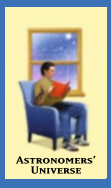
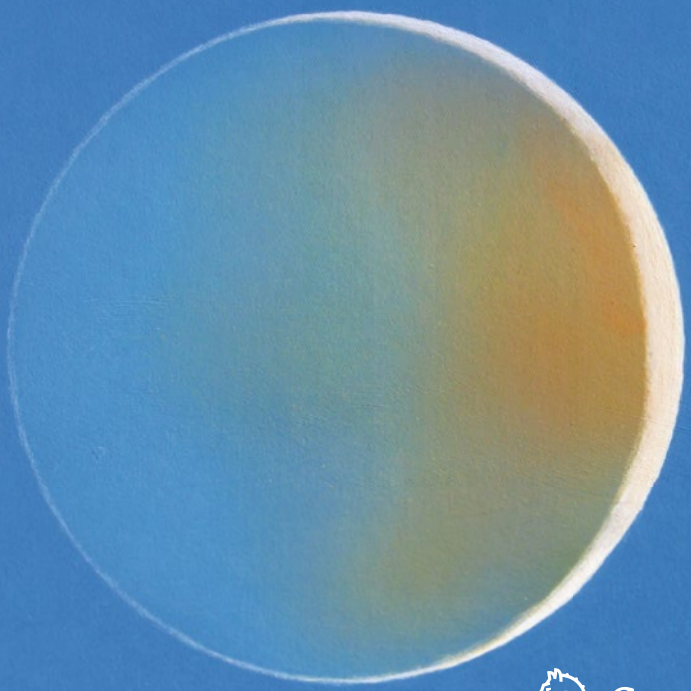


John C. Barentine

Mystery of the Ashen Light of Venus

Investigating a 400-Year-Old Phenomenon



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International Dark-Sky Association
Tucson, AZ, USA

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Cover illustration: A painting by astronomer William K. Hartmann, who, with fellow astronomer Dale P. Cruikshank, followed Venus telescopically for several days as it passed between Earth and Sun. On one those days, they both thought they could see a faint discoloration of Venus's dark side, as depicted in this painting. © W. K. Hartmann, Senior Scientist Emeritus, Planetary Science Institute, Tucson

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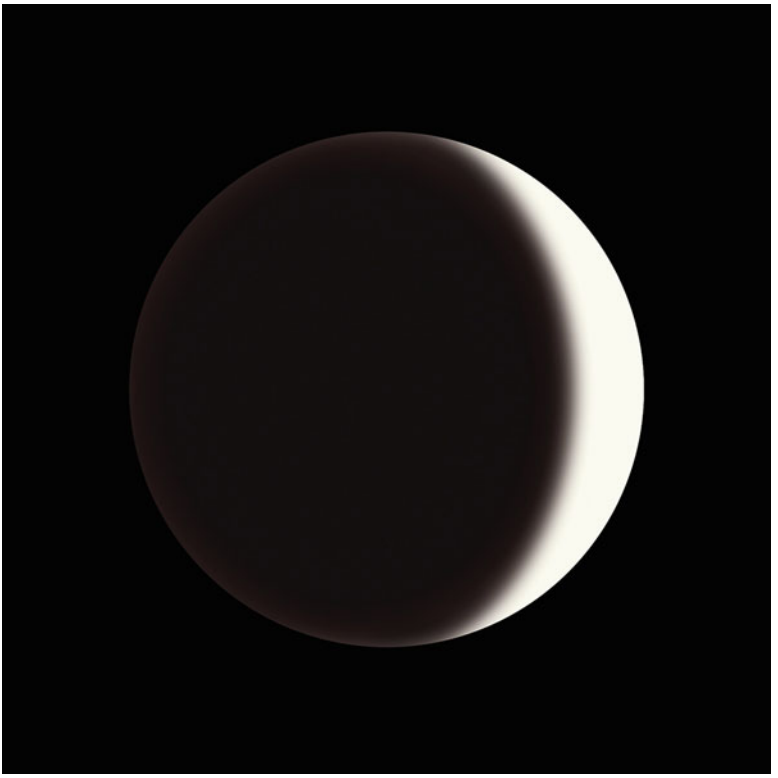

This book is dedicated to the memory of Richard Baum (1930–2017), a fine amateur astronomer whose contributions to the history of its subject over many decades have so informed my work.

Acknowledgments

As much as it is a cliché, it is worth reiterating that no substantial piece of writing is composed in a vacuum otherwise inhabited only by the author. There are many people I am glad to thank for their assistance and counsel throughout the process by which this book came together.

First and foremost, I couldn't have completed this project without the love and support of my partner, Woody Carrick, who has already heard far more about the Ashen Light from me than most people will ever care to know.

I'm indebted to my interview subjects, who answered my questions thoughtfully and patiently, and other experts who spent much time engaging with me on this topic. These include Prof. Paul Abel, Mary Stewart Adams, Dr. Dale Cruikshank, Dr. Andrew Crumey, Daniel Fischer, Dr. Candace Gray, Dr. William Hartmann, Dr. Vladimir Krasnopolsky, Dr. Richard McKim, Dr. Emilie Royer, Dr. Manuel Spitschan, and Prof. Christopher Russell. I'm grateful to the astrophotographers who kindly provided permission to reproduce their work here, namely Giuseppe Donatiello, Daniele Gasparri and John Sussenbach.

A few people saw substantially final versions of this manuscript before publication and offered comments and suggestions for improvements. I am particularly grateful to Francine Jackson (Brown University's Ladd Observatory) for making a very careful read and writing a very helpful review in repsonse.

The decision to embark on this project might not have been made without the advice of the British amateur astronomer and Ashen Light eyewitness, Richard Baum, whom I was fortunate to get to know right at the very end of his life. In my last correspondence with him in May 2017, just months before his death, Richard encouraged me to make the book "stimulating to thought,"

otherwise readers with pre-existing opinions about the Ashen Light would dismiss it, thinking there was nothing further about the subject to consider. "I have seen this only too often in my 87 years," Richard wrote me. "A saddening process in fact because they fail to realise the importance of what they pass over." I wish Richard lived long enough to see this book published, as I would have loved to know whether he felt I did justice to the topic.

I appreciate both that Springer took a chance on this topic and that Hannah Kaufman was my editor and Dinesh Vinayagam my production manager. Once again, it was a smooth and trouble-free experience bringing a title from concept to publication.

Lastly, thanks are due to innumerable friends, colleagues and members of my family who offered kind words and expressions of support throughout the project. I'm forever in your debt.

Tucson, AZ, USA — John C. Barentine
February 2021

Contents

Introduction

In the fading light minutes before sunset, I rack the telescope focus in and out before obtaining a sharp view of the Evening Star that has dominated twilight for the past several months. Each late afternoon, it is the first "star" visible in the deep blue of the western sky. I follow it for the next few hours, gradually lower toward the horizon, as the light of day fades and the brilliant crescent seems to shine more brightly. Next to other observations about it, I scrawl yet again in my notebook.

"Ashen Light not suspected."

It is, in fact, the same observation as every time I observed Venus during the last thirty years. The words are a reference to the appearance of faint light emanating from the night side of the planet, coming from a place where one has no expectation of seeing any light. It is pale and often devoid of color, or nearly so. It is the *lumière cendrée* of the French language, and the *Graulicht* of German. As ghostly a name as it is a spectre haunting the history of astronomy, in English it is the Ashen Light.

"Night side entirely dark."

Reports by other reputable observers are too numerous, and some of those observers too reputable, for me to completely dismiss the notion that *something* occasionally happens on the hemisphere of Venus facing away from the Sun that yields direct and very real light, the quiet rain of which falls partly into the telescopes of Earthbound observers, tickling their retinas in just the right way as to lead their brains to believe that they have seen something as real as the planet itself. Some argued passionately, to their very last days, for the objective

certainty of what they saw. But others insisted with equal passion that they *never* saw it, even after a lifetime of dedicated Venus watching.

"Region away from the bright crescent examined for light. None seen."

Despite actively searching for most of my life, I can't say that the presence of the Ashen Light has ever suggested itself through the eyepiece of my telescope. Not once. And yet the mystery is so enticing that it became an obsession of four years' running by the time this book went to press.

My first encounter with the Ashen Light story came in the late 1980s when I was gifted a copy of James Muirden's *Amateur Astronomer's Handbook*, first published in 1974. Like nearly every other astronomy book I encountered as a kid, I read it from cover to cover because every aspect of astronomy seemed fascinating. On taking up the chapter on Venus, I came across a description of the Ashen Light that spanned only a few paragraphs, seemingly thrown in for completeness. Muirden introduced the Light with maybe the most succinct statement about it ever committed to print: "A phenomenon which has given rise to much dispute, even though its occurrence seems established by the weight of observation, is the occasional very faint luminosity of the dark side, aptly termed the *Ashen Light*."

I'm still taken aback by those words. How could anything seen by visual observers using small telescopes for so long be controversial? By the time I read Muirden, humans had not only sent spacecraft to Venus, but they even managed to land a few on its hellish surface. It didn't make sense that something might be going on in the atmosphere of Venus that was powerful enough to produce light observable from Earth, and yet there was not so much as a single photograph that objectively demonstrated its existence. Muirden doesn't sound like much of a skeptic, deferring to the weight of centuries of reports by reliable observers. Instead, he probed at the edges of what might be a plausible physical explanation:

> What is the Ashen Light? We do not know and can therefore only theorize, but it seems possible that it could be caused by intense auroras in Venus' atmosphere. We must remember that Venus is relatively close to the sun, and so receives much more radiation than does the earth. If Ashen Light sightings could be tied in with solar activity, the evidence would be conclusive.[1]

Starting from a belief that the phenomenology of the Ashen Light is the first and best source of information that leads to informed speculation about

[1] Muirden, 167–168.

its cause, I started my own quest to understand the subject by collecting as many descriptions of sightings of the Light as possible. Two years of searching yielded nearly 500 individual published reports spanning some three centuries. Combing through those observations and noticing certain patterns and repeated themes was the genesis of this book, as was finding out (to my surprise) that no such work already existed.

The project led me to dip a toe into original research on the subject, to consider what other areas of observational astronomy remain incompletely explored by amateurs and professionals alike, and to gain (and in short order, to lose) a friend of unimpeachable expertise in this field, whose parting words to me were to "make [this book] popular and stimulating to thought; otherwise many will glance at it then walk away thinking they know it all."

At the end of this work, I come to a few broad conclusions about the Ashen Light and what it says about us as fully fallible human beings.

First, the human eye and brain are, as a system for detecting and processing the signals of very faint light, vastly underrated in their efficacy. By the first half of the twentieth century, as astronomy was overtaken by astrophysics as the more princely of the disciplines during the ramp-up of research spending fueled by the post-war economic boom, the photographic process displaced visual observations as the more reliable recording medium. At the same time, the push to construct ever-larger telescopes demanded technology that could wrest from the universe the secrets encoded in the steady arrival of cosmic photons on Earth, extracting every drop of information possible from every particle of light, some of which required billions of years to even reach our planet. Digital detectors, with much higher efficiency, in turn fully displaced the best photographic emulsions by the dawn of the new century. Visual observing was relegated to a pastime of amateur astronomers.

Second, the ways in which our senses couple to both memory and logic result in the firm belief in the objective reality of what those senses tell us about the world: at some level, seeing really *is* believing. It can be argued that visual impressions are too impermanent and too imprecise to be considered reliable, while imaging processes are the only means of achieving the objectivity that science demands. Yet to discard the careful records of eyewitnesses is to downplay billions of years of evolution by natural selection that has given humans tremendous sensory capabilities. Our eyes are sensitive to a dynamic contrast range of light comprising some twenty stops, or a ratio of a million to one. But they are coupled to brains, incredibly complex organs that also give us the credulity of superstition, a territoriality that sorts us into warring tribes, and the tendency to follow leaders blindly that has brought our species to the edge of obliteration and back in just the past century. Humans are often

led to firm belief in the objective existence of things that very clearly never were, through observations of the world that left vivid memories and deep impressions. Our faith in the reality of our perceptions of the world, though devout, does not prevent us from being completely wrong.

Finally, while remaining formally agnostic about the existence of the Ashen Light—much less any specific explanation for it, if real—I believe the eyewitnesses throughout history who reported seeing it. I think they were reasonably convinced of the authenticity of what their eyes and brains told them about the information their telescopes collected when pointed toward Venus. At the same time, the prospect of a definitive explanation that will satisfy every skeptic seems dimmer than ever. Perhaps someone in the future will yet produce the unassailable evidence that either finally establishes or disproves the Ashen Light as a real, physical phenomenon. In either case, we would learn something important about human perception from simply knowing the right answer. And while this book certainly won't be the last word on the subject, I hope it is seen as helpful in collecting together in one place as much of the evidence for and against the Ashen Light as one author can.

So with that, a great story about the planet Venus begins with an equally great story about the planet Mars. And perhaps the greatest misapprehension in the history of astronomy began with an unfortunately bad translation of a single Italian word.

1

Prologue: The Martians That Never Were

"Little memory, no genius, much patience, and an everlasting curiosity about everything," was how Giovanni Virginio Schiaparelli (Fig. 1.1) once described himself,[1] but that self-deprecating review of his own intellectual capabilities belied his contribution to nineteenth-century astronomy. Although an observer possessed of keen perceptive abilities, he was also nearsighted and colorblind, crucial characteristics that likely influenced his judgment and left a particular imprint on how we now view the reliability of the human eye and brain in making useful astronomical observations.

Born on March 14, 1835, in Savigliano, an ancient city in what was then the Kingdom of Sardinia, Schiaparelli learned the lore of the night sky "as an infant," in his own words. His father, Luigi Schiaparelli, was a brick- and tile-maker from a long line of kilnmen, but he evidently believed in the value of education for his son, the first of eight children born to him and his wife, his third cousin Caterina Schiaparelli. Luigi instructed him in writing and mathematics, while Caterina taught him to read.

Through his father, Schiaparelli "came to know the Pleiades, the Little Wagon, the Great Wagon, and the *Via Lactea*." After seeing the trails of meteors blazing across the night sky, he asked Luigi what they were. "My father," he later wrote:

> answered that this was something the Creator alone knew. Thus arose a secret and confused feeling of immense and awesome things. Already then, as later, my

[1] 1907 letter to Professor Giovanni Marchesini, director of the Review of Philosophy, Pedagogy and Other Sciences, quoted in Mazzucato (2006).

J. C. Barentine, *Mystery of the Ashen Light of Venus*, Astronomers' Universe,
https://doi.org/10.1007/978-3-030-72715-4_1

Fig. 1.1 Giovanni Virginio Schiaparelli (1835–1910) seen in a portrait by an unknown photographer dating from the 1870s

> imagination was strongly stirred by thoughts of vastness, of space as well as of time.[2]

He later cited as a crucial formative moment the total solar eclipse that swept across the Italian Piedmont on the morning of July 8, 1842. Writing to the journalist Onorato Roux toward the end of his life, Schiaparelli described how the event shaped an inquisitive view of his world:

> I put on my trousers quickly, I went to the window: it was just the time of total disappearance of the solar disc. … My wonder increased even more when I was told that some men were able to predict such phenomena by date and time. I had, then, the wish to be one of them and the ambition to witness the forces that govern the universe.

Under the pale glow of the solar corona, a young Schiaparelli "formed the ardent desire of participating in the counsels governing the universe."[3] He wanted a seat at the table among the arbiters of the heavens.

While still in Savigliano, he attracted the attention of Paolo Dovo, a learned man and priest at the church of Santa Maria della Pieve; later, Schiaparelli fondly remembered him as "a man of gold, a great lover of astronomy, and

[2] Bianucci, P. 1980. Giovanni Virginio Schiaparelli, *L'Astronomia*, 6, 45.

[3] 1878, 'Osservazioni e fisiche sull'asse di rotazione a sulla topografia del pianeta Marte,' Memoria Prima, *Reale Accademia dei Lincei*; 1930, *Le Opere di G. V. Schiaparelli*, Milan, (reprint, New York, 1969), 1, 11–12.

one whose image could never be erased from the memory of those who had known him." Dovo gave Schiaparelli his first formal instruction in astronomy, lending him books and providing the young man with his first views of the night sky through a telescope fixed in the church's campanile. The magnificent universe expanded before him, the telescope revealing Saturn's rings, the phases of Venus, and the bright moons of Jupiter discovered two centuries earlier by his fellow countryman, Galileo Galilei.

His parents were sufficiently well-off such that they could afford to enroll him at the Gymnasium Lycée of Savigliano, which he began attending in the same year that his young eyes watched the shadow of the Moon darken the countryside of the Piedmont. In 1850 he enrolled at the University of Turin, completing a degree with distinction in hydraulic engineering and civil architecture. He was an excellent student; memorializing him in the pages of the *Monthly Notices of the Royal Astronomical Society* in the year after his death, the English amateur astronomer Edward Ball Knobel (1841–1930) wrote that in Turin Schiaparelli "gained a high reputation with his professors, and rapidly outdistanced his fellow-students in the study of pure and applied mathematics and in drawing."

Upon graduation, Schiaparelli remained for a while in Turin, teaching mathematics at the Gymnasium of Porta Nuova in order to earn a living. However, in Knobel's words, he found it "a position that was distasteful," so he petitioned the government of the Kingdom of Sardinia for financial support in order to further his astronomy studies abroad. His request was successful, and in 1857 he relocated to Berlin to study under Johann Franz Encke (1791–1865), most famous for calculating the orbital elements of the periodic comet that now bears his name. While in Berlin he also studied philosophy, meteorology, and geography, among other subjects.

In 1859, after a brief stint at Potsdam Observatory, he got a job at the Pulkovo Observatory near St. Petersburg, Russia, working for Friedrich Georg Wilhelm von Struve (1793–1864), his son Otto Wilhelm von Struve (1819–1905), and Friedrich August Theodor Winnecke (1835–1897). His performance at Pulkovo landed him a permanent position as second Astronomer at the Brera Observatory at Milan under Francesco Carlini (1783–1862). Carlini's death shortly thereafter, and Schiaparelli's keen intellect and scientific output, led to his appointment as Director. He remained in Milan for the rest of his life, making his permanent professional home at Brera.

By the 1870s, Giovanni Schiaparelli had become one of the world's preeminent astronomers. Using a 4-inch telescope, he discovered the asteroid (68) Hesperia in 1861, naming it for the ancient Greek word for Italy. In the mid-1860s, comparing the orbits of various comets to the directions on

the sky from which certain meteor showers appear to radiate, he correctly deduced the causal relationship between the streams of dusty debris shed from comets and swarms of "shooting stars" whose timely reappearance each year had puzzled observers for millennia. He further contributed a quarter-century of precise measurements of the positions of double stars and made extensive observations of Mercury and Venus, venturing (incorrect) estimates of their rotation periods.

While "his eye was famous for its keenness," wrote the clinical psychologist and historian of astronomy, William Sheehan, it was "not without its peculiarities." Schiaparelli was "severely myopic" and he suffered from red-green color blindness, a fact that certainly affected his perception of subtle shading on the discs of the planets he saw through the telescope eyepiece. Although he acknowledged privately that his eyes were "only slightly sensitive to the nuances of colour,"[4] Schiaparelli still achieved fame as one of the most distinguished visual observers of his generation.

Although in existence for a century by the time Schiaparelli arrived there, Brera Observatory was far from a cutting-edge research center. Its instruments were dated and inadequate for pursuing his research agenda. The nascent Kingdom of Italy took note of his discoveries, and the Minister of Public Education appropriated funds to provide the observatory with an equipment upgrade. In February 1875, Schiaparelli oversaw the installation of a brand-new refracting telescope, its 22-centimeter objective lens figured by the celebrated Bavarian lens maker Georg Merz (1793–1867). Although on the small side of the range of instruments available to observers at the world's premiere research facilities, the new telescope placed within Schiaparelli's reach the power to make important contributions to planetary astronomy.

It was through the Merz refractor that Schiaparelli began observing Mars during the dog days of the summer of 1877. That he spent some time on Mars was practically incidental to what he considered the important work on Venus and Mercury, though both planets suffered from the circumstance that they never appeared very far from the Sun in the sky and hence were invisible for most of the night. The Red Planet made for a useful point of comparison, allowing Schiaparelli to gauge the quality of the new telescope. While he did not intend then to dedicate himself to a "protracted series of regular observations," he wrote that he:

[4]1882, Proceedings of the Meeting of the Royal Astronomical Society, *The Observatory*, 5, 135–137.

> desired only to experiment to see whether our refractor of Merz, which had given such good performance on double stars, possessed the necessary optical qualities to allow also for the study of the surfaces of the planets. I desired also to verify for myself what the books of descriptive astronomy expounded about the surface of Mars, its spots and its atmosphere. I must confess that, on comparing what I saw on the planet with the maps that had been most recently published, my first attempt did not seem very encouraging.[5]

Nevertheless, he persisted in his Mars work, and his drawings proved to be as good as the best then-published.

In the latter half of 1877, Mars was situated nearly opposite the Sun in the night sky and available for viewing all night long. Schiaparelli undertook a careful examination of Mars at this "opposition," having become convinced that useful work was to be done delineating its topography. At the time, Schiaparelli shared the prevailing opinion of the planet among astronomers, formed in the days of the earliest telescopic views in the seventeenth century: Mars was a watery world where bright areas on its surface indicated landmasses floating in the voids of dark seas. These, however, were always shadowy and indistinct to earlier observers, and Schiaparelli felt that existing maps of the planet were insufficient to draw meaningful conclusions about the true nature of its surface.

The astronomical "seeing" from his rooftop observatory in the autumn of 1877 was remarkably good, to the extent that in October he experienced certain moments of near-perfect atmospheric calm in which entirely new sights unfolded to him through the eyepiece of the Merz refractor. And in those interludes when the image of Mars steadied amidst the roiling vapors above Milan:

> it seemed as if a dense veil were removed from the surface of the planet, which appeared like a complex embroidery of many tints. But such was the minuteness of these details, and so short the duration of this state of affairs, that it was impossible to form a stable and sure impression of the thin lines and minute spots revealed.[6]

A new planetary world was thusly born, the nomenclature of its features inspired by the mythology of classical antiquity. As Sheehan tells the story,

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[5]1878, "Osservazioni e fisiche sull'asse di rotazione a sulla topografia del pianeta Marte," Memoria Prima, *Reale Accademia dei Lincei*; *Opere*, 1, 61.

[6]1889; "Ueber die Beobachtungen Erscheinungen auf der Oberflache des Planeten Mars", *Himmel und Erde*, Vol. 1, Berlin; also in *Opere*, 2, 23.

Schiaparelli "introduced names which have ever since been part and parcel of the romantic lore of the red planet: Syrtis Major, Sabaeus Sinus, Margaritifer Sinus, Solis Lacus, Juventae Fons, Hellas, Elysium, Tharsis." Among the new terms to describe and label what he saw on the Martian surface, one stood out fatefully.

Canali.

Through the eye of the lens, indistinctly in the beginning and then with greater certainty, Schiaparelli gradually convinced himself of the reality of various streaks and shadings that appeared to him with striking linearity. In August he identified the first such feature, naming it Ganges after the great Asian river with its vast delta, tracing the drainage of northeastern India from a wide channel into an array of rivulets emptying into the Bay of Bengal. He saw through his telescope the geography of water, and he used the corresponding Italian words to describe what he felt must be the courses of waterways. *Canale* (meaning, variously, "channel," "duct," or "gully") and *fiume* ("river") appear interchangeably in his writing to denote many of the delicate lines he saw on the disc of Mars. But there is some ambiguity in how the word *canale* might be rendered, given that it also carries connotations of its English cognate, *canal*, which is readily distinguishable as a deliberate modification of the land. Schiaparelli's words, translated into English, carried much more of the artificial sense than it seems he ever intended, even though he didn't protest too loudly against the interpretation his words received on the other side of the Atlantic.

It turns out that Schiaparelli's use of *canali* with reference to Mars wasn't new. The term was used as early as the 1850s by Father Angelo Secchi, S.J. (1818–1878), Director of the Observatory at the Pontifical Gregorian University. In 1858, Secchi identified perhaps the largest and most noticeable of the dark regions on Mars as the "Atlantic Canale," but it is Schiaparelli's name – Syrtis Major – that is found on maps of the Red Planet to this day.

Schiaparelli's view was initially somewhat skeptical, and while he seems to have thought that Ganges was not a real river delta, he acknowledged that it was certainly a unique landform. But as late summer progressed into autumn, one by one, linear features seemed to unmistakably appear to him everywhere:

> In most cases the presence of a *canale* is first detected in a very vague and indeterminate manner, as a light shading which extends over the surface. This state of affairs is hard to describe exactly, because we are concerned with the limit between visibility and invisibility. Sometimes it seems that the shadings are mere reinforcements of the reddish colour which dominates the continents — reinforcements which are at first of low intensity. … At other times, the appearance may be more that of a grey, shaded band… It was in one or other

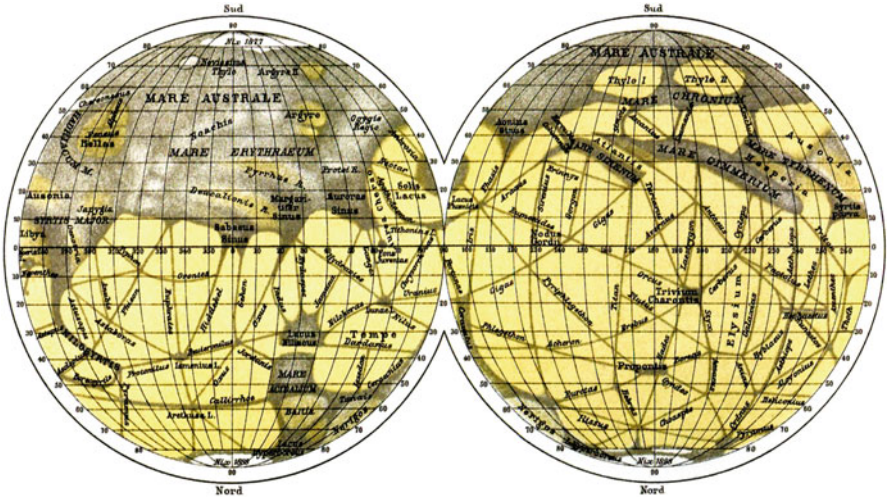

Fig. 1.2 "General map of the planet Mars according to the observations made in Milan from 1877 to the present" from Giovanni Schiaparelli's *La Vita Sul Pianeta Marte* (1893). The map's two hemispheres represent a synthesis of nearly two decades of Schiaparelli's visual observations of Mars

> of these indeterminate forms that, in 1877, I began to recognise the existence of the Phison (October 4), Ambrosia (September 22), Cyclops (September 15), Enostos (October 20), and many more.[7]

In the same year that Father Secchi died, Schiaparelli published his first map of Mars showing the *canali* as well as other shadowy features he patiently observed through the Merz refractor at Brera. The map evolved and was refined over the following two decades; a summary published in 1893's *La Vita Sul Pianeta Marte* ("Life on Planet Mars") is shown in Fig. 1.2. His imperfect eyes saw Mars dissolve into a tangle of lines, stretching predominately across the planet's southern hemisphere. They seemed to bridge the broader dark patches, as though situated in such a way as to connect together great bodies of water by a vast network of straight, narrow earthworks. Although Schiaparelli didn't say as much, the implication of his maps was hardly disguised: Mars was covered in an elaborate system for the intentional geographic redistribution of water. The *canali* weren't simply natural waterways. They were engineered rivers.

To further complicate matters, after the Mars opposition of 1881–1882 Schiaparelli began drawing nearly all the *canali* as sets of doubled lines, which

[7] *Opere*, 1, 164.

he referred to as "geminations," a term that the Greek astronomer Eugène Michel Antoniadi (1870–1944) later said "made a Sphinx-world of Mars."[8] Although Schiaparelli himself seemed a little taken aback at what he thought he saw during that Martian apparition in a handful of instances, he gradually came to identify geminations in virtually every linear feature on Mars that he perceived. Knobel wrote in Schiaparelli's obituary that the Italian astronomer:

> was inclined to think that the gemination of the lines was periodic, and made its appearance when the heliocentric longitude of Mars was about 110° or 120°, some 2 months after the spring of the northern hemisphere. Such unexpected phenomena excited a large amount of criticism and scepticism, which indeed up to the present day is not yet allayed.[9]

Was Schiaparelli simply predisposed to see linear features on other planets through his telescope? His work on the planet Mercury gives some insight. In his extensive observations of the innermost planet, he thought he saw shadings indicative of the planet's true surface, enabling him to make an estimate of the planet's rotation period. Due to an alignment between Mercury's "solar day" (the time between successive sunrises at any location on its surface) of 176 Earth days and the time between successive morning or evening elongations of the planet, 117 Earth days, observers see alternating faces of the planet at each elongation east or west of the Sun. From this, assuming the same telescopic appearance in each case, Schiaparelli and others concluded incorrectly that the rotation period of Mercury must equal its orbital period about the Sun, 88 days. In fact, it was not until nearly a half-century after his death that radio astronomers determined a very precise—and much shorter—rotation period of 58.65 days.

Nevertheless, Schiaparelli saw what he saw, and in 1889 he noted his impression, "when the seeing with the instrument becomes very steady, that all the appearances are resolved into very fine formations."[10] His certainty in the objective existence of the lines crystallized during the previous year's Martian opposition. Quoting him nearly two decades later, the American zoologist and orientalist Edward Sylvester Morse (1838–1925) wrote that Schiaparelli declared:

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[8] 1898, *Memoirs of the British Astronomical Association*, 6, 102.

[9] Knobel, 284.

[10] 'Sulla Rotazione e Sulla Costituzione del Pianeta Mercurio', in *Opere*, 5, 333–343.

> "the *canali* had all the distinctness of an engraving on steel, with the magical beauty of a colored engraving." He furthermore says: "As far as we have been able to observe them hitherto, they are certainly fixed configurations upon the planet, the Nilosyrtis has been seen in that place for nearly 100 years and the others for at least 30 years."[11]

Yet Schiaparelli admitted that the lines revealed themselves only in moments of particular atmospheric calm, while in other instances they became blurred and indistinct as the air tumbled about turbulently over the telescope dome. While he may well have believed the features he saw to be so narrow such that they only truly became visible in brief glimpses when the air settled down, the circumstances allow for some degree of "postselective discretion," as Sheehan put it, enabling the interpretation of observations "to fit one's scheme."

Other astronomers took note of Schiaparelli's claims and began turning their own telescopes toward the Red Planet. What followed may be the best-known case of a kind of mass delusion recorded in the annals of the history of astronomy. One by one, astronomers throughout Europe and the United States began to report confirmations of Schiaparelli's *canali* through various telescopes and under all manner of observing conditions. Even the narrowness of the linear features he reported, attributable to the optical phenomenon of diffraction and the more limited resolution of the smaller telescope he used in comparison with those deployed by other observers, was noted and carefully recorded by others. Because Professor Schiaparelli said he saw straight lines on Mars, others reasoned that they must exist.

Awareness and eventual acceptance of the geminations waited for several years to pass. In 1886 two French astronomers, Henri Joseph Anastase Perrotin (1845–1904) and Louis Thollon (1829–1887), confirmed the appearance of the doubled lines through the Nice Observatory's 74-centimeter refracting telescope. Schiaparelli was ecstatic on hearing the news. "I attach very great importance to this confirmation for people will hereafter cease to scoff at me in certain places," he wrote. "The geminations are very difficult to explain, but it is indeed necessary to admit their existence."[12] Two years later, Perrotin muddied the waters by publicly announcing that the "continent" of Libya had disappeared since the previous opposition, declaring that it "no longer exists today." Results from other observatories, on the other hand, found no changes to Libya.

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[11] 1906, *Mars and its Mystery*, Boston: Little, Brown & Co., 59.

[12] *Corrispondenza*, 1, 153.

Some observers affirmed the appearance of the canals but without the geminations, while others saw no canals at all. There were objections both to the existence of the straight lines and the interpretation that they must represent some kind of artificial landscape engineering effort. Nathaniel Everett Green (1823–1899), an English professional painter and astronomer, complained during an 1890 meeting of the British Astronomical Association that Schiaparelli and other proponents of the *canali*:

> have seen them, so that they must be there. That other observers have seen whatever forms the basis of these lines I do not for a moment doubt, but I feel thoroughly convinced they *have* not drawn what they have *seen*, or, in other words, have turned soft and indefinite pieces of shading into clear, sharp lines.[13]

Schiaparelli remained coy on the subject for more than a decade after publishing the results on Mars, neither fully and publicly acknowledging nor endorsing the implication of some kind of intelligence probably responsible for creating his *canali* until 1893. His openness toward the possibility of a visible manifestation of intelligent life on Mars attracted the interest of some of the greatest names of nineteenth-century astronomy, including the Frenchman Camille Flammarion (1842–1925), who illustrated the canals in 1894's *Le Terres du Ciel* (Fig. 1.3), and the American businessman Percival Lowell (1855–1916), who at the same time as Schiaparelli's admission about life on Mars was building his own great observatory on the aptly named Mars Hill just outside the town of Flagstaff, Arizona.

In his sensational *Mars and Its Canals* (1906), Lowell made clear that he bought the theory lock, stock, and barrel: "The strange geometricism which proves inexplicable on any other hypothesis now shows itself of the essence of the solution," Lowell wrote. It all fit together beautifully; the broad dark spots he himself observed with his 24-inch Alvan Clark and Sons refractor at Flagstaff were Martian oases and "clearly ganglia to which the canals play the part of nerves."[14] These featured prominently in virtually all of his drawings (Fig. 1.4) from the establishment of Lowell Observatory to his death.

In the span between Schiaparelli's description of the *canali* and the dawn of the Space Age, the story took on elaborate and dramatic details: the canals were dug in desperation by a dying Martian race to conduct water from the planet's polar ice caps to the parched desert cities of its equatorial regions as a last-

[13] 1890, Report of the meeting of the association held December 31, 1890, *Journal of the British Astronomical Association*, 1, 112; emphasis in the original.

[14] 1906, *Mars And Its Canals*, London: MacMillan & Co., 365.

Fig. 1.3 "Le lever du soleil sur les canaux de Mars" ("Sunrise over the Canals of Mars") in Figure 31 from Camille Flammarion's *Les Terres Du Ciel* (1884). The romantic notion of watery Martian landscapes persisted in popular works of science well into the twentieth century

ditch means of saving the Martians from certain extinction. In this hypothesis was a parallel that followed the development of technology from the promise of industrialization's nineteenth-century march to the devastation of World War I in Europe, wrought by twentieth-century technology meeting perhaps humanity's oldest impulse—to rain destruction down upon itself. The Martian canals were, therefore, both an allegory and a cautionary tale. No matter the details, what they implied was clear: humanity was not alone in the cosmos, and intelligent life had arisen essentially right next door to our own world.

It was enough for the *New York Times* to scream rather startlingly **THERE IS LIFE ON THE PLANET MARS** in a December 9, 1906, headline

Fig. 1.4 "Mars. Sinus Titanum. November, 1894." Plate 1 from Percival Lowell's *Mars* (1895)

(Fig. 1.5). The story's author, Emily Lilian Whiting (1847–1942), breathlessly asserted that not only Schiaparelli's canals, but also the manifest existence of their intelligent makers, were incontrovertible facts determined after sufficient scientific scrutiny, debate, and resolution:

> The hypothesis of canals on Mars has already emerged from its progress through the usual stages of skepticism, ridicule, and denial which every new advance in science has to encounter. It seems to be the law and the prophets regarding all phases of the conquering of the unknown. "Every generation," remarks Mrs. Julia