

**A New Look at the Heavens and
Another Trip to the Moon**
Introduction to Kepler's *Somnium* by James Gunn

- 1.1. The universe named after the first-century Greek astronomer Ptolemy placed the earth, unmoving as Aristotle and Plato insisted, at its center, and the other planets, the sun, and even the stars revolving around it. The Ptolemaic scheme made the earth, and humanity, seem supremely important. Because of this, because it fit into the Biblical concept of special creation, and because the mathematical elaboration of epicycles and eccentrics made the system accurate enough for predicting the movement of the planets, the Ptolemaic universe was adopted by the Catholic Church and stubbornly defended for more than a thousand years.
- 1.2. But the system was delicately balanced on a complicated structure of assumptions. The Polish astronomer Copernicus (1473-1543) gave the first shove. Wouldn't it be simpler, he suggested, to suppose that the earth and the planets revolved around the sun? His theories circulated in manuscript for many years before he allowed a book to be published, just before his death. *De Revolutionibus Orbium Coelestium* (1543) was banned by the Catholic Church until 1835. In a sense, the scientific revolution started with Copernicus. Humanity and the earth were removed from the center of things, diminished, their uniqueness removed; in compensation, science gave humanity new control over its fate and over its earthly environment.
- 1.3. Copernicus never looked through a telescope. Galileo (1564-1642) built a telescope, looked through it, and reported what he saw, and was forced by the Inquisition to recant his heresy that the earth moved around the sun. Galileo's work was continued by Johannes Kepler (1571-1630) in Germany.
- 1.4. Educated for the ministry, Kepler was recognized early in his career as a brilliant mathematician, and he soon turned to the teaching of science and the study of astronomy. He adopted the views of Copernicus, worked under the elderly Danish astronomer Tycho Brahe (1546-1601), and inherited Brahe's astronomical observations of the apparent motions of the planets, which he finally explained with his famous three laws of planetary motion.
- 1.5. Most Renaissance scientists needed the protection and support of nobility, and Kepler served as court astronomer for two Holy Roman emperors. Nevertheless, he often was in financial and other difficulties. Like those of many of his contemporaries, his ideas combined a strange mix of medieval mysticism and modern science. As court astronomer, for instance, he often cast horoscopes for the emperor and others, and he believed in the music of the spheres, but his discovery that the orbits of the planets were ellipses with the sun as one focus put an end to Greek astronomy and cast doubt on the theory behind astrology.
- 1.6. Kepler's contribution to the development of science fiction, *Somnium, or Lunar Astronomy*, seems like a strange mixture of superstition and science, but the references to demons and witchcraft are largely metaphorical. Kepler also may have thought that travel to the moon with the aid of a demon was only slightly less likely than by any other means, and perhaps safer theologically than

some physical mechanism that might be taken seriously.

- 1.7. Once Kepler's hero reaches the moon, however, he finds the kind of lunar conditions that Kepler thought actually existed there. Kepler admitted his indebtedness to Lucian, but the stories share little more than the moon. Kepler and Lucian both send characters to the moon for reasons other than telling a good story, but once the characters arrive, Lucian turns to satire and Kepler to the kind of reality he thought a real space traveler would find.
- 1.8. The narrative excitement still is minimal, but the purpose is approaching that of science fiction.
- 1.9. *Somnium*, which means "a dream," was written about 1610, circulated privately, and may have been responsible for his mother's arrest for witchcraft in 1620 (although she had a reputation for actually dabbling in the occult). She died shortly after Kepler procured her release; the demonpropulsion may not have been so safe after all. The story was not published until 1634, four years after Kepler's death.

Somnium, or Lunar Astronomy

by Johannes Kepler

Translated by Edward Rosen

- 1.10. In the year 1608 there was a heated quarrel between the Emperor Rudolph and his brother, the Archduke Matthias. Their actions universally recalled precedents found in Bohemian history. Stimulated by the widespread public interest, I turned my attention to reading about Bohemia, and came upon the story of the heroine Libussa, renowned for her skill in magic. It happened one night that after watching the stars and the moon, I went to bed and fell into a very deep sleep. In my sleep I seemed to be reading a book brought from the fair. Its contents were as follows.
- 1.11. My name is Duracotus. My country is Iceland, which the ancients called Thule. My mother was Fiolxhilde. Her recent death freed me to write, as I had long wished to do. While she lived, she carefully kept me from writing. For, she said, the arts are loathed by many vicious people who malign what their dull minds fail to understand, and make laws harmful to mankind. Condemned by these laws, not a few persons have perished in the chasms of Hekla. My mother never told me my father's name. But she said he was a fisherman who died at the ripe old age of 150 (when I was three) in about the seventieth year of his marriage.
- 1.12. In the earliest years of my boyhood my mother, leading me by the hand and sometimes hoisting me up on her shoulders, often used to take me up to the lower slopes of Mt. Hekla. These excursions were made especially around St. John's Day, when the sun is visible all twenty four hours, and there is no night. Gathering some herbs with many rites, she cooked them at home. She made little bags out of goatskin, which she filled and carried to a nearby port to sell to the ship captains. This is how she earned her living.
- 1.13. Once, out of curiosity, I cut a bag open. Suspecting nothing, my mother was about to sell it, when out fell the herbs and linen cloth embroidered with various symbols. Because I had deprived her of this little income, she angrily made me, instead of the bag, the property of the skipper in order to keep the money. On the next day he unexpectedly sailed out of the harbor, and with a favorable wind steered approximately toward Bergen in Norway. After a few days a north wind sprang up and drove the ship between Norway and England. He headed for Denmark and passed through the strait, since he had to deliver a letter from a bishop in Iceland to the Dane, Tycho Brahe, who lived on the island of Hven. The tossing of the boat and the unaccustomed warmth of the air made me violently sick, for I was a youth of fourteen. When the boat reached shore, he put me and the letter in the hands of an island fisherman. Expressing the hope that he would return, he sailed away.
- 1.14. When I delivered the letter, Brahe was quite delighted and began to ask me many questions. These I did not understand, since I was unacquainted with the language except for a few words. He therefore instructed his students, whom he

supported in great numbers, to talk to me frequently. So it came about, through Brahe's generosity and a few weeks' practice, that I spoke Danish tolerably well. I was no less ready to talk than they were to ask. For I marveled at many unfamiliar things, and they wondered about the many novelties I related about my country.

- 1.15. Finally the skipper returned to take me back. When he failed, I was very happy.
- 1.16. I was delighted beyond measure by the astronomical activities, for Brahe and his students watched the moon and the stars all night with marvelous instruments. This practice reminded me of my mother, because she, too, used to commune with the moon constantly.
- 1.17. Through this opportunity, then, I, who had come from an entirely destitute background in a half-savage country, acquired knowledge of the most divine science, and this knowledge paved my way to greater things.
- 1.18. For, after spending several years on this island, I was finally overcome by a desire to see my country again. I considered that it would not be hard for me, with the knowledge I had acquired, to rise to some position of importance among my backward people. Hence, having paid my respects to my patron, who gave me his permission to depart, I went to Copenhagen. I found traveling companions, who gladly took me under their protection because of my familiarity with the language and the region. Five years after I had left, I returned to my native land.
- 1.19. What delighted me first on my return was to find my mother still active and engaged in the very same pursuits as before. The fact that I was alive and important put an end to her prolonged grief over the son she had lost through her impetuosity. At that time autumn was approaching, to be followed by those long nights of ours, since during the month in which Christ was born the sun barely rises at noon and sets again at once. On account of this interruption in her work my mother clung to me and did not leave my side, no matter where I went with my letter of recommendation. Sometimes she asked about the countries which I had visited, and sometimes about the heavens. She was deliriously happy that I had become acquainted with that science. Comparing what she had learned with my remarks, she exclaimed that now she was ready to die, since she was leaving behind a son who would inherit her knowledge, the only thing she possessed.
- 1.20. Since I am by nature most eager to acquire new knowledge, I, in turn, questioned her about her arts and her teachers of those arts among a people so remote from all the others. Then one day, choosing the time for her narrative, she went over the whole story from the beginning, about as follows:
- 1.21. Advantages have been conferred, Duracotus my son, not only on all those other regions to which you went but also on our country, too. To be sure, we are burdened with cold and darkness and other discomforts, which I feel only now, after I have learned from you about the salubriousness of the other lands. But we have plenty of clever persons. At our service are very wise spirits, who detest the bright light of the other lands and their noisy people. They long for our shadows, and they talk to us intimately. Among them there are nine chief spirits. Of these

one is especially well known to me. The very gentlest and most innocuous of all, he is evoked by one and twenty characters. By his help I am not infrequently whisked in an instant to other shores, whichever I mention to him; or if I am frightened away from some of them on account of their distance, by inquiring about them I gain as much as if I were there in person. Most of the things which you saw with your own eyes or learned by hearsay or absorbed from books, he related to me just as you did. I should like you to become my companion on a visit, particularly, to that region of which he has spoken to me so often. Quite remarkable are the things which he tells about it. The name she uttered was "Levania"

1.22. Without any delay I agreed that she should summon her teacher. I sat down, ready to hear the entire plan for the trip and description of the region. It was already spring. The moon, becoming a crescent, began to shine as soon as the sun set below the horizon, and was in conjunction with the planet Saturn in the sign of the Bull. My mother went away from me to the nearest crossroads. Raising a shout, she pronounced just a few words in which she couched her request. Having completed the ceremonies, she returned. With the outstretched palm of her right hand she commanded silence, and sat down beside me. Hardly had we covered our heads with our clothing (in accordance with our covenant) when the rasping of an indistinct and unclear voice became audible. It began at once as follows, albeit in the Icelandic tongue.

2. THE DAEMON FROM LEVANIA

2.1. Fifty thousand German miles up in the ether lies the island of Levania. The road to it from here or from it to this earth is seldom open. When it is open, it is easy for our kind, but for transporting men it is assuredly most difficult and fraught with the greatest danger to life. We admit to this company nobody who is lethargic, fat, or tender. On the contrary, we choose those who spend their time in the constant practice of horsemanship or often sail to the Indies, inured to subsisting on hardtack, garlic, dried fish, and unappetizing victuals. We especially like dried-up old women, experienced from an early age in riding hegoats at night or forked sticks or threadbare cloaks, and in traversing immense expanses of the earth. No men from Germany are acceptable; we do not spurn the firm bodies of Spaniards.

2.2. Great as the distance is, the entire trip is consummated in four hours at the most. For we are always very busy, and agree not to start until the moon begins to eclipse on its eastern side. Should it regain its full light while we are still in transit, our departure becomes futile. Because the opportunity is so fleeting, we take few human beings along, and only those who are most devoted to us. Some man of this kind, then, we seize as a group and all of us, pushing from underneath, lift him up into the heavens. In every instance the takeoff hits him as a severe shock, for he is hurled just as though he had been shot aloft by gunpowder to sail over mountains and seas. For this reason at the outset he must be lulled to sleep immediately with narcotics and opiates. His limbs must be arranged in such a way that his torso will not be torn away from his buttocks nor

his head from his body, but the shock will be distributed among his individual limbs. Then a new difficulty follows: extreme cold and impeded breathing. The cold is relieved by a power which we are born with; the breathing, by applying damp sponges to the nostrils. After the first stage of the trip is finished, the passage becomes easier. At that time we expose their bodies to the open air and remove our hands. Their bodies roll themselves up, like spiders, into balls which we carry along almost entirely by our will alone, so that finally the bodily mass proceeds towards its destination of its own accord. But this onward drive is of very little use to us, because it is too late. Hence it is by our will, as I said, that we move the body swiftly along, and we forge ahead of it from now on lest it suffer any harm by colliding very hard with the moon. When the humans wake up, they usually complain about an indescribable weariness of all their limbs, from which they later recover well enough to walk.

- 2.3. Many additional difficulties arise which it would be tedious to enumerate. On the other hand, we suffer no harm at all. For as a group we inhabit the earth's shadows, whatever their length. When they reach Levania, there we are as though disembarking from a ship and going ashore. Up there we quickly withdraw into caves and dark places, lest after a short while the sun overpower us in the open, and drive us out of the living quarters we had chosen, and force us to follow the retreating shadow. Up there we are granted leisure to exercise our minds in accordance with our inclinations. We consult with the daemons of that area and enter into a league. As soon as a spot begins to be free from sun, we close ranks and move out into the shadow. If it touches the earth with its apex, as generally happens, we rush toward the earth with our allied forces. This we are permitted to do only when mankind sees the sun in eclipse. Hence it happens that solar eclipses are feared so much.
- 2.4. I have said enough about the trip to Levania. Next I shall talk about the nature of the region itself, starting like the geographers with its view of the heavens.
- 2.5. The fixed stars look the same to all Levania as to us. But its view of the movements and sizes of the planets is very different from what we observe here, so that its entire system of astronomy is quite diverse.
- 2.6. Just as our geographers divide up the sphere of the earth into five zones on the basis of celestial phenomena, so Levania consists of two hemispheres. One of these, the Subvolva, always enjoys its Volva, which among them takes the place of our moon. The other one, the Privolva, is deprived forever of the sight of Volva. The circle which separates the hemispheres passes through the celestial poles, like our solstitial colure, and is called the divisor.
- 2.7. In the first place I shall explain what is common to both hemispheres. All Levania experiences the succession of day and night as we do, but they lack the variation that goes on all year among us. For throughout the whole of Levania the days are almost exactly equal to the nights, except that each day is uniformly shorter than its night for the Privolvans, and for the Subvolvans longer. What varies in a period of eight years will be mentioned later on. To produce equal nights at each of the poles, the sun is hidden half the time and shines half the time as it travels around the mountains in a circle. For Levania seems to its inhabitants to remain just as motionless among the moving stars as does our earth to us humans. A night and a day, taken together, equal one of our months,

since at sunrise in the morning almost an entire additional sign of the zodiac appears on any day as compared with the previous day. For us in one year there are 365 revolutions of the sun, and 366 of the sphere of the fixed stars, or more accurately, in four years, 1,461 revolutions of the sun but 1,465 of the sphere of the fixed stars. Similarly, for them the sun revolves 12 times in one year and the sphere of the fixed stars 13 times, or more precisely in eight years the sun revolves 99 times and the sphere of the fixed stars 107 times. But they are more familiar with the nineteenyear cycle, for in that interval the sun rises 235 times, but the fixed stars 254 times.

- 2.8. The sun rises for the middle of central Subvolvans when the moon appears to us in its last quarter, but the middle Privolvans when we have the first quarter. What I say about the middle must be understood as applying to complete semicircles drawn through the poles and the middle at right angles to the divisor. These may be called the Midvolvan semicircles.
- 2.9. Halfway between the poles there is a circle corresponding to our terrestrial equator, by which name it too may be denoted. It twice intersects both the divisor and the Midvolva in opposite points. At all places on the equator the sun at noon passes almost exactly overhead daily, and exactly overhead on two opposite days of the year. For all the others, who live on either side of the equator toward the poles, the sun deviates from the zenith at noon.
- 2.10. On Levania they have also some alternation of summer and winter. But the contrast is not to be compared with ours, nor does it always occur, as with us, in the same places at the same time of year. For within a period of ten years their summer shifts from one part of the sidereal year to the opposite part in any given place. The reason is that in a cycle of nineteen sidereal years, or 235 Levanian days, summer occurs twenty times near the poles and winter just as often, but forty times at the equator. Every year they have six summer days, the others winter, like our months. This alternation is scarcely felt near the equator, because in those places the sun deviates no more than 5° back and forth to either side. It is felt much more near the poles, where the sun is present or absent in alternating periods of six months, as is the case among us on earth for those who live near either of the poles. Hence the sphere of Levania, too, is divided into five zones, corresponding somewhat to our terrestrial zones. But their tropical zone, like their arctic zones, contains scarcely 10° . All the rest belongs to zones similar to our temperate zones. The tropical zone passes through the middle of the hemispheres, with half of its longitude in the Subvolva and the other half in the Privolva.
- 2.11. The intersections of the equatorial and zodiacal circles create four cardinal points, like our equinoxes and solstices. These intersections mark the start of the zodiacal circle. But from this start the motion of the fixed stars in the order of the signs is very swift, since they traverse the entire zodiac in twenty tropical years (a tropical year being defined as one summer and one winter). For us this traversing takes almost 26,000 years. So much for the first motion.
- 2.12. The theory of the second motions is for them no less different from what appears to us, and is much more complicated for them than for us. The reason is that all six planets (Saturn, Jupiter, Mars, sun, Venus, Mercury) exhibit, besides the many inequalities which they have in common with us, three others for

them. Two of these irregularities are in longitude; one is daily, the other has a period of eight and a half years. The third is in latitude, with a period of nineteen years. For the midPrivolvans have the sun at their noon, other things being equal, bigger than when it rises, and the Subvolvans smaller. Both agree in believing that the sun diverges by some minutes from the ecliptic back and forth now among these fixed stars, now among those. These oscillations return to the original position, as I said, in a period of nineteen years. Yet this deviation takes a little more time for the Privolvans, a little less for the Subvolvans. And although the sun and the fixed stars are assumed to advance uniformly in the first motion around Levania, nevertheless, the sun barely progresses in relation to the fixed stars at noon for the Privolvans, whereas for the Subvolvans it is very fast at noon. The reverse is true at midnight. Hence the sun seems to make, as it were, certain jumps in relation to the fixed stars, separate jumps every day.

- 2.13. The same statements hold true for Venus, Mercury, and Mars; in the cases of Jupiter and Saturn, these phenomena are almost imperceptible.
- 2.14. Furthermore the diurnal motion is not uniform even at the same hour every day. On the contrary, it is slower at times not only for the sun but also for the fixed stars, while at the opposite season of the year at the like hour of the day it is faster. Moreover, the retardation shifts throughout the days of the year, so that sometimes it occurs on a summer day, sometimes on a winter day, which in another year had experienced the acceleration, one cycle being completed in a period of a little less than nine years. Hence the day sometimes becomes longer (through a natural retardation, not as with us on the earth through the unequal division of natural day), and sometimes the night, in turn, becomes longer.
- 2.15. But if the retardation occurs for the Privolvans during their night, its excess over their day is increased; on the other hand, if the retardation falls in their daytime, then their night and day approach more closely to equality, which is reached once in nine years. The converse is true for the Subvolvans.
- 2.16. So much for the phenomena which in a certain way happen in common to the hemispheres.

2.17. THE HEMISPHERE OF THE PRIVOLVANS

- 2.18. Now as for what concerns the individual hemispheres separately, there is an enormous contrast between them. By its presence and absence Volva gives rise to quite different spectacles. Not only that, but the common phenomena themselves produce very divergent effects on the two sides. As a result, the Privolvans' hemisphere may perhaps more properly be called nontemperate, and the Subvolvans', temperate. For among the Privolvans night lasts fifteen or sixteen of our natural days. It is made frightful by as deep an uninterrupted darkness as we have on a moonless night, since it never receives any light even from Volva's rays. Consequently everything turns stiff with ice and frost, abetted by very sharp and very strong winds. Day follows, as long as fourteen of our days or a little less. During this time the sun is quite large and moves slowly with respect to the fixed stars. There are no winds. The result is immense heat. And thus, in the interval of our month or the Levanian day, one and the same place is exposed both to heat fifteen times hotter than our African, and to cold more

unbearable than the Quiviran.

- 2.19. It should be especially noted that the planet Mars sometimes appears almost twice as big to the Privolvans as to us; to the midPrivolvans this happens at midnight, and to the other Privolvans at some particular moment of the night for each.

3. THE HEMISPHERE OF THE SUBVOLVANS

- 3.1. In making the transition to this topic, I begin with the frontiersmen who inhabit the divisor circle. What is peculiar to them is that the elongations of Venus and Mercury from the sun seem much bigger to them than to us. Moreover, at certain times Venus looks twice as big to them as to us, especially to those of them who live near the north pole.
- 3.2. But the most beautiful of all the sights on Levania is the view of its Volva. This they enjoy to make up for our moon, of which they and likewise the Privolvans are completely deprived. From the perennial presence of this Volva this region is termed the Subvolvan, just as from the absence of Volva the other region is called the Privolvan, because they are deprived of the sight of Volva.
- 3.3. To us who inhabit the earth, our moon, when it is full and rising and climbing above distant houses, seems equal to the rim of a keg; when it mounts to midheaven, it hardly matches the width of the human face. But to the Subvolvans, their Volva in midheaven (a position which it occupies for those who live in the center or navel of this hemisphere) looks a little less than four times longer in diameter than our moon does to us. Hence, if the disks are compared, their Volva is fifteen times larger than our moon. However, to those for whom Volva always clings to the horizon, it presents the appearance of a mountain on fire far away.
- 3.4. Consequently, just as we differentiate between regions according to the greater and smaller altitudes of the pole, even though we do not see the pole itself with our eyes, so this same function is performed for them by Volva, which, although it is always visible, differs in altitude from place to place.
- 3.5. For, as I said, Volva stands directly over the heads of some of them; in other places it is seen low down near the horizon; and for the rest its altitude varies from the zenith to the horizon, while remaining forever constant in any given area.
- 3.6. Yet they, too, have their own poles. These are located, not at those fixed stars where our celestial poles are, but around other stars which for us mark the poles of the ecliptic. These poles of the moon dwellers in a period of nineteen years traverse small circles around the poles of the ecliptic in the constellation of the Dragon and, at the other extremity, in the Swordfish (Dorado), Sparrow (Flying Fish), and the Greater Nebula. Since these poles of the moon dwellers are about a quadrant's distance from their Volva, their regions can be delimited both according to the poles and according to Volva. Hence it is clear how much more convenient their situation is than ours. For they indicate the longitude of places with reference to their motionless Volva, and the latitude with reference both to Volva and to the poles, whereas for longitudes we have nothing but that most lowly and barely perceptible declination of the magnet.

- 3.7. Their Volva remains fixed in place, then, as though it were attached to the heavens with a nail. Above it the other heavenly bodies, including the sun, move from east to west. There is never a night in which some of the fixed stars in the zodiac do not pass behind this Volva and emerge again on the other side. But the same fixed stars do not do so every night. All those which are within a distance of 6° or 7° from the ecliptic take turns. The cycle is complete in nineteen years, after which the first stars return.
- 3.8. Their Volva waxes and wanes no less than our moon does. In both cases the cause is the same: the presence of the sun or its departure. The length of time involved is also the same, if you look to nature. But they measure it in one way, and we in another. They consider a day and a night the interval in which their Volva passes through all its waxings and wanings. This is the interval which we call a month. On account of its size and brilliance Volva is practically never, not even at new Volva, hidden from the Subvolvans. This is true in particular for those who live near the poles and are deprived of the sun during that time. For them Volva turns its horns upward at noon in the interVolvan period. For in general, for those who live between Volva and the poles on the mid-Volvan circle, new Volva is the sign of noon; the first quarter, of evening; full Volva, of midnight; the last quarter, of returning sunlight. For those who have Volva as well as the poles located on the horizon and who live at the intersection of the equator with the divisor, morning or evening occurs at new Volva and full Volva, noon or midnight at the quarters. Let these remarks provide the basis for conclusions regarding those who live in between.
- 3.9. In the daytime, too, they distinguish the hours in this way according to the various phases of their Volva; for example, the closer the approach of the sun and Volva to each other, the nearer is noon for the midVolvans, and evening or sunset for those at the equator. But at night, which regularly lasts as long as fourteen of our days and nights, they are much better equipped to measure time than we are. For besides that series of Volva's phases, of which we said that full Volva is the sign of midnight at the midVolvan circle, Volva itself also distinguishes the hours for them. For even though it does not seem to have any motion in space, nevertheless, unlike our moon, it rotates in its place and displays in turn a wonderful variety of spots, as these spots move constantly from east to west. One such revolution, in which the same spots return, is regarded by the Subvolvans as one hour of time; it is equal, however, to a little more than one of our days added to one of our nights. This is the only uniform measure of time. For, as was pointed out above, the sun and stars move nonuniformly about the moondwellers every day. This nonuniformity is revealed very clearly by this rotation of Volva if it is compared with the distances of the fixed stars from the moon.
- 3.10. So far as its upper, northern part is concerned, Volva in general seems to have two halves. One of them is darker and covered with almost continuous spots. The other is a little lighter, being interpenetrated by a bright belt which lies to the north and serves to distinguish the two halves. In the darker half the shape of the spot is hard to describe. Yet on the eastern side it looks like the front of the human head cut off at the shoulders and leaning forward to kiss a young girl in a long dress, who stretches her hand back to attract a leaping cat. The bigger and

broader part of the spot, however, extends westward without any apparent configuration. In the other half of Volva the brightness is more widely diffused than the spot. You might call it the outline of a bell hanging from a rope and swinging westward. What lies above and below cannot be likened to anything.

- 3.11. Besides distinguishing the hours of the day for them in this manner, Volva also furnishes no obscure indication of the seasons of the year to anyone who is observant, or who is unaware of the arrangement of the fixed stars. Even when the sun is in the sign of the Crab, Volva clearly displays the north pole of its rotation. For there is a certain small dark spot which is stuck in the middle of the bright area above the figure of the girl. From the highest and uppermost part of Volva this spot moves toward the east, and then as it drops down over the disk, toward the west; from this side it again turns eastward toward the top of Volva, and thus it is perpetually visible at that time. But when the sun is in the sign of the Goat, this spot is nowhere to be seen since the entire circle with its pole disappears behind the body of Volva. In these two seasons of the year the spots travel westward in a straight line. But in the intervening seasons, when the sun is in the sign of the Ram or the Balance, the spots either drop down or climb up crosswise in a somewhat crooked line. These facts show us that, while the center of the body of Volva remains stationary, the poles of this rotation revolve on an arctic circle once a year around the pole of the moon-dwellers.
- 3.12. More careful observers notice also that Volva does not always retain the same size. For at those hours of the day when the heavenly bodies travel fast, the diameter of Volva is much bigger, so that then it altogether exceeds four times the diameter of our moon.
- 3.13. What shall I say now about the eclipses of the sun and of Volva? Eclipses occur on Levania too, and they occur at the same moments as solar and lunar eclipses here on the globe of the earth, although obviously for the opposite reasons. For when a total eclipse of the sun is visible to us, for them Volva is eclipsed. In turn, when our moon is eclipsed for us, the sun is eclipsed for them. Nevertheless, the correspondence is not complete. For they often see partial eclipses of the sun when no part of the moon is blacked out for us. On the other hand, they not infrequently miss eclipses of Volva when we have partial eclipses of the sun. Volva is eclipsed for them when it is full, just as is the moon for us when it is full; but the sun is eclipsed at new Volva, as it is for us at new moon. Since their days and nights are so long, they experience very frequent darkenings of both bodies. For whereas among us a large percentage of the eclipses passes on to our antipodes, their antipodes, because they are Privolans, see absolutely none of these phenomena, which are all witnessed by the Subvolvans alone.
- 3.14. They never see a total eclipse of Volva. However, for them the body of Volva is traversed by a certain small spot which is reddish around the rim and black in the middle. Entering from the eastern side of Volva, it leaves by the western edge, following the same course as the natural spots of Volva, while surpassing them in speed. It lasts onesixth of a Levanian hour or four of our hours.
- 3.15. A solar eclipse is caused for them by their Volva, just as it is for us by our moon. This phenomenon is inevitable since Volva has a diameter four times bigger than the sun's. As the sun crosses from the east through the south beyond the motionless Volva to the west, it very often passes behind Volva, which thus

occults the sun's body partially or totally. Even though an occultation of the sun's entire body is frequent, it is nevertheless quite remarkable because it lasts several of our hours, while the light of both the sun and Volva is extinguished at the same time. This is a grand spectacle for the Subvolvans. For under other circumstances their nights are not much darker than their days on account of the brilliance and size of Volva, which is always present, whereas in a solar eclipse both luminaries, the sun and Volva, are quenched for them.

- 3.16. Yet among them solar eclipses have the following peculiar feature. Hardly has the sun disappeared behind the body of Volva than, as happens quite frequently, bright light arises on the opposite side. It is as though the sun expanded and embraced the entire body of Volva, whereas at other times the sun appears just as many degrees smaller than Volva. Therefore complete darkness does not always occur, unless the centers of the bodies are almost exactly aligned and the condition of the intervening transparent medium is suitable. Nor, on the other hand, is Volva extinguished so suddenly that it cannot be seen at all, even though the sun is entirely hidden behind it; the only exception takes place at the middle moment of a total eclipse. But at the beginning of a total eclipse in certain localities on the divisor Volva still shines, like an ember which continues to glow after a flame has been put out. When Volva, too, ceases to shine, the middle of the total eclipse has arrived (for if the eclipse is not total, Volva does not cease to shine). When Volva resumes its shining (at the opposite localities on the divisor circle) the sun also approaches visibility. Thus to a certain extent both luminaries are extinguished at the same time in the middle of a total eclipse.
- 3.17. So much for the phenomena in both hemispheres of Levania, the Subvolvan and the Privolvan. From these phenomena, even without my saying anything, it is not difficult to infer how much the Subvolvans differ from the Privolvans in all other respects.
- 3.18. For although the Subvolvan night lasts as long as fourteen of our days and nights, nevertheless by its presence Volva lights up the land and protects it from the cold. Indeed, so huge a mass, so intense a brilliance cannot fail to impart warmth.
- 3.19. On the other hand, even though a day among the Subvolvans has the sun irksomely present for fifteen or sixteen of our days and nights, nevertheless it is a smaller sun, whose strength is not so dangerous. The luminaries, being joined, pull all the water to that hemisphere, where the land is submerged so that only a tiny quantity of it protrudes. By contrast the Privolvan hemisphere is dry and cold because all the water has been drawn off. However, when night begins for the Subvolvans and day for the Privolvans, the hemispheres divide the luminaries between them, and therefore the water is divided too; the fields of the Subvolvans are drained, whereas the moisture provides the Privolvans with some slight relief from the heat.
- 3.20. The whole of Levania does not exceed fourteen hundred German miles in circumference, that is, only a quarter of our earth. Nevertheless, it has very high mountains as well as very deep and wide valleys; to this extent it is much less of a perfect sphere than our earth is. Yet it is all porous and, so to say, perforated with caves and grottoes everywhere, especially in the Privolvan region; these recesses are the inhabitants' principal protection from heat and cold.

- 3.21. Whatever is born on the land or moves about on the land attains a monstrous size. Growth is very rapid. Everything has a short life, since it develops such an immensely massive body. The Privolvans have no fixed abode, no established domicile. In the course of one of their days they roam in crowds over their whole sphere, each according to his own nature: some use their legs, which far surpass some of our camels; some resort to wings; and some follow the receding water in boats; or if a delay of several more days is necessary, then they crawl into caves. Most of them are divers; all of them, since they live naturally, draw their breath very slowly; hence under water they stay down on the bottom, helping nature with art. For in those very deep layers of the water, they say, the cold persists while the waves on top are heated up by the sun; whatever clings to the surface is boiled out by the sun at noon, and becomes food for the advancing hordes of wandering inhabitants. For in general the Subvolvan hemisphere is comparable to our cantons, towns, and gardens; the Privolvan, to our open country, forests, and deserts. Those for whom breathing is more essential introduce the hot water into the caves through a narrow channel in order that it may flow a long time to reach the interior and gradually cool off. There they shut themselves up for the greater part of the day, using the water for drink; when evening comes, they go out looking for food. In plants, the rind; in animals, the skin, or whatever replaces it, takes up the major portion of their bodily mass; it is spongy and porous. If anything is exposed during the day, it becomes hard on top and scorched; when evening comes, its husk drops off. Things born in the ground—they are sparse on the ridges of the mountains—generally begin and end their lives on the same day, with new generations springing up daily.
- 3.22. In general, the serpentine nature is predominant. For in a wonderful manner they expose themselves to the sun at noon as if for pleasure; yet they do so nowhere but behind the mouths of the caves to make sure that they may retreat safely and swiftly.
- 3.23. To certain of them the breath they exhaust and the life they lose on account of the heat of the day return at night; the pattern is the opposite of that governing flies among us. Scattered everywhere on the ground are objects having the shape of pine cones. Their shells are roasted during the day. In the evening when, so to say, they disclose their secrets, they beget living creatures.
- 3.24. Relief from the heat in the Subvolvan hemisphere is provided chiefly by the constant cloud cover and rain, which sometimes prevail over half the region or more.
- 3.25. When I had reached this point in my dream, a wind arose with the rattle of rain, disturbing my sleep and at the same time wiping out the end of the book acquired at Frankfurt. Therefore, leaving behind the Daemon narrator and her auditors, Duracotus the son with his mother, Fiolxhilde, as they were with their heads covered up, I returned to myself and found my head really covered with the pillow and my body with the blankets.