Chapter 2
Early Modern ET, Reflexive Telescopics, and Their Relevance Today

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Abstract The period from the discovery of Tycho's New Star in 1572 to Galileo's "geometrization of astronomical space" in 1610 (and the years following) saw the disintegration of the boundary between the sublunary and superlunary spheres—between the "lower storey" and "upper storey" of the Aristotelian Universe. This establishment of a strong physical affinity between the universe "up there" and the earthly realm "down here" was also complemented by the rise of Copernicanism: for once the Earth was seen as a planet, the other planets could readily be imagined as other Earths. This analogy suggested not only physical but also biological affinities and supported the plausibility of humans' capacity to travel to the Moon and beyond. Robert Burton—given the demise of Aristotle's physics—declared in 1621 that "If the heavens be penetrable … it were not amiss in this aerial progress to make wings and fly up." John Wilkins and Francis Godwin in the 1630s actively imagined creatures in the Moon and human journeys thither. The epic poet John Milton in 1667 hinted that "every star [is] perhaps a world / Of destined habitation." Moreover, space travel was no one-way street: Thomas Traherne in the 1670s imagined a dweller among the stars visiting Earth and remarking on what must be the condition of its inhabitants. In these and other ways, seventeenth-century writers offered serious and impressive speculation about extraterrestrial life and its possible perceptions of Earth. Such speculations remain pertinent to astrobiological theory today. What Hans Blumenberg in the 1970s called "reflexive telescopics"—the examination of Earth from an imagined extraterrestrial viewpoint—is an important counterpart to the search for life "out there." It serves as a reminder of the obvious but profound premise that Earth is part of the cosmos. At a popular level we often continue to speak of "outer space" as if the old "two-storey" picture of the universe still had some residual legitimacy. However, if Galileo, Wilkins, and other devotees of the New Astronomy were right about Earth's being a full participant in "the dance of the stars," then "outer" is a merely relative and parochial term, not a

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scientific or qualitative one. And it is no trivial claim to assert that the search for intelligent life in the universe has already identified its first specimens.

2.1 Introduction

As the now-classic studies of Crowe (1986) and Dick (1982) have indicated, ET-related discussions began in antiquity and were not completely neglected in the European Middle Ages. Nonetheless, a series of landmark developments in mathematical and observational astronomy drove that discussion forward during the early modern period, and our capacity to conceive of space travel and ultimately of astrobiology was powerfully shaped by two particular sixteenth-century innovations in astronomy. To grasp their significance, we do well to review some of the assumptions of the old astronomy that eventually the theories and observations of astronomers such as Nicolaus Copernicus and Tycho Brahe utterly undermined.

2.2 "Two Storeys" of the Universe

Astronomical teaching in the European universities, resting chiefly on the *Physics* of Aristotle and the *Almagest* of Ptolemy,[1] involved (generally speaking) the following premises (see Fig. 2.1, the Ptolemaic cosmos from Apian 1550). The Universe is immense in size but finite, consisting of ten spheres, the tenth or outer one being the "Prime Mover" and the ninth being the crystalline sphere. Below these is the eighth, the sphere of the fixed stars, followed by the spheres of the seven planets, or wandering stars: Saturn, Jupiter, Mars, the Sun, Venus, Mercury, and the Moon. Beneath the sphere of the Moon is located the (unnumbered) "elementary" sphere, comprising the domains of the four Aristotelian elements, in descending order: fire, air, water, earth. The domains above the Moon and below it—also known respectively as the superlunary sphere and the sublunary sphere—are qualitatively different from each other as to their physics and substance. Motion is governed by different laws peculiar to the two realms, and things in the superlunary sphere are composed not of earth, water, air, or fire, but of a fifth element, or quintessence. There was thus in the Aristotelian cosmos no known physical or scientific basis for presuming any analogy between what Arthur Koestler has dubbed the "two storeys" of the Universe (Koestler 1959, 59–62). The most radical practical difference between the superlunary and sublunary realms is that "up there" nothing ever changes, whereas "down here" *everything* changes: all things come to be and pass away. Indeed, the very processes of what we now call biology—conception, birth, growth, decline, death, and the manifold mutability that

[1] See Aristotle (1930) and Ptolemy (1984), but also excerpts from these works in Danielson (2000), Chaps. 6 and 11.

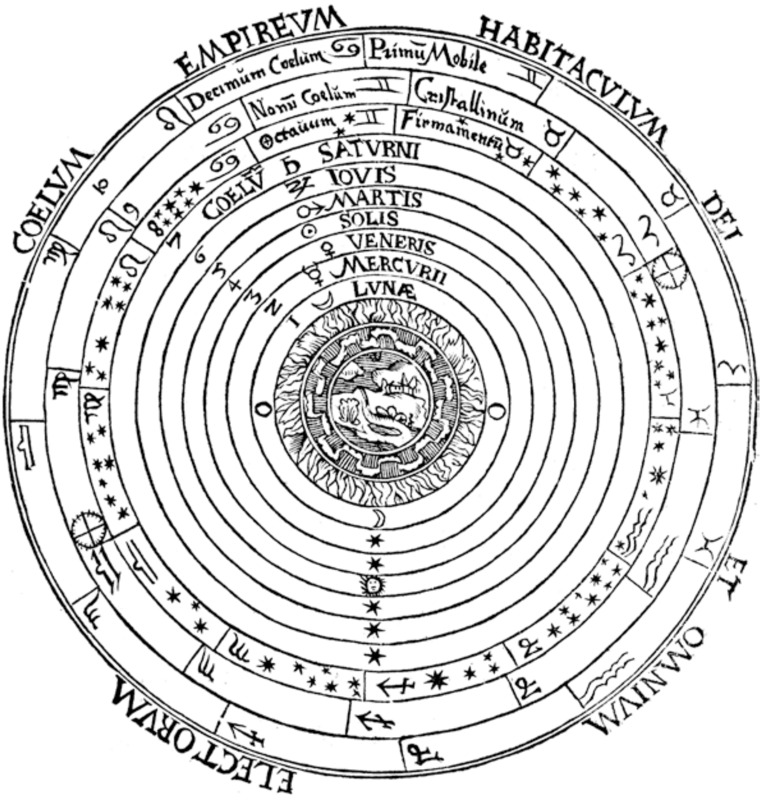

Fig. 2.1 The Ptolemaic universe (from Apian 1550). Courtesy of the Linda Hall Library of Science and Technology

characterizes them all—were held to take place uniquely in the sublunary realm. With the new astronomy and physics of the early modern period, however, those assumptions would gradually undergo a complete revision.

2.3 "The Shadow of Heaven"

The English astronomer Thomas Digges neatly embodies Copernicus's and Tycho's twin contributions to the dissolution of the Aristotelian model of the universe and to subsequent discussions of ET. Like Tycho, Digges studied the Supernova of 1572 to determine whether that new phenomenon was sublunary or superlunary: whether it was truly stellar. And, like Tycho, he concluded on observational and trigonometric grounds that it genuinely was superlunary.[2] In early

[2] For the gripping account of the Danish astronomer's first observations of what came to be known as Tycho's Supernova, see Brahe (1929).

1573 Digges published (in Latin) *Alae seu scalae mathematicae, quibus visibilium remotissima coelorum theatra conscendi—Mathematical wings or ladders whereby we may ascend the highest theater of the visible heavens*. Even though this important work on parallax was not specifically about the new star of 1572, its prefatory dedication to William Cecil unambiguously declared the new phenomenon to be "far beyond the sphere of the moon" (Digges 1573, sig. A.iii.^{v}). A demonstration that mutability exists in *both* domains made it possible for humans to begin imagining what else the two domains might have in common. The observation of the new star's coming to be and passing away thus inserted into human thinking the thin edge of a powerful analogy. Even allowing for great differences, it created grounds for adumbrating similitudes, and it raised the question, as Milton would write almost a century later:

> What if Earth
> Be but the shadow of heaven, and things therein
> Each to other like, more than on earth is thought? (5.574–576).

In short, Tycho's and Digges's observations of change taking place in the realm of the stars began to erase the boundary between the lower and upper storeys of the Universe, so that these no longer needed to be thought of as radically distinct or characterized by utterly dissimilar physics, substances, and beings.

Then in 1576 Digges published *A perfit description of the Caelestiall Orbes*, in which he included the main cosmological parts of book I of Copernicus's *De revolutionibus*—the very first translation of that work from Latin into any vernacular language. Digges also included an influential graphic of the Copernican system that continues to appear regularly in books on the history of astronomy (see Fig. 2.2). Digges's foreword "To the Reader" begins by mentioning the older model—"according to the doctrine of Ptolemy, whereunto all universities … have consented"—and continues:

> But in this our age one rare wit (seeing the continual errors that from time to time more and more have been discovered, besides the infinite absurdities in their theorics, which they have been forced to admit that would not confess any mobility in the ball of the Earth) hath by long study, painful practice, and rare invention delivered a new theoric or model of the world, showing that the Earth resteth not in the center of the whole world, but only in the center of this our mortal world or globe of elements which environed and enclosed in the Moon's orb, and together with the whole globe of mortality is carried yearly round about the Sun, which like a king in the midst of all reigneth and giveth laws of motion to the rest, spherically dispersing his glorious beams of light through all this sacred celestial temple. And the Earth itself to be *one of the planets* having his peculiar and straying courses turning every 24 hours round upon his own center whereby the Sun and great globe of fixed stars seem to sway about and turn, albeit indeed they remain fixed (Digges 1576, sig. M.1^{r}; italics added).

While reveling in both the science and the poetic flavor of Copernicus, Digges also noticeably retained, indeed reinserted, much vocabulary inherited from the system that Copernicanism would displace—"mortal world," "globe of elements," etc.—language that Copernicus's original text does not in fact employ. Moreover, Digges retained these pictorially as well as textually. The main thing presented in his famous graphic is the Copernican planetary system, with Mercury, Venus,

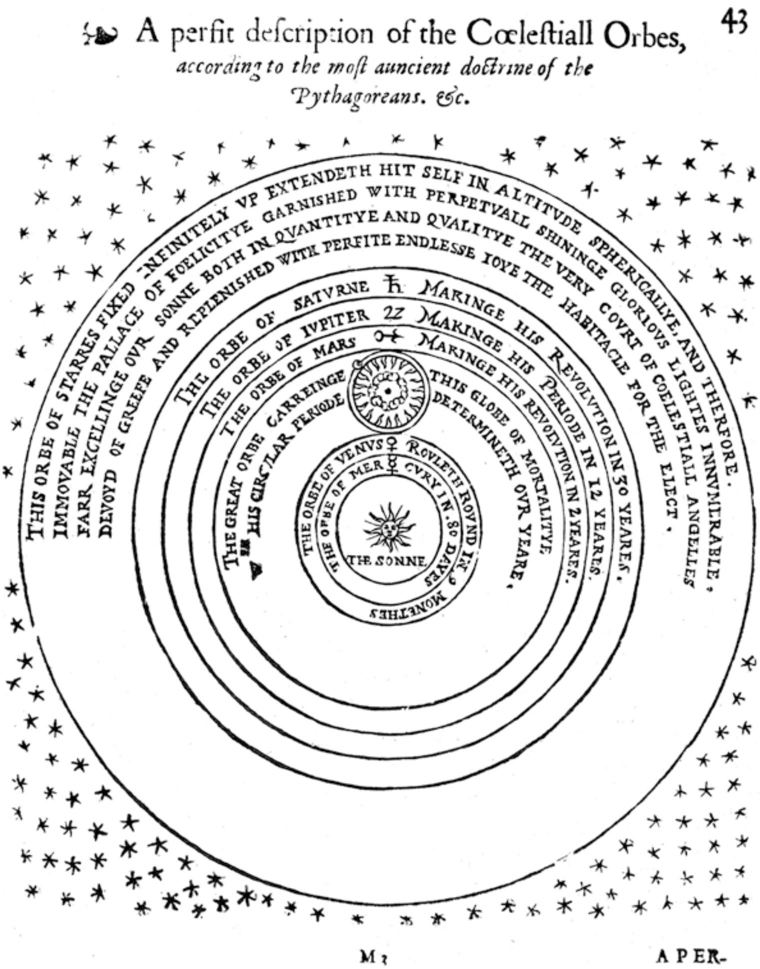

Fig. 2.2 Thomas Digges's version of the Copernican Universe (from Digges 1576). Courtesy of Owen Gingerich

Earth, Mars, Jupiter, and Saturn circling the central Sun. But if we look closely, we notice that the terrestrial system—the Earth with the Moon circling it—is simply a shrunken, simplified version of the old Ptolemaic sublunary sphere enclosing the familiar Aristotelian elements (compare Fig. 2.1). It is impossible to determine Digges's motivations for offering this particular presentation of the universe. However, deliberately or not, his graphic would have permitted a sixteenth-century audience to contemplate the encompassing Copernican cosmology without having to jettison the "local arrangements" in which they had been taught to feel so at home. And crucially, the picture is modular in one further important respect. Just as Digges neatly cut-and-pasted the familiar sublunary core of the Ptolemaic universe into that of Copernicus, so in turn he quietly but dramatically inserted

Copernicus's finite cosmos—what we now know simply as the solar system—into an infinite super-cosmos of stars that "infinitely up extendeth itself in altitude spherically" (see Fig. 2.2). In short, accepting the Copernican cosmos as Digges presented it would have permitted one to continue believing in Ptolemy's sublunary sphere and yet at the same time to venture forth imaginatively into an infinite universe inherited from Atomists such a Lucretius.

2.4 "Each Star an Island"

Such hybridity, or syncretism—the tendency to combine and harmonize disparate elements from different philosophical traditions—is one of the most prominent and occasionally endearing or befuddling elements of Renaissance-humanist thought. A further relevant example of it in Digges's time is offered by a long Latin poem by the Italian Marcello Palingenius (ca. 1500–1543) called the *Zodiacus vitae*, which Digges quotes approvingly a number of times in *A perfit description*'s foreword. Although in many ways a philosophical hodgepodge, this poem must have appealed to sixteenth-century readers, for it was printed in England seven times in Latin between 1569 and 1599 (four of these by Digges's own printer), and three times in Barnaby Googe's English translation (1565, 1576, 1588). For our purposes, it is notable not only for continuing to offer the familiar gloomy estimation of life in the sublunary sphere ["all that nature framed beneath the Moon, is nought, and ill" (Palingenius 1565, sig. GG.vii.^{r})], but also for proposing a number of times the likely existence of extraterrestrials. Palingenius argues this claim from the immense largeness of the universe relative to the Earth ("the seas and earth … are[,] compared to the skies[,] as nothing") and from the quasi-religious belief that God's creativity tends to fill all the places he creates.[3] Of the Earth, accordingly, Palingenius writes:

> Shall then so small and vile a place so many fish contain [,]
> Such store of men, of beasts and fowls and th'other void remain?
> Shall skies and air their dwellers lack? He dotes that thinketh so.
> (Palingenius 1565, sig. X.v.^{r})

Thus he concludes that "Each star an island shall be thought," and "doubtless heaven, stars, and air inhabitants enjoys" (Palingenius 1565, sig. X.vi.^{r}).

Palingenius was neither an astronomer nor a Copernican, yet his writings are evidence that talk of ET and of inhabited stars in an immense created universe—atomism without atheism, as it were—had already appeared prominently on the scene in the sixteenth century some decades before the writings of Giordano Bruno, whom general accounts often give quite disproportionate credit for introducing such ideas.[4] Digges, whose work also preceded both Bruno's and Kepler's, was

3 On this "Principle of Plenitude," see the previous chapter, Crowe and Dowd (2013).

4 On, for example, Bruno's tenuous grasp of Copernicanism, see McMullin (1987).

indeed an astronomer and a Copernican (England's first thoroughgoing one). He lucidly recognized, moreover, that Copernicus's cosmology was proposed as no mere mathematical model: "Copernicus meant not as some have fondly excused him to deliver the grounds of the Earth's mobility only as mathematical principles, fained and not as philosophical truly averred" (sig. M.1^{r}). Digges was thus clear—as many interpreters even into the seventeenth century were *not* clear—that the Copernican proposal offered no mere saving of the appearances, no purely instrumentalist model. Yet, as already indicated, Digges deftly fused a realistic Copernicanism with familiar vocabulary inherited from the Aristotelian/Ptolemaic model, repeatedly referring to Earth, for example, as a "dark star" (sig. M.2^{r}).

As far as ET is concerned, however, the crucial word here is simply "star." I have argued elsewhere that one of the great original impediments to the acceptance of Copernicanism was not, as many have assumed, its *demotion* of the central Earth but rather its demotion of the Sun from its planetary status and *exaltation* of Earth into the heavens—not a suitable place for something that in Aristotelian physics was supposed to be the sump of the Universe, or in Giovanni Pico's choice words the "excrementary and filthy parts of the lower world" (Pico 1948, 224; see also Danielson 2001, and 2006, 75–78). In the old cosmology, the planets (as their names even today still suggest) were identified with divinity—something to which the upstart Copernican Earth now cheekily seemed to aspire. Most decisively for the present discussion, the reconception of Earth as a planet, a wandering *star*, established a firm analogy between it and the other planets.

2.5 "The Light of the Earth"

The period from the discovery of Tycho's New Star in 1572 to Galileo's pursuit of telescopic observations of the heavens in 1609 and the years following accordingly saw further disintegration of the imagined boundary between the sublunary and superlunary spheres—between the lower and upper storeys of the Aristotelian Universe. This cosmological "homogenization"—the establishment of a strong physical uniformity between the Universe "up there" and the earthly realm "down here"—was complemented by the rise of Copernicanism. For the analogy just mentioned was a two-way street: not only was Earth reconceived as a planet, but also the other planets could now readily be imagined as other Earths.

Galileo's telescopic observations of the Moon powerfully reinforced the same analogy, particularly as complemented by his demonstration that geometrical dimensions could be calculated in the heavens. We so take this application for granted that we may miss how radical it was at the time. By contrast with Aristotelian tenets concerning qualitatively different sublunary and superlunary spaces, in Galileo's Universe geometry (literally "Earth measure") applies up there as well as down here. This is what Samuel Edgerton refers to as the "geometrization of astronomical space" (Edgerton 1991; Danielson 2000, Chap. 25). As soon as Galileo saw the similarity between mountains on Earth and mountains on the Moon, he set out by means of measuring shadows and angles to compute the elevations of the lunar mountains. He noticed that some peaks appeared illuminated even though they stood on the dark side of the "terminator," the line on the Moon dividing light and dark. And, using basic trigonometry, he calculated that those mountains are higher than any in the Alps. As Copernicus's student Rheticus had written some years earlier, deliberately echoing the Lord's Prayer, thus we behold "God's geometry in heaven and on earth" (quoted in Danielson 2006, 82). As Johannes Kepler so poetically expressed it in his response to Galileo's *Sidereus nuncius*, "Geometry … shines in the mind of God" (Kepler 1610, 43). Little wonder, then, that in such an age Milton should imagine the Creator himself as exercising his geometry by means of eternal drafting tools—his golden compasses—to shape and "circumscribe / This universe" (7.226–227).

A further highly significant recognition arising from Galileo's lunar observations—again, which we might simply take for granted but which had radical implications—concerns the behavior of light. Consider first that in Aristotle's Universe the natural tendency of all things is to fall or flow downward, or inward, toward the center. Earth was therefore generally thought to receive, but not to emit, light, just as it was the recipient literally of astronomical or astrological influences. Thus, from a cosmic and extraterrestrial perspective, Earth was inevitably dark, as implied by the residual Aristotelian/Ptolemaic vocabulary even of a genuine Copernican such as Digges ("dark star" etc.).

Yet once Copernicanism had fully grasped Earth's star status, that idea concerning terrestrial darkness could not long endure. Hence the importance of Galileo's empirical confirmation of Earth's brightness as reported in *Sidereus nuncius*. Conducting the first telescopic examination of the dark side of the Moon, Galileo discerned that it is in fact bathed in gentle light reflected from the Earth, just as Earth reciprocally receives light from the Moon:

> … In its cycle each month the Moon gives us alternations of brighter and fainter illumination. But the benefit of her light to the Earth is balanced and repaid by the benefit of the light of the Earth to her. … This is the law observed between these two orbs: whenever the Earth is most brightly enlightened by the Moon, that is when the Moon is least enlightened by the Earth, and vice versa.
>
> That is all I need say for now on this subject, which I will consider more fully in my *System of the Universe*, where many arguments and experimental proofs will be provided to demonstrate a very strong reflection of the Sun's light from the Earth—this for the benefit of those who assert, principally on the grounds that it has neither motion nor light, that the Earth must be excluded from the dance of the stars (Danielson 2000, 149–150).

Even today, scientists and the general public often only dimly grasp the extent to which Copernicanism thus raised, not lowered, the cosmic status of the Earth; and it did so in part by theorizing Earth as a light-bearer and light-sharer (along with the Moon and other planets). It did so, in other words, by making Earth part of a dynamic cosmic community—no longer, as Galileo's words indicate, "excluded from the dance of the stars." Indeed, from the demonstration of the Moon's and the Earth's "grateful exchange" of light, John Wilkins, three decades later in England, would go on to extrapolate and emphasize what we now assume to be the homogeneity or uniformity of space. Within this space, he declared, these twin planets inhabit "but one region" and enjoy a mutually beneficial light-sharing relationship "as loving friends" (Wilkins 1638, 153). The Aristotelian/Ptolemaic dark, isolated, sump-like Earth could hardly have undergone a more radical imaginative transformation, nor one of greater consequence for humankind's capacity to imagine—and perhaps form relationships with—beings elsewhere in the Universe.

2.6 "To Make Wings, and Fly Up"

Johannes Kepler instantly recognized these implications. Upon reading Galileo's *Sidereus nuncius* in 1610, Kepler immediately asserted the probability "that there are inhabitants not only on the moon but on Jupiter too," and went on to speculate that the "Jovians" may enjoy four moons (unlike us, who have only one) as consolation for the fact that they are less ideally located in the universe than we Earthlings. Kepler also boldly prophesied the day when we might launch our own lunar and planetary expeditions. For surely "settlers from our species … will not be lacking" and "given ships or sails adapted to the breezes of heaven, there will be those who will not shrink from even that vast expanse" (Kepler 1610, 39–41).[5]

Not only such imaginative journeys but also the science that supported them—the robust physical analogy between the upper and lower storeys of the Universe, complemented by a planetary Earth and changes proven to be taking place in the heavens—received ever greater acknowledgment in the seventeenth century. In his encyclopedic *Anatomy of Melancholy* in 1621, Robert Burton, recognizing the demise of Aristotelian physics and the abolition of crystalline spheres, endorsed the *sine qua non* of space travel: that "If the heavens be penetrable … it were not amiss in this aerial progress to make wings, and fly up" (Burton 1621, 325). Moreover, the achievements of Copernican astronomers such as Galileo and Kepler led to what historian David Cressy has called "England's lunar moment" (Cressy 2006, 967). In 1638, two influential works appeared that helped awaken more thoughts of space travel than ever before. The first of these, published posthumously, was Francis Godwin's imaginative fiction *The Man in the Moon*: *or a Discourse of a Voyage Thither*. Some elements of Godwin's narrative, such as the tethered flock of geese that conveys the main character to the Moon, are indeed fanciful. But the journey offers a vivid, non-Aristotelian account of physical features such as gravitation as well as the daily rotation of the Earth "according to the late opinion of Copernicus." What Godwin's fiction perhaps most movingly conveys, however—something actualized powerfully and photographically in

[5] Kepler extended his brilliant exploration of possible lunar travel, environment, and perspectives much further in his posthumous *Somnium* (Kepler 1967). For more on how Kepler and other early moderns prepared the way for eventual spacetravel, see Danielson (2011).

late 1968 by the Apollo 8 mission—is a vision of our own planet as a "new star" masked "with a kind of brightness like another moon" (Godwin 1638, 90, 92).

In a second English work appearing in 1638, *The Discovery of a World in the Moon*, John Wilkins extrapolated from his enthusiastic presentation of Copernican astronomy the idea of an inhabited Moon. Like Godwin, Wilkins not only vividly described conditions on the Moon but also imagined the shining appearance of our native globe from space. With some relish, he supported the scientific credibility of this imagined vision by citing the authority of two contemporary anti-Copernican Continental philosophers:

> Thus also Carolus Malapertius, whose words are these … "If we were placed in the Moon, and from thence beheld this our Earth, it would appear unto us very bright, like one of the nobler planets." Unto these doth Fromondus assent, when he says … "I believe that this globe of Earth and water would appear like some great star to any one who should look upon it from the Moon" (Wilkins 1638, 149–150).

Admitting the difficulties of a lunar voyage but building, like others, on the recent success of journeys to earthly places such as America (another kind of "New World"), Wilkins concluded by eloquently reprising the prophetic strains of Kepler. He could not, he admitted, conjecture how one might sail to the Moon. "We have not now any Drake or Columbus to undertake this voyage, or any Daedalus to invent a conveyance through the air. However, I doubt not but that time who is still the father of new truths … will also manifest to our posterity that which we now desire but cannot know" (Wilkins 1638, 107).[6]

2.7 Reflexive Telescopics

In the epic *Paradise Lost* (1667 and 1674)—which John Tanner has called "perhaps the greatest description of space travel in high-brow fiction" (Tanner 1989, 268)—John Milton hinted that "every star [is] perhaps a world / Of destined habitation" (7.621–622) and presented his anti-hero Satan as an astronaut (literally a sailor among the stars). In the second-to-last stop on his journey to tempt humankind, the Adversary alights on the Sun to asks directions of its resident angel, who offers him a thoroughly Galilean prospect of the Earth, which appears as a globe that "shines" and so *can be seen*, just like the other wandering stars, in particular like its "neighboring Moon / (So call that opposite fair star)" (3.727–728). In the earlier words of Robert Burton, the Earth "shines to them in the Moon, and to the other planetary inhabitants, as the Moon and they do to us" (Burton 1621, 326–327). Repeatedly in the seventeenth century, therefore, both scientists and poets not only looked outward into a newly conceived Universe but also exercised "reflexive telescopics," a phrase coined by Hans Blumenberg in the 1970s—shorthand for the imagined examination of Earth from an extraterrestrial viewpoint,

[6] The other prominent mid-seventeenth account of a lunar voyage was that of Cyrano de Bergerac (posthumously published in 1657).

complementing terrestrial observation of and speculation concerning what is "out there." According to Blumenberg, no sooner had Galileo trained his telescope upon the Moon than the question arose, How would the Earth appear through a telescope? (Blumenberg 1987, 675). At the end of this chapter I shall return to one of the most detailed and beautiful instances, written by Thomas Traherne in the 1670s, of such a scenario: that of a dweller among the stars approaching our Earth and remarking on what must be the condition of its inhabitants.[7]

First, however, two further late seventeenth-century writers deserve mention. Bernard le Bouvier de Fontenelle, popularizer of a Cartesian version of Copernicanism, was introduced in the previous chapter and is known for colorfully pondering the implications of an infinite universe, in which for example the Milky Way comprises an "ant-hill of stars, … seeds of worlds." Yet it should be noted how carefully Fontenelle strove, within this expanded model of the universe, to deny that the cosmic immensities negated the value of the small and the local. In his dialogue, the philosopher accordingly assures the beautiful marquise: "The infinite multitude of other worlds may render this [world] little in your esteem, but they do not spoil fine eyes, a pretty mouth, or make the charms of wit ever the less: These will still have their true value … in spite of all the worlds in the Universe." Our gaze outward into the cosmos must be complemented by a due regard for the undoubted value of things within our own world, even granted that we are "but one little family of the Universe" (Fontenelle 1688, 141, 136, 94).

The language of kinship was extended extraterrestrially by the Dutch scientist Christiaan Huygens in his late-seventeenth-century re-articulation the familiar analogy between our planet Earth and other planets upon which the ET hypothesis was chiefly founded. In his *Celestial Worlds Discovered* (1698), Huygens summarized key assumptions whose foundations had been a-building for more than a century:

> A man that is of Copernicus's opinion, that this Earth of ours is a planet, carried round and enlightened by the Sun, like the rest of them, cannot but sometimes have a fancy, that it's not improbable that the rest of the planets have their dress and furniture, nay and their inhabitants too as well as this Earth of ours: especially if he considers the later discoveries made since Copernicus's time of the attendants of Jupiter and Saturn, and the champaign and hilly countries in the Moon, which are an argument of a relation and kin between our Earth and them (Huygens 1698, 1–2; see also Aït-Touati 2011, 95–129).

The kinship of which Huygens writes is precisely what forms the foundation too of reflexive telescopics, an intellectual exercise still highly relevant to wider considerations of astrobiology today.

I conclude this chapter, then, with an application of reflexive telescopics, beginning with a brief interpretation of the frontispiece (Fig. 2.3) that appeared in John Wilkins's re-publication in a single volume in 1684 of two works he had published in 1638 and 1640. The first of the works mentioned on this title page (discussed earlier under its original title, *The Discovery of a World in the Moone*) is the

[7] In the context of this volume it might be remarked that if Ted Peters can design a questionnaire that asks Earthlings their opinions concerning extraterrestrials (Peters 2013), it is certainly a reasonable exercise to ponder what extraterrestrials might think about us.

Fig. 2.3 Frontispiece from Wilkins (1684). Courtesy of the Linda Hall Library of Science and Technology

Discourse concerning a New World, Wilkins's extrapolation from the work of both Galileo and Kepler regarding the nature of the Moon as an earthlike planet with, by analogy, earthlike inhabitants. As already acknowledged, every analogy has two sides, and the "discovery" of an earthlike Moon was thus appropriately followed by an examination of what Wilkins called "another planet"—by which of course he meant the planet Earth, still apparently a novel-sounding idea even a 141 years after the publication of Copernicus's *De revolutionibus*.

And as for Copernicus, there he is in Wilkins's frontispiece posing the hypothesis that in real life he actually *never* posed merely as a hypothesis: "What if it be thus?" But on the other side of the title stand Wilkins's other two heroes, Galileo and Kepler, who represent the twin pillars of astronomy then as now: (1)

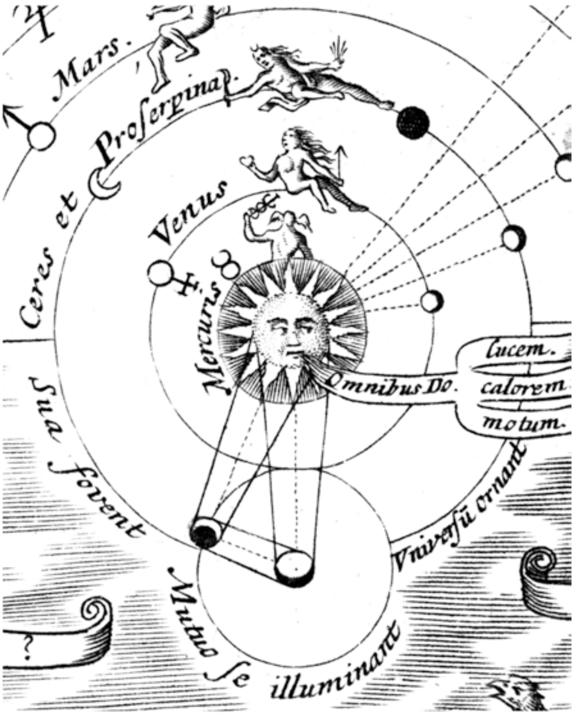

Fig. 2.4 Detail from Fig. 2.3, frontispiece from Wilkins (1684). Courtesy of the Linda Hall Library of Science and Technology

Observation (Galileo with his telescope, "Here be his eyes"); and (2) Mathematics (Kepler: "Yes, and his wings"—a metaphor reaching back through Digges to Rheticus and even to Plato; see Danielson 2006, 25–26). The other thing to notice in the top third of Wilkins's frontispiece is that the Copernican cosmos offered here is the *English* Copernican cosmos inherited from Digges, with the stars not in a nice neat band or stellar sphere, but seeming to spill off over the edge of the page and so suggesting a possibly infinite Universe.

Nonetheless, even within that immensity there is a coherent family of Sun-and-planets (see Fig. 2.4) who in Wilkins's charming but serious cartoon literally eye each other. The Sun "gives light, warmth, and motion" to all of them, while the Moon and Earth, in accordance with their reciprocal luminosity as discovered by Galileo, "enlighten each other." No wonder that Kepler, Wilkins, and their inheritors, having postulated beings on the Moon and having arrived at the basic but decisive Galilean realization that Earth is visible from "out there," began imagining how Earth might appear to ET. In a manuscript discovered only in the 1990s but dating from the 1670s, Thomas Traherne offered just such a scenario, that of a "Celestial Stranger" discovering our planet for the first time:

> Had a man been always, in one of the stars, or confined to the body of the flaming Sun, or surrounded with nothing but pure ether, at vast and prodigious distances from the Earth, acquainted with nothing but the azure sky, and face of heaven, little could he dream of

> any treasures hidden in that azure veil afar off. … Should he be let down on a sudden, and see the sea, and the effects of those influences he never dreamed of; such strange kind of creatures; such mysteries and varieties; … such never heard of colors; such a new and lively green in the meadows; such odoriferous and fragrant flowers; such reviving and refreshing winds, … it would make him cry out How blessed are thy holy people, how divine, how highly exalted! Heaven it self is under their feet! … The Earth seems to swell with pride, that it bears them all; all its treasure[s] laugh and sing to serve them. … Verily this star is a nest of angels! … This little star so wide and so full of mysteries! So capacious, and so full of territories, containing innumerable repositories of delight, when we draw near! Who would have expected, who could have hoped for such enjoyments? (Traherne 2002, 112–114).

Traherne's reflexive-telescopic thought experiment remains significant today for a number of reasons, and I end with these more personal reflections. First, I worry that at some popular level the search for exoplanets and for ET may potentially dilute the profound sense of responsibility and admiration we ought to have for our own local, precious, precarious planet. Vividly imagining how an extraterrestrial being might view our home and native star—and indeed exclaim concerning its glories—may mitigate any too cavalier attitude toward the availability (at least to us) of alternative habitats for life in the Universe. Second, a related point: If reflexive telescopics indeed offer a legitimate exploration of the possibilities of interplanetary or interstellar consciousness, then Earthlings must not be excluded or bracketed off from scientific theorizing about life in the Universe. Is it not misguided, we may reasonably inquire, to worry too much about purging our search for ET of "anthropocentrism"? Yes, of course we ought to remain open-minded about what forms other life or intelligence might manifest, but surely it is arbitrary and artificial not to pay special attention to the single sample we actually have of the very category of thing we are searching for.[8]

The editor of this volume has commented on the need to beware how prior assumptions impeded the acceptance of new discoveries that were later widely endorsed. So let me also suggest, against the backdrop of the achievements of the early modern period, that we continue the process of purging remnants of latent Aristotelianism that in the twenty-first century might still cloud our thinking about life in the Universe. For example, we still often carelessly speak of "outer space," as if the old "two-storey" picture of the Universe retained some residual legitimacy. However, if Galileo, Wilkins, and other devotees of the New Astronomy were right about Earth's being a full participant in the dance of the stars, then "outer" is a merely relative and parochial term, not a scientific or qualitative one. And it is a fact with truly cosmological implications that the search for life in the Universe has already identified its first specimens—whom, and whose astonishing home planet, we have compelling reasons to cherish and seek to preserve.

[8] See Sullivan's (2013) comments about the "N = 1" problem in Chap. 3.

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A Note on References

For ease of reading I have modernized spelling and capitalization in all quotations from early modern publications; titles, however, have been left in their original spelling. For works lacking page numbers, in-text citations indicate instead the signature by letter, number, and whether recto or verso (e.g.: sig. X.vi.^{r}). In-text citations of Milton's *Paradise Lost* indicate book and line numbers (e.g. 7.226–227).