signal, and some one inside opened a hole" (Howitt 1904, p. 389), through which the aerial traveller subsequently passed. "Among the Kurnai the statement is always made that the wizard went up in company with the ghosts on something called a *marangrang*, and that he went through a hole in the sky, which was opened by a *Mrart* like a *gwera-eil* Kurnai, that is, like a headman."<sup>22</sup>

In a number of traditions, a separate hole is assumed for each of the respective layers of which the stratified cosmos was held to consist. In Siberia, the Khanty regarded heaven as a structure with seven storeys, connected through seven smoke holes: "Die Ostjaken, welche sich in dem Himmel sieben Schichten vorstellen, sprechen von 'dem Himmel mit sieben Rauchlöchern'" (Holmberg 1923, p. 30). The Chukchi postulated a series of two to four "worlds" below the earth, complemented symmetrically by the same number of "worlds" above it:

20. The *wiraraps* were "medicine-men," while *Bunjil* was the supreme deity (cf. Howitt 1904, p. 405). "The ascent was made by a cord through a hole in the vault" (Elkin 1945, p. 87).

21. Cameron 1885, p. 360, probably also alluded to in Howitt 1904, p. 389.

22. Howitt 1884, p. 196, adding: "I have not found any of the Kurnai who could give any clear account of what this *marangrang* was supposed to be like; the most common definition has been that it was 'something like a rope', and that the *Bira-ark* and his attendant *Mrarts* went up on it, or holding on to it. Another statement was that it was like steps, for, said my informant, 'it does not touch the ground; you can always hear the *Mrarts* jump down off it'. My informant, Tūlaba, spoke of the *marangrang* as a road (*wau-ūng*), along which the *Yambo* of the dead took its course to the sky."

The house of the Polar Star stands in the zenith. Directly under it is a hole through which it is possible to pass from one world to another. Through a series of these holes the Polar Star can be seen in all the lower and higher worlds, while the other constellations change with the different worlds. . . . All these worlds . . . are joined by holes situated under the Polar Star. Shamans and spirits while going from one world to another slip through these holes. The heroes of several tales fly through them while riding on an eagle or a thunder-bird. (Bogoras 1904–1909, pp. 331, 307)

Conversely, it is through these “several holes” that the “one mighty Being, called “Upper Being,” who lives at the pole, “can observe all earthly doings and pursuits” (Bogoras 1904–1909, p. 331). Again: “Each world has a hole in the zenith of the sky, right under the base of the polar star . . . Through this hole the people of the upper world may look down upon the lower one” (Bogoras 1902, p. 590).<sup>23</sup> On Mangaia, one of the Cook Islands, in Polynesia, it is claimed that “At least ten heavens are built of azure stone, one above another (to correspond with the different lands in Netherworld), with apertures for inter-communication” (Gill 1876, p. 21). And in some traditions, the *axis mundi* is explicitly claimed to run through the respective holes of the cosmos. Contemporary Maya people of Yucatán, Mexico, indicated that “there are seven heavens above the earth, each of which has a hole in the center, one directly above the other. According to one idea, a giant *ceiba* (*yaštšé*), growing in the exact center of the earth, rears its branches through the successive holes in the heavens until it reaches the seventh, where ‘*El Gran Dios*’ of the Spaniards lives. It is by means of this tree that the dead spirits ascend from one world to the other until they reach the topmost one, where they finally remain. Another explanation is that there is a ladder made of vines running from the earth up through the holes in the heavens to the seventh, and it is by this vine that the souls ascend.”<sup>24</sup>

In the world view of the Inuit of Labrador, northeast Canada, the “pathway” linking the earth to the hole in the sky is formed by the rays and beams of the *aurora borealis* or the northern lights. The sky is regarded as “a great dome of hard material arched over the earth,” with “a hole in it through which the spirits pass to the true heavens”: “Only the spirits of those who have died a voluntary or violent death, and the raven, have been

23. “The inhabitants of the upper world are called ‘Upper people’ (*TñáIrgI-rámklIn*) or ‘Dawn people’ (*TñáIrgI-řámklIn*)” (p. 590).

24. Interviewed from 1902 to 1905 CE, in Tozzer 1907, p. 154. The tree is the *yax cbel cab* or “first tree of the world,” identified botanically as the kapok, *ceiba* or wild cotton tree (*Ceiba pentandra*) (Roys 1967, p. 102 n. 2).



over this pathway.” This pathway was thought to join earth and sky at the place where the northern lights occur—at the pole, in other words: “The ends of the land and sea are bounded by an immense abyss, over which a narrow and dangerous pathway leads to the heavenly regions. . . . The spirits who live there light torches to guide the feet of new arrivals. This is the light of the aurora.”<sup>25</sup> This belief emerges as a significant pointer towards the nature of the mythical sky hole in general.

### Aurorae Perceived as Holes

Faced with the challenge to offer a credible explanation for the widespread belief in the perforation of an otherwise impenetrable sky, as documented above, the researcher stands to gain much from an examination of the physical appearance of the polar lights—the *aurora borealis* and its southern counterpart, the *aurora australis*, or the “southern lights”—as recorded throughout the centuries. Though widely known, these magnificent luminous spectacles are only ever observed by a minute portion of the population, due to their geographic restriction to circumpolar latitudes at times of solar and geomagnetic quiescence. Elias Loomis, Sophus Tromholt, Kristian Birkeland, and others first established that the aurorae result as local perspectives on a singular cosmic phenomenon, an understanding that culminated in 1963 with Yasha Feldstein’s final proof that the aurorae are distributed in oval regions around either geomagnetic pole.<sup>26</sup> Viewed from space, each of these auroral ovals presents the appearance of a “window” containing a hole centred on the geomagnetic pole. On rare occasions, the luminous rings extend far enough towards the equator to be discerned by the inhabitants of lower latitudes. From any given earth-bound location at polar latitudes, the ovals appear as arcs or fragments of an incomplete circle, not unlike the rainbow, due to the curvature of the earth.

As auroral records show, it is within the repository of local appearances of the aurorae, as seen from earth, that a plausible origin for the theme of a celestial aperture can be found. Beginning no later than the 4th century BCE, classical philosophers recognised a category of atmospheric phenomena designated as a “chasm,” *chásma* in Greek and *hiatus* or *discensus* in Latin, which was grouped together with what are now recognised as com-

25. “The whistling cracking noise which sometimes accompanies the aurora is the voices of these spirits trying to communicate with the people of the earth. . . . The heavenly spirits are called *sélamiut*, ‘sky-dwellers’, those who live in the sky” (Hawkes 1916, p. 153). “Those who have been murdered or have committed voluntary suicide and women who die in childbirth are recompensed with the highest heaven, located in the Aurora Borealis, where they enjoy themselves playing football with a walrus head” (p. 137).

26. e.g., Brekke and Egeland 1983, pp. 81–83; Bone 1996, p. 36; Paschmann *et al.* 2003, p. 2.

ets, meteors and other types of aurorae (Stothers 1979, p. 90). The *locus classicus* for this auroral “chasm” is the following passage from Aristotle’s treatise on meteorology:

Sometimes on a clear night a number of appearances can be seen taking shape in the sky, such as “chasms,” “trenches” and blood-red colours. . . . Chasms have an appearance of depth because the light breaks out from a dark blue or black background. Similar conditions often cause the fall of “torches” when there is a greater degree of condensation: but while the process of contraction is going on a chasm appears.<sup>27</sup>

The term *bóthynoi*, which Lee translated as “trenches,” is a variant of *bóthros*, “hole, trench, or pit dug in the ground,”<sup>28</sup> that appears to be restricted to the above passage and an enumeration of atmospheric “fires” supplied by Pseudo-Aristotle (2<sup>nd</sup> century CE?), where Furley rendered the term as “pits”: “In this fiery and disorderly element, as it is called, meteors and flames shoot across, and often planks and pits and comets, as they are called, stand motionless and then expire.”<sup>29</sup> Seneca likewise distinguished *chásmata* from *bóthynoi*, but regarded both types as a sort of “cracks in the heavenly firmament”:

There are *bothyni*: within a surrounding corona there is a great gap in the sky like a hole dug in a circle. There are *pitthiai*: an enormous round mass of fire, like a barrel, either darts by or blazes in one place. There are *chasmata*: some area of the sky settles and, gaping in hiding—so to speak—sends out flame.<sup>30</sup>

Pliny appears to have recognised only chasms: “There also occurs a yawning of the actual sky, called *chasma*.”<sup>31</sup> The concept of these chasms, apparently merging with that of *bóthynoi*, survived in the early scientific literature of modern Europe, along with other Aristotelian categories of atmospheric lights. For example, the Dutch physician and astronomer, Cornelius Gemma (1535–1578 CE), listed five types of portentous atmo-

27. Aristotle, *Meteorologica*, 1. 5 (342a34–35, 342b15–18), trans. Lee 1987, pp. 36–39, translating *chásmata*, *bóthynoi*, and *baimatódē chrómata* as “chasms,” “trenches,” and “blood-red colours.”

28. Liddell and Scott 1996, p. 320 s. v. “βόθρος” βοθύνοσ”.

29. Pseudo-Aristotle, *De Mundo*, 2 (392b), trans. Furley 1978, pp. 352–353.

30. Seneca, *Naturales Quaestiones*, 1. 14. 1, trans. Corcoran 1971, pp. 74–75, translating *ingens caeli recessus* . . . *similis effossae in orbem specu* as “a great gap in the sky like a hole dug in a circle”; with Bone 1996, p. 28.

31. Pliny, *Naturalis Historia*, 2. 26 (97), trans. Rackham 1991, pp. 240–241, translating *hiatus* as “a yawning.”

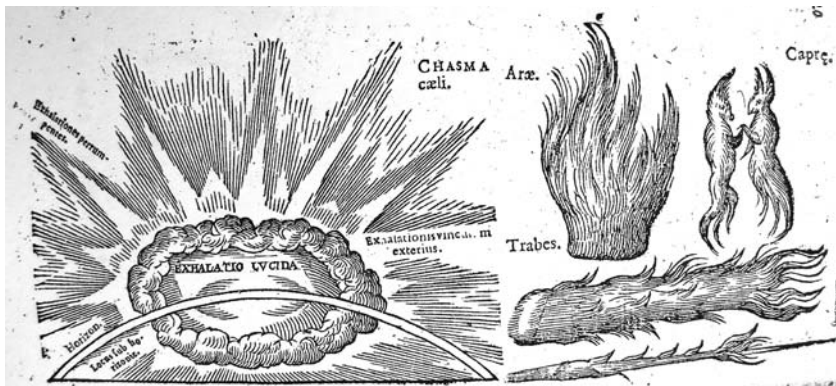
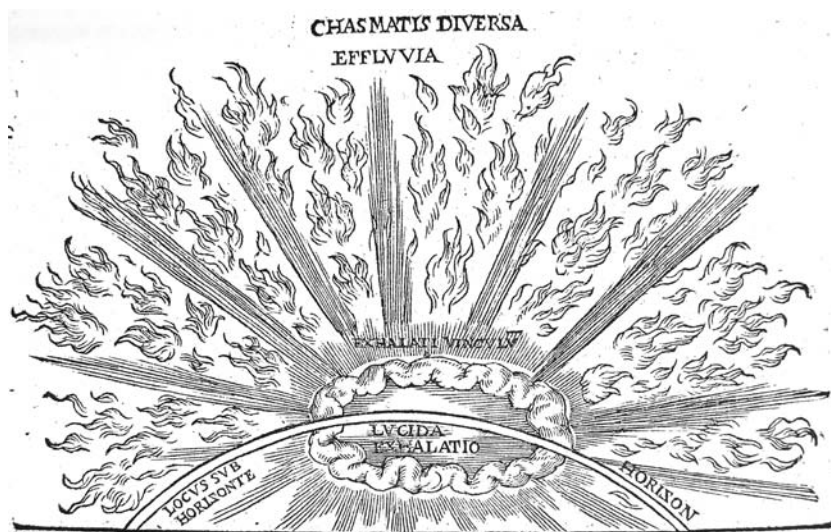


Figure 1. An overview of types of aurorae (1575 CE)

spheric phenomena that are regarded as aurorae today, including *hiatus*, *chasmata Græcis*, “a gap, chasms to the Greeks.”<sup>32</sup> The four occasions on which he claimed to have personally witnessed the latter are presumably the events he gave for 10 September 1569, 11 September 1571, 15 June 1572, and 27 January 1573 (Gemma 1575, II:65–66, 69, 75–76, 162), characterised in terms such as *tum & cælum discindi visum est*, “and then the sky was seen to split,” *chasma in aëris parte quæ circium spectat*, “a chasm in the part of the air that looks northwest (?),” *chasma . . . exactè à cæli parte quæ subsolanum respicit*, “a chasm exactly in the part of the sky that belongs to the east,” *huius interior quædã vorago nigrior occurrebat*, “the interior of which presented itself as a blacker pit,” and *chasma . . . in aëre . . . instar ciuitatis incensæ*, “a chasm in the air, the likeness of a burning city.” The accompanying images, which constitute some of the oldest illustrations of the northern lights in Europe, include one labelled *CHASMA cæli* or “hole of the sky” (Figure 1; Gemma 1575, I:120) and one entitled *CHASMATIS*

32. “Præter cometas plurima restant in eandem classem à meteorographis relegata. Sunt enim & hiatus, chasmata Græcis, tam quarter à nobis obseruata: semper quidem Boream versus, aut Circium, aut Hellespontum, eadem specie, iisdem comitantibus malis. Cuncta hæc plenius inter nostræ ætatis prodigia describentur, quomodo & aræ ardentes, & hastæ, & faculæ, & capræ saltantes, aliaq’ de quibus satis feliciter à physicis disputatum est. \* Multum in illis materiæ species facit, plurimum aspectus ex ipsa positione diuersitas, quod & in iride demonstrat Aristoteles” (Gemma 1575, I:119). The categories distinguished here are the *hiatus*, *chasma* or “chasm,” *aræ ardentes* or “burning altars,” *hastæ* or “spears,” *faculæ* or “torches,” and *capræ saltantes* or “leaping goats.” Link’s (1967, pp. 299, 303) impression that the Aristotelian term “chasm” began to be used as a designation for aurorae in general from the 16<sup>th</sup> century onward certainly does not apply to Gemma, whom he did cite.



**Figure 2.** The *aurora borealis* of 18 February or 7 October 1564 (1575 CE)

*DIVERSA EFFLUVIA*, “various outflows of a chasma,” which was recorded on 18 February or 7 October 1564 (Figure 2; Gemma 1575, II:43). In addition to these, Gemma offered accounts of such chasms for the birth of Christ, 18 February and 7 October 1564, when *chasmata & hiatus* were observed *debescente caelo*, “as the sky opened up,” 25 September 1568, with *vorago caeli circa Septentrionem*, “a gap of the sky around Ursa Major,” and a day in 1574 (I:193–194; II:42–43, 63, 175). In a cataloguing project that can be regarded as a continuation of Gemma’s activities, the German astronomer, Christfried Kirch (1694–1740), listed a “Chasma” for 20 October 1593, followed by several other instances.<sup>33</sup>

Meanwhile, medieval and Renaissance chroniclers more naively continued to record portentous schisms of the sky with resort to popular imagery instead of the “scientific” jargon; sometimes a longitudinal shape would appear inside the opening. Thus, for 2 January 1564, Norway’s best known author of the time, Absalon Pederssøn Beyer (1528–1575 CE), noted in his diary that “Peder Simonson’s servant, who was reliable and a pious person as well, saw the sky open and there seemed to fall from it a

33. Kirch, *Notes*, ed. Schröder 1996, p. 24. Kirch, too, acknowledged that, in earlier times, “chasm” was only one of a number of designations of the aurora: “Denn die Alten gaben ihnen zuweilen den Nahmen Chasma, oder einen brennenden Himmel, oder nördliche Helligkeit, oder wohl gar, wenn die Farbe sich dazu schickte, einen blutigen Himmel” (1729, p. 15, ed. Schröder 1996, p. 42).

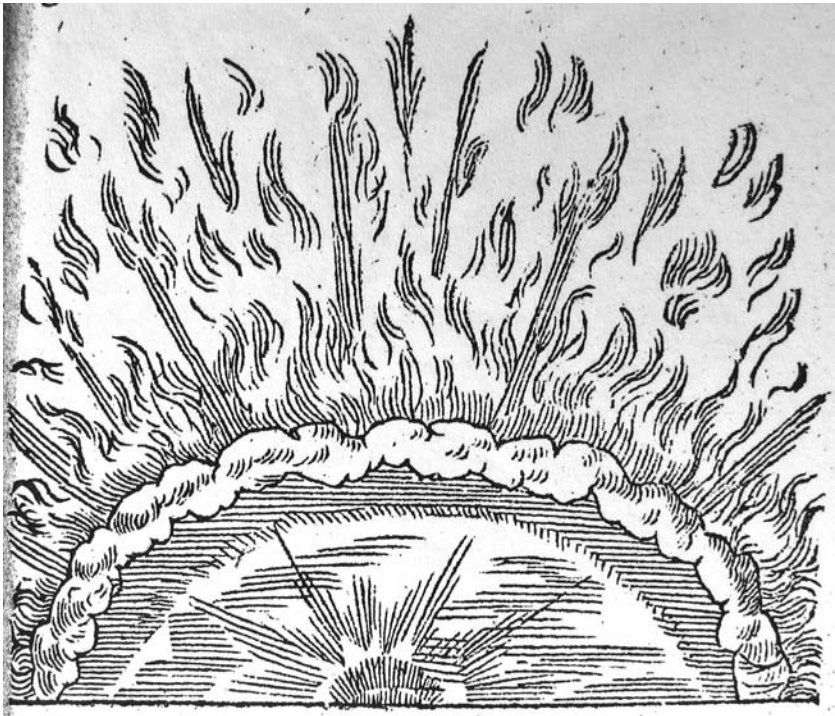
glowing Saint Olav's sword. It seemed to fall down towards the earth and then rise again."<sup>34</sup> And even in relatively modern times, the inhabitants of the isle of Øsel, Estonia, subscribed to a belief that, on some nights, heaven opened up and two armed warriors appeared, each eager for a fight, but prevented from doing so by God (Brekke and Egeland 1983, p. 5; the source is not identified).

### Typology of Auroral Holes

Can such "chasms" or "schisms" be identified more precisely in terms of modern auroral morphology? Auroral *arcs* go a long way towards elucidation of the motif. Arcs, which tend to appear in the early hours of the evening and can remain static for some time, up to several hours, are thin, curved ribbons of light with a smooth lower edge, that usually run from east to west across the whole sky, and normally to the north at northern latitudes. An arc can be nearly 2,000 kilometres in length and seems like "an enormous wall of light suspended on its edge in the atmosphere" (Petrie 1963, p. 50), gaining in brightness and definition as it rises from a position close to the horizon towards the zenith. The Canadian scientist, William Petrie, remarked: "A homogeneous arc when located near the horizon is seen as a luminous arch across the sky and appears to be a segment of a circle. . . . Because of the sharp lower edge, the sky between it and the horizon appears to form a dark segment. The Greeks and the Romans likened this to the mouth of a cave, a chasm, or to a gulf from which flamed forth the fires of heaven" (p. 31). A Scottish auroral researcher, the late Neil Bone (1959–2009), concurred: "In ancient Roman and Greek records, references may sometimes be found to 'chasmata' in the sky, the auroral arc structure being regarded in such instances as being the mouth of a celestial cave" (1996, pp. 8–9; cf. Link 1967, p. 299). This explanation of Aristotle's terminology was arguably first furnished by the German scholar, Hermann Fritz (1830–1883), who wrote in 1881: "Bei den Bezeichnungen *χάσματα* (Oeffnungen) und *βόθυνοι* (Höhlen) hat man sich Erscheinungen mit Bogen (mit darunter befindlichem dunkeln Theile, dem Segmente) vorzustellen" (p. 331).

The illustrations Gemma offered of the respective *chásmata* discussed in his text bear out the adequacy of the interpretation of the "chasms" as references to the dark zone confined between the horizon and an auroral arc. Each of these drawings depicts the chasm as the dark upper half of a circle

34. "Saage (natten til mandagen huilket aar var skudaar) her Peder Simensons tienstekarle ssom staa til troend, oc ere fromme personer den tid at de komme thil Huarffuen huorlunde at himmelen obnedis, och falt der aff honnom som dem syntis en glöende Sancte Olluffs breyde, oc syntis hun dem fälle ned mod jorden, oc lit der effter opfare igen" (Pederssøn, *Dagbok 1552–1572*, ed. 1963, p. 50, trans. Brekke and Egeland 1983, p. 40).



**Figure 3.** The *aurora borealis* of 27 January 1573 (1575 CE)

of vaporous substance, surrounded by luminous rays and flames; for the events of 1564 and 1573 specifically, the complementary, lower half of the circle is added and captioned with the words *locus sub horizonte*, “the area below the horizon” (Figures 2, 3; Gemma 1575, II:43, 162), indicating that the visible half of the chasm above the horizon corresponds to what is currently called an auroral arc. In his account of the aurora of 16 and 17 November 1729, Kirch offered an explicit description that could easily have served as a caption to Gemma’s images: “Wenn man genau Achtung gab, erblickte man 2 blasse Bogen, die aber nur sehr wenig heller waren, als die übrige Erleuchtung, deren einer bis an den Polarstern in die Höhe reichte, der andere war unter demselben; Gegen dem Horizont krümmten sie sich um, und formirten als Ovale, deren unterstes Theil unter dem Horizont verborgen war” (Kirch 1729, pp. 3–4, ed. Schröder 1996, pp. 36–37).

The striking darkness of such segments regularly drew attention from

eyewitnesses and was discussed in the literature from as early as 1832, when the German historian of meteorology, Julius Ludwig Ideler (1809–1842), wrote of “das dunkle Segment in der Nähe des Horizontes” in connection with aurorae (1832, p. 79). His compatriot, the naturalist and explorer, Friedrich Alexander, baron von Humboldt (1769–1859), felt that such dark segments formed a physical entity of their own, the formation of which can precede that of the enclosing arc. Possibly following Ideler, he dubbed this “the so-called *black segment* of the aurora, which rises gradually on the horizon like a dark wall of clouds” and observed that “The blackness is not . . . a mere result of contrast, since it is occasionally visible before it is bounded by the brightly-illuminated arch. It must be a process effected within some part of the atmosphere, for nothing has hitherto shown that the obscuration is owing to any material blending. The smallest stars are visible through the telescope in this black segment, as well as in the colored illuminated portions of the fully-developed aurora” (Humboldt 1868, pp. 147–148).<sup>35</sup> The black segment was commented on by an observer of the so-called “Carrington Event” based at Halifax, Nova Scotia, on 28 August 1859: “Soon after 8 P.M. two arcs of light N. and S. appeared, that to the south being the brightest. Under both these arcs the heavens were dark; but observers were uncertain as to whether the darkness was cloud or not” (Lieutenant N. Home, in Anonymous 1860, p. 251). The day after, the dark area beneath an arc was noted by the French astronomer, Remi Armand Coulvier-Gravier (1802–1868), based in Paris: “The space occupied by the small arch was, as usual, of a greenish color; the centre near the horizon being black, and the whole destitute of rays” (Anonymous 1860, p. 391). The German polar scientist, Karl Weyprecht (1838–1881), witnessed the phenomenon in a manifestation of the northern lights in December 1873:

Dort im Süden, tief am Horizonte, steht ein matter Lichtbogen. Er sieht aus, als sei er die obere Grenze eines dunklen Kreissegmentes; allein die Sterne, die in ungetrübten Glanze daraus hervorblicken, überzeugen uns, daß das Duster des Segmentes nur eine durch Con-

35. Cf. Humboldt 1848, p. 192 n.\*. Along with Ideler’s “schwarzen Nordlichtstrahlen” (1832, p. 91) and Humboldt’s categories of “*black rays*” and “*black patches*,” modern physicists refer to these “black segments” as *black aurorae* and tend to explain them as “anti-aurorae,” occurring when negatively charged particles do not move into the atmosphere of the earth, producing the characteristic glow, but move away from it, cf. Anthony L. Peratt, personal communication, 18 May 2009. The understanding that the optical darkness is due to particles that are sucked away is redolent of the classical descriptions of a “yawning” of the sky. Compare Weyprecht 1881, p. 39; Tromholt 1885, pp. 197, 211–212.

trast hervorgerufene Täuschung ist. (Weyprecht, in Payer 1876, pp. 197–198)<sup>36</sup>

And on Thursday, 18 October 1894, travelling at a latitude of just below 81° North, the Norwegian Arctic explorer and scientist, Fridtjof Nansen (1861–1930), observed a similar scene:

On coming up again on deck later in the evening, I found nearly the whole of the aurora collected in the southern half of the sky. A low arch, 5° in height, could be seen far down in the south over the dark segment of the horizon. (1897, p. 484)<sup>37</sup>

Meanwhile, the impression of dark holes during auroral displays is not limited to the low regions of the firmament close to the horizon; on the same occasion as the one cited above, Nansen stated that “the sky seems to be constantly covered with a luminous veil, in which every here and there are dark holes” (p. 485). Apparent rifts higher up in the celestial fabric are required to make sense of mythical or other traditional accounts of “tears,” such as may be situated *corona cingente introrsus*, “within a surrounding corona,” as Seneca stipulated for the *bóthynoi*. A promising candidate in this regard is the *corona* or “crown,” often praised as the pinnacle of auroral splendour. Reasonably common at latitudes higher than perhaps 50°, but rare below it, the corona is a configuration in which rays, folded bands or other features from all around the sky, as a result of perspective, appear to arrange themselves around a single centre, bathing the entire sky in celestial fire similar in form to a starburst or a radiant “sun.” The centre of convergence is the magnetic zenith, where the local direction of the earth’s magnetic field is straight overhead. Effectively, an observer of the corona looks straight up into the centre of the auroral oval, as it passes overhead. As witnesses have often remarked on the empty dark space at the zenithal “eye” of a corona, this may be an alternative explanation for “holes” in the sky, especially insofar as the zenith at these latitudes is close enough to the constellations of the rotational poles to justify a traditional association of such a hole with the pole, as discussed above. For example, days after the auroral occurrence cited above, on Monday, 22 October 1894, Nansen was treated to a “lovely aurora” of this kind:

A brilliant corona encircled the zenith with a wreath of streamers in several layers, one outside the other; then larger and smaller

36. The reason that this auroral arc appeared to the south is that Payer’s vessel at this time was situated at a latitude of 79°51′ North, well to the north of the auroral oval, which is centred on 67° North at midnight.

37. Nansen observed these aurorae “in the southern part of the sky” as he was travelling at 81° N, more than 10 latitudinal degrees north of the auroral oval.



sheaves of streamers spread over the sky, especially low down towards S.W. and E.S.E. All of them, however, tended upwards towards the corona which shone like a halo. I stood watching it a long while. Every now and then I could discern a dark patch in its middle, at the point where all the rays converged. It lay a little south of the Pole Star, and approached Cassiopeia in the position it then occupied. (1897, p. 490)

At one point, “fresh streamers shot out of the darkness outside the inner halo, followed by other bright shafts of light in a still wider circle, and meanwhile the dark space in the middle was clearly visible” (p. 490). Earlier, Humboldt had already noted: “The central portion of the corona of the aurora (which, owing to the effect of linear perspective, corresponds at its highest point with the magnetic inclination of the place) is also usually of a very deep black color” (1868, p. 148). As an example, he cited the corona witnessed from Cambridge, England, between 10 and 11 pm on Sunday 24 October 1847 by the English physicist and astronomer, James Challis (1803–1882): “The most remarkable feature of the phenomenon was the distinct convergence of all the streamers towards a single point of the heavens, situated a little to the east of the meridian and to the south of the zenith. Around this point a corona, or star-like appearance, was formed; the rays of which diverged in all directions from the centre,—leaving a space about the centre free from light” (1847, p. 1151).<sup>38</sup> And on 23 August 1838, Richard Carter Smith (1802–1864), who was stationed at Frogner, Oslo, also perceived a “portal” in the polar centre at the exact moment a corona appeared:

Gradually, the aurora came closer, and it became more and more radiant until Ursa Major was in the middle of a broad shining band. As it moved up toward the Polar Star it started to emit light rays down toward the northern horizon. Soon thereafter the uttermost points on the huge arc became clearer, and suddenly they emitted light beams straight up to the zenith, until they disappeared to make a portal above our heads. . . . The light radiated

38. Challis determined that the corona was centred on the magnetic zenith: “It was easy to fix on the central point. According to an estimate made conjointly by myself and a friend at 10<sup>h</sup>. 10<sup>m</sup>. Cambridge mean time, it preceded the bright star Mirach, or  $\beta$  Andromedæ, 10<sup>m</sup>. in right ascension, and had greater North Polar distance by 2°. Consequently, by calculation, its azimuth was 18°41′ from S. towards E. and its altitude 69°51′. The azimuth appeared not to vary with the diurnal motion of the heavens. According to the above result, this singular point was situated in or very near a vertical circle passing through the magnetic pole” (1847, pp. 1151–1152).

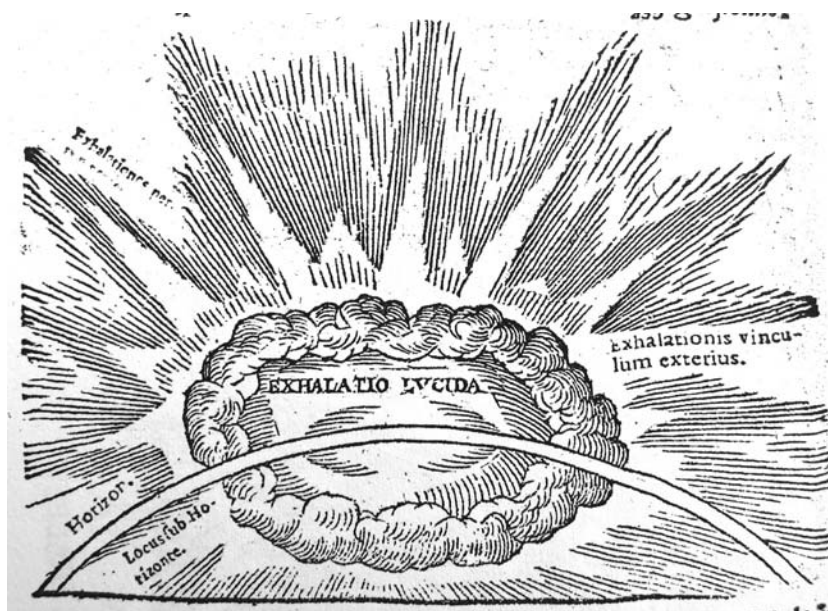


Figure 4. The *aurora borealis* of 25 September 1568 (1575 CE)

incessantly from horizon to zenith and changed continually in intensity.<sup>39</sup>

In sum, eyewitness reports of auroral arcs and coronae frequently describe gaping dark holes, in which one may see the original referents of the sky hole mentioned in archaic mythological or cosmological traditions.

#### Repetitive Opening and Shutting of the Hole

The hypothesis that the sky holes of ancient cosmological traditions derived from observations of dark spots coincident with auroral arcs and coronae is strengthened by a number of additional agreements between mythological traditions and auroral physics. In a manner reminiscent of the Greek motif of the Symplegades or “clashing rocks,”<sup>40</sup> a number of

39. R. C. Smith, *Travel in Norway 1838 = Reise i Norge 1838*, trans. Johnny Johnsen, Oslo, 1976, in Brekke and Egeland 1983, p. 33. For 25 September 1568, Gemma (1575, II:62) likewise reported a *vorago cæli circa Septentrionem*, “a gap of the sky around Ursa Major,” but it is doubtful whether this was a corona as the accompanying illustration (see figure 4) presents the chasm as a low-hanging arc. The observation will have been made at a relatively low latitude, where the polar region of the sky appears low enough to potentially be seen inside an arc.

40. See the appendix for a discussion of this comparison.

myths expatiate on the propensity of the hole in the sky to open and close by means of a cover, often in rapid progression. For example, on the cosmology of the Chukchi people, the “several holes” associated with the pole star were believed to be “closed with stoppers” (Bogoras 1904–1909, p. 331; compare the stories in 1902, p. 591). The Tsimshian, of northern British Columbia, observe that the sky, “a beautiful open country,” “is reached through the hole in the sky . . . , which opens and closes”: “In order to pass through, one has to count four times; and when it opens the fourth time, it is possible to fly through the hole rapidly” (Boas 1916, p. 453).<sup>41</sup> A *wulla mulling* or medicine-man of the Bratowooloong, one of the tribes of the Kurnai, in Victoria, Australia, subjoined the following report of his initiation:

My father put a cord of sinews round my waist and under my arms, and he and the old men carried me by it over the sea at Corner Inlet, and set me down at Wilson’s Promontory in front of a big rock like the side of a house. I noticed that there was something like a door which opened and shut very quickly. My father tied something over my eyes and led me into the rock. I knew this because I heard the door make a sound of shutting to behind us. Then he uncovered my eyes and I found that I was in a place as bright as day. (Tankli, son of Bunjil-bataluk, a Bratowooloong, in Howitt 1887, p. 51)

In a similar way, prospective shamans of the Wiradjuri people, of central New South Wales, used to believe that their spiritual guides led them upwards to the celestial abode of the supreme god Baiame. From an anonymous member of the kangaroo totem of the Muri subclass of this nation comes the account of a medicine-man whose initiation took place when his father, acting as a supervisor, led him upwards to Baiame’s place on a “thread,” presumably in the mind:

My father then said we will go up to Baiame’s camp. He got astride of a thread and put me on another, and we held by each other’s arms. At the end of the two threads was Wombū the bird of Baiame. We went through the clouds, and on the other side was the sky. We went through the place where the doctors go through, and it kept opening and shutting very quickly. . . . On the other side we saw Baiame sitting in his camp. (Howitt 1887, pp. 50–51)<sup>42</sup>

41. For the culture hero passing through the hole, see 1916, pp. 60–62.

42. In the *verbatim* repetition of this account in 1904, p. 407, the term used for the “thread” is given as *Mauir*.

In the course of his celestial journeys, a Wiradjuri “doctor” had to pass through the same “fissure,” following his arrival in the “darkness of the night sky”:

To pass into Palima, the doctor had to go through a fissure, through which the Ancestral Beings had passed when they left the earth. This fissure or cleft was termed *’mup̄ara:m* (or *’m̄p̄aran*), and its two walls were continually moving around; this was demonstrated by the informant who used the open palms of both hands, placed them together, and rubbed them in a circular manner. The revolving of the *’mup̄ara:m* left a small aperture which was revealed at intervals; it was through this latter that the doctor had to pass. . . . Watching the revolving *’mup̄ara:m* till an aperture appeared, the doctor entered and found himself in Palima, a country much the same as the earth, having also a sky above it. (Berndt 1946–1947, p. 362)

The early comparative mythologists, Paul Ehrenreich (1855–1914) and Uno Holmberg (1882–1949), detected a correlation between the motif of the “clashing rocks” and the widespread belief, at least on the northern hemisphere, “daß am Erdrand, wo Himmel und Erde sich berühren, ein Spalt sich befindet, über dem der Himmel sich erhebt und senkt” (Ehrenreich 1910, p. 205).<sup>43</sup> As an example of the latter, the Haida, of the Queen Charlotte Islands, British Columbia, sustained a notion that “The firmament rises and falls at regular intervals; and the clouds, which strike against the mountains in consequence, produce a noise. It may be distinctly heard, but is quite different from thunder.”<sup>44</sup> In parallel traditions, the repeated elevation of the sky is often stated to expose a gap. For example, the Buryat, of south-central Siberia, held that the sky, conceived as a “grossen, abwärts gewendeten Kessel,” is engaged in a “ständiger, abwechselnd hebender und senkender Bewegung”: “Beim Heben des Himmelsdeckels entstehe zwischen seinem Rande und demjenigen der Erde eine Öffnung.” This circumstance allegedly enabled a legendary hero to pass through into the sky: “Ihre Sagen berichten, wie ein Held, diese Gelegenheit benutzend, seinen Pfeil zur Stütze in die zwischen den Rändern des Himmels und der Erde entstandene Öffnung steckte und so auf die Aussenseite der Welt schlüpfen konnte” (Holmberg 1923, p. 11). A plau-

43. For an example from Russian folklore, see Holmberg 1923, p. 11, who considered this motif perfectly natural and intuitive with respect to the horizon: “Eine derartige Auffassung kann bei den verschiedenen Völkern ganz von selbst entstehen, da doch der Horizont in unserem Gesichtskreise sich tatsächlich herab bis an den Rand des Erdkreises zu erstrecken scheint.”

44. Ghandl alias Walter McGregor (±1851–±1920), a Sea-Lion-Town Haida, or Abraham, a Rear-Town Haida, in 1900 or 1901, in Swanton 1909, p. 12.

sible parallel in the mythology of the Sikuani, of eastern Colombia, concerns the journey of Ibaruova, a primordial being, to “the spot where the sea joins with the sky”: “The sky is like a curtain. The woman, by lifting the curtain, passed to the other side and climbed up into a little palm. After she had climbed to the top the tree began to grow, as if reaching for the curtain. In another lowering of the curtain the woman jumped onto the other world, the sky” (Gabriel Moreno, in Wilbert and Simoneau 1992, p. 90).<sup>45</sup> In another version of the same myth, the mechanism of entry into the sky is “a stone that rises and falls,” arguably a parallel to the shifting cover that continuously opens and closes:

Ibaruova took another route, navigating downriver in a fragment of a canoe. She came down the Orinoco until she reached the spot where the sky touches the earth. At the end of the sky there is a stone that rises and falls. Around there Ibaruova ascended . . . She walked for many years. (Pedro Martínez, in Wilbert and Simoneau 1992, p. 95)

Various cultures singled out one or more of the cardinal directions as the specific points on the horizon where these death-dealing openings were formed. The Chukchi thus associated the cardinal points on the horizon with gates that open and close at a rapid speed: “In our world the sky is supposed to touch the earth on all sides of the horizon. Each border of the horizon is called “Attainable Border of the Sky” (Yê<sup>e</sup>-pkêt-ta’gîn). On the four corners of it, the rocks of the sky come down to the rocks of the earth, like moving gates, shutting and opening alternately. . . . the birds, when flying to their own world every fall, have to pass between these rocks: therefore the gates are called “Attainable Border of the Birds” (Ga’lha-pkêt-ta’gîn). The rocks shut so quickly that birds lagging behind are caught, and crushed between them. . . . These moving gates have existed from the time of the first creation” (Bogoras 1904–1909, p. 332; reproduced almost *verbatim* from 1902, p. 60). Indeed, the Chukchi regarded the shutting mechanism of these gates as the cause of the winds: “Their incessant movement . . . produces winds, which blow from all sides of the horizon” (p. 332). Moreover, “the friction of the “Attainable Border of the Sky” against the rocks of the earth” produced “fragments” from which “men are said to have originated” (p. 332; cf. 1902, p. 641). The Karen, of Birma, situated a perilous aperture on the western horizon: “In the west

45. Compare: “as she arrived, the sky lifted itself up and was consumed in the river” (Obdulia Rodríguez, in 1992, p. 80); “Ibaruova, the old woman, reached the sky by another path that descended” (Rita Gaitán, in 1992, p. 86); “She went to the end of the earth and there she, too, ascended” (Eutimio Vargas, interviewed in 1963, in 1992, p. 97).

are two massive strata of rocks which are continually opening and shutting. Between these strata the sun descends at sunset, but how the upper stratum is supported, no one can describe" (Mason 1865, p. 234). During an annual festival held in February or March, the Bghai section of the Karen would sacrifice a fowl with the following admonition:

The seven heavens, thou ascendest to the top; the seven earths, thou descendest to the bottom. Thou arrivest at Khu-the; thou goest unto Tha-ma [i. e., Yu-ma, the judge of the dead]. Thou goest through the crevices of rocks, thou goest through the crevices of precipices. At the opening and shutting of the western gates of rock, thou goest in between; thou goest below the earth where the sun travels. . . . I make thee a messenger, I make thee an angel. (p. 233)<sup>46</sup>

In a tradition related by a chief of the Seneca, a branch of the Iroquois, of New York State, a band of young men headed by De'haě<sup>n</sup>'hyō'wě<sup>n</sup>'s or "He-Who-Cleaves-the-Sky-in-Twain" sets out towards the west and arrives at the edge of the oscillating sky:

They were surprised at seeing the visible sky rise and fall again, at regular intervals. In their estimation it rose to the height of the tallest pine tree known to them, before falling back. They saw, too, that the place from which it rebounded was so smooth that it glistered. While watching the rising and falling of the Sky, they beheld a large number of pigeons flying out from the other side of the Sky, and which after flying around for some time returned whence they had come. Then De'haě<sup>n</sup>'hyō'wě<sup>n</sup>'s said, "What manner of thing shall we now do? To be sure, here seems to be, indeed the end of the earth. It is evident, indeed, that there is another country lying beyond this sky-barrier which is thus continually rising and falling. . . . we must pass so quickly under the sky as it rises that we shall not be caught by it when it falls back."<sup>47</sup>

As the adventurers transcend the gap, they lose one of their group:

Then the man who had been addressed, reassuring himself, selected a favorable starting point for his dash under the rising sky. Carefully timing the rising and falling of the sky he dashed forward as swiftly as possible. His friends watched him rush onward until he

46. "Yu-ma" is a typographic error for *Yama*.

47. John Arthur Gibson (1850–1912), a Seneca chief, in 1899, in Hewitt 1928, pp. 795–796; compare the more liberal translation in Curtin and Hewitt 1918, pp. 610–611.

had disappeared on the farther side of the obstacle. As the sky kept rising and falling the second man, making like dispositions, dashed forward, clearing the barrier as the first man had, and disappearing on the other side. The third man and the fourth man had like success in clearing this obstacle. The sky, however, did not cease from rising and falling back onto its bed. It was now the turn of the fifth and last man to tempt the peril of attempting to pass under the sky. His four companions anxiously watched him making ready to clear the danger which they had safely passed. The quartet did not see him start, but as the sky arose they saw him running still far from the passage. But, just as he leaped, the sky fell back, crushing him to death. He had miscalculated the time and distance he had to run, and his career ended in that place.<sup>48</sup>

A variation on this tale recounted by an Ottawa spokesman from Michigan portrays the east, where the sun rises, as a place where the elevation of the sky intermittently produces an opening, allowing access to gusts of wind as well as the sun. In this myth, the boy hero, Iosco, and his friends embark on a long journey to the east in order to meet the sun. Following the crossing of the sea that surrounds the earth, they encounter the old man, Manabozho, possibly representing the morning star, who reveals:

Soon after you leave this place, you will hear a deafening sound: it is the sky descending on the edge, but it keeps moving up and down; you will watch, and when it moves up, you will see a vacant space between it and the earth. You must not be afraid. A chasm of awful depth is there, which separates the unknown from this earth, and a veil of darkness conceals it. Fear not. You must leap through; and if you succeed you will find yourselves on a beautiful plain, and in a soft and mild light emitted by the moon.<sup>49</sup>

Upon reaching this point, two of the party successfully leaped across the gap, while two others again perish in the chasm:

They had not proceeded far, when they began to hear the sound of the beating sky. It appeared to be near at hand, but they had a long interval to travel before they came near, and the sound was then stunning to their senses; for when the sky came down, its pressure would force gusts of wind from the opening, so strong that it was

48. John Arthur Gibson, in 1899, in Hewitt 1928, p. 796; compare Curtin and Hewitt 1918, p. 611 and two variants recorded by Frederick Waugh at the Six Nations Reserve, Ontario, Canada, between 1911 and 1918, #113 and #114, in Randle 1953, pp. 630–631.

49. Chusco or Muskrat of Michilimackinac ( $\pm 1765$ –1837 CE), an Ottawa chief, in Schoolcraft 1839, pp. 51–52.

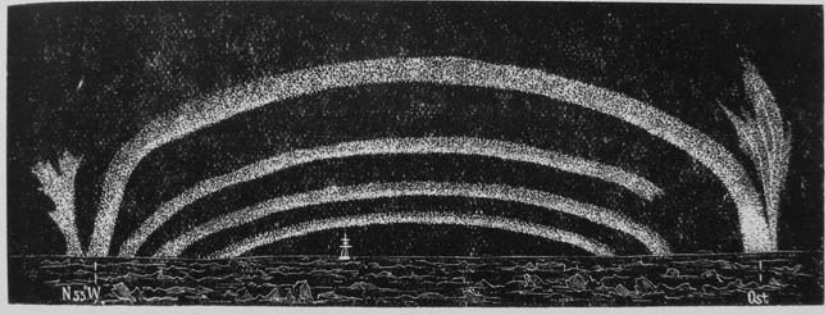
with difficulty they could keep their feet, and the sun passed but a short distance above their heads. They, however, approached boldly, but had to wait some time before they could muster courage enough to leap through the dark veil that covered the passage. The sky would come down with violence, but it would rise slowly and gradually. The two who had made the humble request, stood near the edge, and with no little exertion, succeeded, one after the other, in leaping through, and gaining a firm foothold. The remaining two were fearful and undecided: the others spoke to them through the darkness, saying, "leap! leap! the sky is on its way down." These two looked up and saw it descending, but fear paralyzed their efforts; they made but a feeble attempt, so as to reach the opposite side with their hands; but the sky at the same time struck on the earth with great violence and a terrible sound, and forced them into the dreadful black chasm. (Chusco or Muskrat of Michilimackinac, in Schoolcraft 1839, pp. 53–54)

Restricting himself to the mythology of the Iroquois, the American ethnographer, John N. B. Hewitt (1859–1937), appears to have been the only scholar ever to finger the aurorae as a likely source of the theme of the recurrent shutting and opening of the sky: "In many of the Iroquois myths of the journeys of men and disembodied spirits to the Land of Souls, it is asserted that the sky raises and falls at the point of egress from this world, and that spirits which have not fulfilled their duties in this life are crushed by the impact of the sky at this passage. The origin of this notion seems to be in the fact that the fitful coruscations of the aurora borealis or northern lights dance over the nebulae of the night, a phenomenon that they may have supposed was caused by the raising and falling of the sky, not suspecting that their explanation of the cause of the dancing of the aurora was a subjective notion. Confirmative of this explanation of the belief in question is the fact that usually this passage is located in the extreme northwest" (1892).<sup>50</sup> Circumstantial support for Hewitt's proposal derives from the "unequaled . . . brightness" followed by the "game of lacrosse ball-play" the legendary travellers encountered following their arrival in the sky, according to one tale;<sup>51</sup> the belief that the northern lights are the scene of a host of spirits engrossed in a ball game of some sort is wide-

50. The examples collected by Hewitt as examined above situate the clashing sky exclusively in the west, not in the northwest. Savage (1995, p. 33) misled readers when presenting Hewitt's hypothesis as a documented Iroquois tradition.

51. John Arthur Gibson, in 1899, in Hewitt 1928, pp. 796–797; compare the more liberal translation in Curtin and Hewitt 1918, pp. 611–612.





**Figure 5.** *Aurora borealis* in the form of four homogeneous arcs, observed from the Swedish vessel *Vega*, when it was frozen into the Bering Strait in the winter of 1878–1879

spread in the northern hemisphere<sup>52</sup> and in at least one tradition—from the Wabanaki, of New England and the Canadian Maritimes—a mortal chief witnesses the sport during a visit to “the country of Wa-ba-ban (northern lights)” (Brown 1890, p. 213). Though the rising and falling of the sky is not featured in the latter story, it does undergird the possibility that the celestial sojourn of the Seneca and Ottawa tales was likewise deemed to have occurred in the region of the northern lights. Yet our attempt to resuscitate Hewitt’s forgotten suggestion will need to be more specific about the exact types of aurorae that could be responsible for the motif. From an auroral perspective, the repetitive opening and closing of the aperture in the sky lends itself to at least two types of interpretations, one of which concerns openings formed directly above and apparently “behind” the horizon, the other holes observed higher up in the sky.

Traditions that situate the hazardous opening in the borderland between heaven and earth, as cited above, are best explained on the association of the hole with the dark space between the horizon and an auroral arc; the repeated occlusion then corresponds to horizontal oscillations in the position of the arc.<sup>53</sup> The folkloristic notion of the cyclical rising and sinking of the “sky” above the horizon, as explored above, can hardly be separated from the abundantly documented tendency of auroral arcs to rise and fall at various rates of succession. An example is the following auroral

52. *e.g.*, for the Chukchi, Bogoras 1902, pp. 634–635; 1904–1909, p. 334; and for the Inuit of Labrador, Hawkes 1916, pp. 137, 153.

53. Compare: “Wegen ihrer Lage am Erdrande bezeichnen die Symplegaden oft ausdrücklich den Eingang zur Unterwelt” (Ehrenreich 1910, p. 205).

record from Korea for 22 November 1141 CE: “During the night, a scarlet vapor soared into the sky. It reached Gouzhen and Ziwei. Also there were more than ten bands of white vapor alternately rising and falling.”<sup>54</sup> (For an example of multiple arcs, see figure 5.) And in keeping with a common pattern, the faint arc Weyprecht observed above the southern horizon in 1873, delimiting an eerily dark chasm, slowly progressed towards the zenith, followed by others, until all began to retreat again:

Langsam nimmt der Bogen an Intensität zu und hebt sich gegen den Zenith; er ist vollkommen regelmäßig, seine beiden Enden berühren fast den Horizont und schreiten gegen Ost und West vor, je mehr er sich hebt. . . . Höher und höher steigt der Bogen, in der ganzen Erscheinung liegt eine classische Ruhe; nur hie und da wälzt sich langsam eine Lichtwelle von der einen Seite zur andern hinüber. . . . Noch steht er entfernt vom Zenith, und schon trennt sich ein zweiter Bogen vom dunklen Segmente im Süden ab, dem nach und nach andere folgen. Alle steigen dem Zenith entgegen; der erste hat ihn jetzt schon überschritten, senkt sich langsam gegen den Nordhorizont herab und verliert an Intensität. . . . Je tiefer sie gegen Nord herabgehen, desto mehr erblässen sie und verschwinden zuletzt vollständig; oft aber kehren sie alle über den Zenith zurück und erlöschen, wie sie gekommen sind.<sup>55</sup>

Other auroral forms than arcs may display similar repetitive behaviour. In Japan, on 13 April 1652 CE, “At the hour of *hai* (LT = 21–23 h), in the west there was a scarlet gleam as large as a basin and above it there was also a patch of scarlet as big as a pestle. Both moved up and down repeatedly and after two hours they reached the zenith and disappeared” (*Yamaga Sokō Kafunenpu*, trans. Xu *et al.* 2000, p. 235). Or, on 23 March 1599 CE, a Korean chronicler noted: “During the night there were violet vapors like arrows and spears, four in the southeast and one in the west. They alternately advanced and retreated. After about one double-hour they were extinguished.”<sup>56</sup> The latter are best analysed as auroral rays.

Observations of such heaving motions may further relate to a deeply rooted fear that the sky may collapse, especially if the pillars that are thought to hold the sky in place will tumble down. For the year 9 CE, the Roman historian, Cassius Dio (fl. 2<sup>nd</sup> century CE), reported the appearance of what must have been three auroral rays seen over Italy, which appeared

54. Jeong Inji, *Goryeo-sa* (1445–1451 CE), 53, trans. Xu *et al.* 2000, p. 211.

55. Weyprecht, in Payer 1876, pp. 197–198; cf. p. 199. Compare: “. . . schneller schießen die Strahlen in die Höhe, sie werden kürzer; Alles hebt sich, näher und näher kommen sie dem magnetischen Pole” (1876, p. 201).

56. Anonymous, *Jeungbo Munbeon Bigo* (1770 CE), 8, trans. Xu *et al.* 2000, p. 228.

to play havoc with the peaks of the Alps in the north: “the peaks of the Alps seemed to collapse upon one another and to send up three columns of fire; the sky in many places seemed ablaze.”<sup>57</sup> That the downfall of the firmament qualifies as an illusion brought on by aurorae is an attractive proposition in view of the similar sentiment Nansen experienced when exposed to a northern light on Friday, 8 December 1893:

It was an endless phantasmagoria of sparkling colour, surpassing anything that one can dream. Sometimes the spectacle reached such a climax that one’s breath was taken away; one felt that now something extraordinary must happen—at the very least the sky must fall. (1897, p. 275)

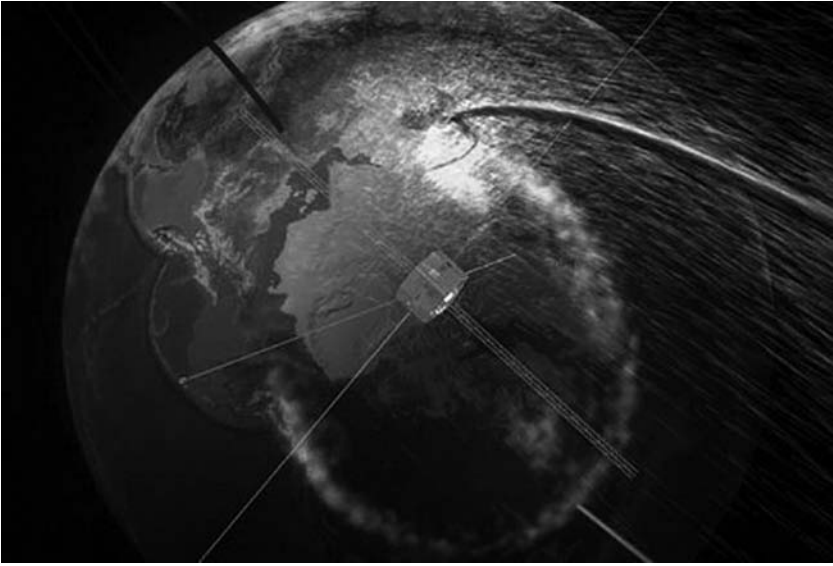
Alternatively, the process of shutting and opening may find a correlate in the goings-on in the dark centre of the “hole,” whether the formation is an arc or, higher up in the sky, a corona. Regarding the latter, one early theorist stated: “The centre of the corona is sometimes dark, that is to say, the sky is seen between the streamers, at other times the central part is filled with luminous matter” (Tromholt 1885, p. 221). Thus, stationed at Burlington, New Jersey, the auroral researcher, Benjamin Vial Marsh (1818–1882), perceived an obstruction of the “perfectly clear” centre of a corona seen on 28 August 1859, a part of the famous “Carrington Event”: “Between 9½ and 9¾ P.M. there was a perfect corona; the streamers on the south side were short, and mostly white, and moved pretty rapidly westward. Their number at one time was probably five or six. At one time the central space was perfectly clear; but afterwards the streamers ran through it to its centre” (B. V. Marsh, in Anonymous 1860, p. 258). The “dark patch” Nansen observed in the middle of a corona on 22 October 1894 likewise exhibited such intermittent behaviour:

Every now and then I could discern a dark patch in its middle, at the point where all the rays converged. It lay a little south of the Pole Star, and approached Cassiopeia in the position it then occupied. But the halo kept smouldering and shifting just as if a gale in the upper strata of the atmosphere were playing the bellows to it. Presently fresh streamers shot out of the darkness outside the inner halo, followed by other bright shafts of light in a still wider circle, and meanwhile the dark space in the middle was clearly visible; at other times it was entirely covered with masses of light. Then it appeared as if the storm abated, and the whole turned pale, and

57. Dio, *Roman History*, 56. 24. 3, trans. Cary 1961, pp. 52–53, translating *bat te koryphai ton Alpeon symptōkēnai te es allēlas kai kionas treis pyroideis aneikēnai édoxan, kai bo ouranōs pblegōménōi pollachēi eūikei*.

glowed with a faint whitish hue for a little while, only to shoot wildly up once more and to begin the same dance over again. Then the entire mass of light around the corona began to rock to and fro in large waves over the zenith and the dark central point, whereupon the gale seemed to increase and whirl the streamers into an inextricable tangle, till they merged into a luminous vapor, that enveloped the corona and drowned it in a deluge of light, so that neither it, nor the streamers, nor the dark centre could be seen—nothing, in fact, but a chaos of shining mist. (Nansen 1897, pp. 490–491)

What Nansen observed bears a striking superficial similarity to the recurrent formation of an “entry window” through which “the solar wind plasma can enter the magnetosphere,” as recently explored by space scientists (Li *et al.* 2008, p. 1; cf. p. 18; 2009, p. 2). Since their launch in 2007, the five satellites that comprise NASA’s fleet of THEMIS spacecraft have contributed much to our knowledge about the exact mechanism by which charged particles from the sun are channelled into the magnetosphere of the earth. In 2008, NASA scientists announced the discovery of a giant hole in the fabric of the earth’s magnetic field, through which charged particles flow in from the solar wind. The flow of plasma from the solar wind into the ionosphere had been known for some years not to be a permanent, steady process, but highly intermittent, dynamic, and “bursty” in character. So-called *flux transfer events*, or FTEs, were thought to take place when the magnetic field of the sun points south and a temporary hole in the fabric of the magnetosphere of the earth allows this to be loaded with plasma (Liu *et al.* 2008; compare, *e.g.*, Paschmann *et al.* 2003, p. 12). In November 2008, space physicists announced evidence that such cracks arise when the solar magnetic field is directed to the north, contrary to the expectation (Li *et al.* 2008). NASA’s five THEMIS spacecraft, while conducting *in situ* experiments, “discovered a breach in Earth’s magnetic field ten times larger than anything previously thought to exist. Solar wind can flow in through the opening to ‘load up’ the magnetosphere for powerful geomagnetic storms” (Phillips 2008b). This opening was four times wider than the earth itself and more than seven earth diameters long, while the influx of particles was likewise “an order of magnitude greater than what we thought was possible.” It was found that “the entry window has a different shape at different stages,” which was “expected to be controlled by the characteristics of the geomagnetic field, the solar wind, and IMF” (Li *et al.* 2008, pp. 7, 11; cf. p. 19). A computer simulation suggested that, in the course of a year, two types of hole develop in the magnetic field of the earth, “one at high latitude over the Northern hemisphere, and one at



**Figure 6.** An artist's conception of a Flux Transfer Event (FTE) over the auroral oval at the earth's south magnetic pole (2008)

high latitude over the Southern hemisphere. The holes form over the daylit side of Earth, on the side of the magnetic shield facing the sun” (Steigerwald 2008). It is believed that an opening arises above the earth's equator and then rolls over to earth's winter pole, which is in the north in December and in the south in July. The hole closes as rapidly as it opens, the NASA's current estimate being that the two fields of the sun and the earth “briefly merge or ‘reconnect’, forming a portal through which particles can flow” approximately “every eight minutes” (Phillips 2008a) (Figure 6). Two holes also appear above the earth's poles in a particle-in-cell (PIC) simulation of the earth's magnetosphere in prehistoric times that has run since 2000, first at Lawrence Livermore National Laboratory, California, and later at Los Alamos National Laboratory, New Mexico, under the auspices of the American plasma physicist, Anthony Peratt.<sup>58</sup>

Do such “portals,” which form “over the daylit side of Earth,” and then

58. A. L. Peratt, personal communication, 30 December 2009; 4 January 2010. The experiment, currently run on *IBM Roadrunner*, the world's fastest computer, simulates the evolution of an initially unstructured and uniformly distributed plasma under the influence of a vertical magnetic field and the laws of electromagnetism solely. The results are applicable to many other cosmological problems than the evolution of earth's magnetosphere alone.

move towards the poles, relate to the holes observed at the heart of auroral coronae, despite the fact that they occur at the immense distance of at least 10 times the radius of the earth, some 60 times higher than the usual upper limit of the aurorae? While, at this early time, it would be rash to assume that flux transfer events can ever be perceived by human observers with the naked eye, the parallel with the cultural testimony regarding “sky holes” is worth observing.

### Radiance of the Hole

Another recurrent trait in mythology and folklore is the emission of light from the hole in the sky. In some cases, this luminosity is specifically attributed to a radiant entity—perceived as the sun god—suspended inside, behind or “above” the hole. At Yalcobá, Yucatán, the ritual specialist or *hmèen* still prays towards *u hol gloryab*, the “hole in the sky,” which he “believes to exist at *čumuk ka’an*, or ‘the middle of the sky’,” at the “zenith position,” “especially when the sun/*Habal Dios* is there” (Sosa 1989, p. 139).<sup>59</sup> In language reminiscent of the *axis mundi*, it is added that it is at this location that the earth is joined to the sky: “At the center, the realm of humans and that of deities are joined at *čumuk lu’um*, ‘the center of the earth’, and *čumuk ka’an*, ‘the center of the sky’, where the *hmèen* believes *u hol gloryab*, ‘the door or hole of heaven’ to exist. The conduit itself, then, which achieves this joining is *u yíiçil ka’an*, ‘the liquid substance of the sky’” (1989, p. 140). The Blackfoot people stated with respect to the “hole in the sky,” situated at the pole, that “Its light is the radiance from the home of the Sun God shining through” (McClintock 1992, p. 500). The sun or lightning above the celestial aperture becomes the target of the respective deities, heroes, ancestors, or visionary souls that ascend along the *axis mundi*. For example, in a dream he had in the night of Saturday, the 8<sup>th</sup> of Tēbēt, 1566 CE, the Jewish mystic, Rabbi Ḥayyim ben-Yoseph Vital (1543–1620 CE), saw a “window” situated at the top of a ladder in the sky, that could only be traversed with rapidity due to its frequent openings and closings, and gave access to a conspicuous fire above it:

I looked and saw a ladder, the bottom of which was standing on the top of the mountain and its top reached the heavens. . . . A distinguished woman, beautiful as the sun, approached the top of the ladder. I thought in my heart that it was my mother. . . . She stretched out her right hand and raised me to the top of the ladder.

59. Sosa appears to relate this ritual to the quotidian sun, as it occupies the zenith at noon, but as these “public functions” would routinely “begin and end” at “either 3 A.M. or 3 P.M.” (1989, p. 140), it is conceivable that the Maya regarded the noon sun at the zenith as the equivalent of a matching pair of “sun” and hole observed during the night.

I saw there a large round window and a large flame coming out of it, back and forth, like a bolt of lightning and it burned everything found there. I knew in my soul that it was the flame of the whirling sword that is at the entrance to the Garden of Eden [Gn 3: 24]. I called to the woman with great grief and said to her: My mother, my mother, help me that the sword should not burn me. [She said] Nobody can help you with this flame; you are on your own! But I will advise you on what to do: Put your hand on your head and you will find there cotton-wool, white as snow. Take some and put it in the flaming window and it will close. Pass by quickly. . . . I did so and passed by quickly. In a moment the flame again shot out as before.<sup>60</sup>

If the “windows” and “gates” of heaven in mythology and visions relate to dark and cavernous openings formed during ephemeral auroral displays, it stands to reason that their effulgence, including the idea of a nocturnal “sun,” is due to the lustre or the sparkling of arcs, rays or coronae, in accordance with Seneca’s description of a *chasma* as a place that “gaping in hiding—so to speak—sends out flame.” This appears to be the intention of a number of Chinese observations, beginning with an aurora recorded in August 154 BCE: “In the northern sky there was a scarlet object like a mat. It was more than ten *zhang* long. Some said it was scarlet vapor, some said it was a fissure in the heavens.”<sup>61</sup> Between 10 August and 8 September 30 BCE something similar to both a “Fissure” and a “Sword” appeared over China: “At night, there was a blue and yellowish-white vapor. It was more than ten *zhang* long and shone on the ground with a brilliant light. Some called it a ‘Heavenly Fissure’, others a ‘Heavenly Sword.’”<sup>62</sup> On 4 February 549 CE, a Chinese observer noted: “The sky in the northwest split apart in the middle; there was a light like fire.”<sup>63</sup> In Europe, the German humanist, Conradus Lycosthenes (1518–1561 CE), reported for the

60. Rabbi Ḥayyim Vital, *Sēpher baḤazyōnūt* (*Book of Visions*), 2. 5. 5326 [1566], trans. Faierstein 1999, pp. 79–80.

61. Bān Gù, *Hànshū* (*History of Western Hàn*; 82 CE): *Tiānwén Zhì* (*Annals of Astronomy*), 26; Qútán Xídá alias Gautama Siddhārta, *Kāiyuán Zhān Jīng* (*Astrological Treatise of the Kāiyuán Period*; 718–726 CE), 3; Lǐ Fāng (ed.), *Tàipíngyǔlǎn* (*Imperial Readings of the Tàipíng Era*; 977–983 CE), 1, trans. Xu *et al.* 2000, pp. 188–189.

62. Chén Mènglí and Jiǎng Tíngxí (eds.), *Gǔjīn Túshū Jíchéng* (*Complete Collection of Illustrations and Writings from the Earliest to Current Times*; 1726 CE), 68, trans. Xu *et al.* 2000, p. 190. The unreferenced translation of apparently the same passage in Brekke and Egeland 1983, p. 34 offered “a deep hole, with a large blazing fire in the sky” instead of “Heavenly Fissure.”

63. Yáo Silián, *Liángshū* (635 CE): *Wǔdì Běnjì* (*Annals of the Five Emperors*), *xia* 3; Lǐ Yánshòu (ed.), *Nánshǐ* (*History of the Southern Dynasties*; 659 CE): *Liáng Běnjì* (*Annals of Liáng*), 7, trans. Xu *et al.* 2000, p. 195.

evening of 19 January 999 CE that “the sky opened and what was like a burning torch was shining over the earth with a long lightning-like tract . . . As the cleavage gradually vanished, a form like that of a snake was seen, with a growing head and dark blue legs.”<sup>64</sup> On 28 December 1073 CE, a Korean astronomer witnessed a “bluish-red” fissure: “During the night, the sky split open west of Wenchang. It was fifteen *chi* long and three *chi* wide and bluish-red.”<sup>65</sup> Again, on 24 January 1506 CE, a Chinese witness reported a “red gleam” that caused an apparent rift in the celestial fabric: “Due north the sky was split by a red gleam two *zhang* wide and several tens of *zhang* long. A moment later, the gleam was extinguished; it rolled up like a mat from the bottom toward the top.”<sup>66</sup> On 2 August 1516 CE, outside the usual “season” for auroral observations, a “fissure” with “red gleam” appeared over China: “Southeast of Baling there was a fissure in the sky more than three *zhang* long. Its red gleam dazzled people.”<sup>67</sup> And on 16 March 1557 CE, another auroral hole produced bright rays that appeared to reach down to the surface: “At Qinzhou, the sky split open for several *zhang*, and a gleam shone on the ground. After a long time it closed.”<sup>68</sup>

The notion of a “sun” or some other source of irradiance stationed within or “beyond” the celestial window is brought into even sharper focus when compared to sightings of “fire,” “gold,” or “scarlet” positioned explicitly inside the auroral schism. A clear-cut example of such a formation is the following auroral record from China for 11 January 584 CE: “At night, the sky opened from the northwest to the southeast. Within it there was a bluish-yellow color and a rumbling sound like thunder.”<sup>69</sup> Comparable is a Korean record for 13 October 1073 CE, according to which a “scarlet” substance filled the interior of the hole: “During the night, the sky split open south of the stars of Tianyuan. It was about five

64. “Anno tertii Otthonis 16. multa p:digia uisa sunt. Terremotus enim factus est p: maximus. Cometes apparuit 19 Cal. Ianuarii, circa horā nonā aperto caelo, quasi facula ardēs, cū lōgo tractu fulgoris instar splendens super terrā, & adeō quidē ut tāto splēdore nō modo q: in agris erāt, sed q: in tectis etiā irrupto quasi fulmine serirent. Qua cœli scissura sensim euanescēte interim uisa est figura quasi serpētis, capite q:dē crescēte cū cæruleis pedibus” (Lycosthenes 1557, p. 368; repeated almost *verbatim* in Rockenbach 1602, p. 174).

65. Jeong Inji, *Goryeo-sa*, 47, trans. Xu *et al.* 2000, p. 203.

66. *Jiànmíngfǔ Zhì*, Kāngxī ed., 46, trans. Xu *et al.* 2000, p. 222.

67. *Húnán Tōng Zhì*, Guāngxù ed., 244; *Dòngtíngfǔ Zhì*, Dàoguāng ed., 7, trans. Xu *et al.* 2000, p. 223.

68. *Sbānxī Tōng Zhì*, Yōngzhēng ed., 163, trans. Xu *et al.* 2000, p. 226.

69. Yáo Silián, *Cbénshū* (636 CE): *Hòuzhǔ Běnjì* (*Annals of Hòuzhǔ*), 6, trans. Xu *et al.* 2000, p. 196.



or six *cun* wide and scarlet inside.”<sup>70</sup> Yet another observation was made in China on 21 October 1359 CE:

I visited Jiahe at dawn while the stars were still at the treetops. Suddenly, the sky in the southwest split open for several tens of hundreds of *zhang*. The flames were like a fierce fire that completely lit up the plain. . . . When I looked carefully at the place where the sky split open, there was a sinuous movement. And within it was again very bright like gold being melted in a crucible. After a little while the opening closed.<sup>71</sup>

And on a Saturday in early January 1529, before “the baptism of the Lord,” “many people observed at night that the heavens seemed to open, and from this opening a very bright gleam and bolt blazed forth for a short time. And some trustworthy people at different places saw in this bolt that armed and fiery men were engaged in a battle” (Petrie 1963, p. 6; the source is not identified).<sup>72</sup> As seen above, the “plug” or “door” with which the aperture of the sky is shut, often in repeated succession, may conform to a luminous patch seen to cover the central eye of a corona. Tromholt had noted that “the central part” is at times “filled with luminous matter,” while Nansen had described a coronal hole which, at times, “was entirely covered with masses of light.” On Sunday, 24 October 1847, James Challis noticed how such light inside the frame of a coronal aurora commenced to assume a circular morphology: “Around this point a corona, or star-like appearance, was formed; the rays of which diverged in all directions from the centre, leaving a space about the centre free from light, in which I noticed at one time the rapid formation and disappear-

70. Jeong Inji, *Goryeo-sa*, 47; anonymous, *Jeungbo Munbeon Bigo*, 6, trans. Xu *et al.* 2000, p. 203. The constellation of *Tiānyuàn* or “Sky Park” roughly corresponds to Eridanus. A *cun* approximates 3.3 centimetres.

71. Yáo Tóngshòu (fl. 1330 CE), *Lèjiāo Sīyǔ* (*Whispers in the Happy Suburb*), trans. Xu *et al.* 2000, p. 217. 1 *zhang* equals  $3\frac{1}{5}$  metres.

72. The Italian humanist, Jovianus Pontanus (1426–1503 CE), apud Lycosthenes (1557, p. 537) recorded for the night of 9 January, which was a Saturday, *chasma quod uoraginem uel hiatus cæli philosophi uocant*, “a chasm that the philosophers call a pit or gap of the sky.” For the interval between 9 and 10 pm on the same date, the German doctor, mathematician and astronomer, Iacobus Milichius (1501–1559 CE; 1535, p. 69; repeated in Celsius 1733 [no page number]; Frobesius 1739, p. 31) likewise listed *Ingens chasma*, a “giant chasm,” observed in Germany. The German mathematician, jurist and classicist, Abraham Rockenbach (1536–1611 CE; 1602, p. 212; followed by Hevelius 1668, p. 845), recorded for the same year, though without giving a date, four comets and *Chasma . . . versus quatuor mundi cardines, se vertens*, “a hole . . . turning itself towards the four directions of the world.”

ance of part of a circular luminous ring” (p. 1151). The mythological concept of a “fire” or “sun” accessed through the sky hole was most likely fuelled by observations of this kind.

### Conclusion

The archaic cosmological idea that the sky, otherwise consisting of a hard substance, contains one or more holes can be successfully explained with reference to auroral arcs and coronae. The same types of aurorae can account for the beliefs that this sky hole opens and closes at a high speed, that it is situated in the liminal zone between the sky and the world below, that the sky may cave in on a fateful day, and that a luminiferous entity dwells above, behind or inside the opening. The auroral hypothesis for such motifs serves to illustrate the potential explanatory power of electromagnetic phenomena in near-earth space with regard to myth and tradition. It is expected that further research on auroral morphology, in relation to the structure of the earth’s magnetosphere, will furnish clues towards an explanation of additional related motifs, such as the apparent solidity of the sky, the notion of a series of stacked holes perforating an identical number of superimposed “heavens,” and a number of themes that have not even been touched on in the present study—deities or ancestors “unplugging” the hole before descending through it or precipitating the deluge, the rupture of the sky as a part of the creation narrative, enabling mythical entities to access the worlds below or above, the hollowness of the material form of the *axis mundi*, the existence of a corresponding aperture in the surface of the earth, and so on.<sup>73</sup>

### Appendix: the Symplegades

In Greek mythology, the Argonauts encountered a mysterious phenomenon variously designated as *symplēgádes*, “the Clashing Rocks” (Apollodorus, *Bibliotheca*, 1. 9. 22), *pétras . . . Kyanéas . . . dýō*, the “twin Cyanean Rocks,”<sup>74</sup> *pétras Plēgádas*, “the Clashing rocks,”<sup>75</sup> *stýgeràs . . . pét ras*, “the horrible rocks,”<sup>76</sup> *oloàs . . . pét ras*, “the deadly rocks,”<sup>77</sup> *syndrómon . . . petran*, “the clashing rocks,”<sup>78</sup> and so on. How does this motif relate to that of a hole formed above the horizon whenever the sky lifts itself up? Unlike some of the traditions discussed above, the Symplegades were thought to

73. For the argument that visible forms of the *axis mundi*, such as a cosmic tree, mountain, or rope, may trace to memories of a highly enhanced aurora, see van der Sluijs 2005.

74. Apollonius Rhodius, *Argonautica*, 2:317–318, trans. Race 2008, pp. 138–139.

75. Apollonius Rhodius, *Argonautica*, 2:644–645, trans. Race 2008, pp. 164–165.

76. Apollonius Rhodius, *Argonautica*, 2:412, trans. Race 2008, pp. 146–147.

77. Apollonius Rhodius, *Argonautica*, 2:420, trans. Race 2008, pp. 146–147.

78. Pindar, *Pythian Ode*, 4:207–208, trans. Race 1997, pp. 286–287.

collide horizontally instead of vertically, did not involve a vertical movement of the sky, and did not transport the protagonists into the sky. Nevertheless, Apollonius Rhodius' (early 3rd century BCE) account in particular bears a number of striking parallels to the traditions of the Ottawa, the Seneca, and others. The following points of agreement can be enumerated in addition to the central *comparandum* of a gateway that opens and closes at a high speed and is crossed safely with resort to a special strategy. First, as in the Ottawa myth, the Symplegades were reached following a lengthy journey towards the east, the actual passage taking place at dawn (Apollonius Rhodius, *Argonautica*, 2:449–450). Second, the Symplegades were situated on the surface of the earth, where the sky meets the sea, and served as the boundary of the—known—world from an archaic Greek perspective. Third, as in the account of the Ottawa, the voyagers encountered an old man, who counselled them regarding the manner in which the perilous passageway must be crossed; Phineus fulfills this role in the Greek story (2:311–407; Apollodorus, *Bibliotheca*, 1. 9. 22). Whereas, in the North American tale, this character appears to represent the morning star, the Argonauts witness the passing of Apollo *Ēōíos* or “of the dawn” on a separate occasion, in the wake of the crossing (Apollonius Rhodius, *Argonautica*, 2:669–688).<sup>79</sup> Fourth, the noise produced by the repeated collisions invited comments both in the Greek myth<sup>80</sup> and the accounts from the Haida and the Ottawa. Fifth, the clipping of the tail feathers of a dove despatched by the Argonauts,<sup>81</sup> which is a stock motif in tales concerning the “clashing rocks” (Frazer 1921, pp. 355–358), constitutes a structural parallel with the death of the final member of the team in the stories from the Ottawa and the Seneca. Sixth, just as the Ottawa and the Seneca viewed the chasm as a portal into the underworld, so the Argonauts passed from the Symplegades to . . .

. . . a path that descends to the abode of Hades, and the jutting Acherusian headland extends high up, and swirling Acheron, cutting its way below through the headland itself, sends forth its waters from a deep chasm. . . . a hollow valley, where the cave of

79. Apollo also connotes the morning star in a Latin inscription from Apulum, in Dacia, dating from the time of emperor Commodus (161–192 CE) and dedicated to *deo bono phosphoro Apollini Pythio*, “benevolent god, Phosphorus, Apollo Pythio”; the title *Phosphoros* or “light-bearer,” which is the literal equivalent of Latin *Lucifer*, was the common Greek appellation of the planet Venus (Drijvers 1980, pp. 170–171; van der Sluijs 2009b, p. 171).

80. Apollonius Rhodius, *Argonautica*, 2:323, 553–554, 565, 740–742; Apollodorus, *Bibliotheca*, 1. 9. 22.

81. “The rocks cut off the tips of the dove’s tail feathers, but she flew away unharmed.” (Apollonius Rhodius, *Argonautica*, 2:571–573, trans. Race 2008, pp. 158–159).

Hades lies, covered over with woods and rocks, from which an ice-cold vapor, blowing up continuously from its chill depth, ever forms a glistening frost.<sup>82</sup>

And seventh, the North American and Chukchi association of the celestial aperture with the north polar region of the sky as well as with “winds” compares to the curious geography the Argonauts discovered behind the clashing rocks: “There is a headland opposite Helice the Bear that is steep on all sides; they call it Carambis, and above it the blasts of the north wind are split in two, so high does it rise to the upper air as it faces the open sea.”<sup>83</sup> The specification *Helikēs katenantíon Árkton*, “opposite Helice the Bear,” is a possible reference to a location “across” the celestial pole. Taken together, these parallels warrant the conclusion that the voyage of the Argo as described in its extant forms is a Greek adaptation of a more archaic legend, in which the narrative framework of the nautical exploration of the Black Sea has replaced an earlier story of an ascent into the sky along a “dangerous gateway” at the eastern edge of the earth. The target of the journey, king Aíētēs of Colchis, son of Helios, and his golden fleece, may originally have been the sun god, as in cross-cultural parallels.

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82. Apollonius Rhodius, *Argonautica*, 2:353–356, 735–739, trans. Race 2008, pp. 140–143, 170–173, translating *eis Aídao . . . kélenthos* as “a path . . . to the abode of Hades,” *ek megálēs . . . phárangos* as “from a deep chasm,” and *koílē . . . nápē . . . spēos . . . Aídao* as “a hollow valley . . . the cave of Hades.” Compare Jason’s speech: “not even if I should voyage through the chasms of Hades shall I any longer let fear fasten upon me . . . No, since we have sailed through the Clashing rocks, I believe that there will never be another such terror in the future,” (2:642–646, trans. 2008, pp. 164–165).

83. Apollonius Rhodius, *Argonautica*, 2:360–363, trans. Race 2008, pp. 142–143.

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