

## ASTRONOMERS' LIVES: THE DEEP BLUE SKY OF THE SEVENTEENTH CENTURY

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**ABSTRACT:** The main aim of this short article is to begin to reason about the profound changes that took place during the 17th century, especially concerning astronomy and the epistemological change regarding the interpretation and vision of the night sky, while taking antiquity into account. Likewise, I will attempt to highlight the dynamics of astronomers' lives in that period, reworking data and perspectives of the time.

**KEYWORDS** Seventeenth century; Astronomy; Copernican revolution; Heliocentrism; Anthropocentrism; κόσμος; Astronomers' lives; Sky observations; Venice

We close our eyes for a moment. Silence and darkness engulf us with the same impalpable force as the wind. We are no longer men or women separate from the world that surrounds us and shocks us with its predictable unpredictability. We are one with it. Force of the same force, atoms of the same atoms. Only νοῦς is guiding us. And then, suddenly, like a bolt of lightning, we arrive at our destination. We open our eyes wide and a benevolent starry sky welcomes us with its mantle studded with myriads of points of light. A salty, pungent smell fills our nostrils, while we immediately perceive the distinct gurgling of waves breaking with a slow but rhythmic lapping sound. A slight feeling of anguish grips the heart and a trickle of sweat on the forehead forms as the first response: where are we? What year is it? Hands convulsively touch our bodies, we discover ourselves dressed in robes and petticoats of ancient fabrics: linen, cotton, leather, real leather. Bewildered and estranged, we hurry towards what appears to be a tavern a few steps away, lit by a slightly dying oil lantern, and on whose threshold a few

men, finely draped in sumptuous trappings, discuss with marked accents. Our questions leave them a little bewildered, even disconcerted, but without further ado, the answers flow in we are in Venice. The year is 1610.

With this introduction with a fictional and even somewhat romantic flavor, this article opens to reconstruct, or at least trying to, the actual horizon with which those who scientifically approached the new astronomy had to measure themselves, namely the night sky. Understanding the *κόσμος*, observing it, and taking note of its variations and shifts has been since antiquity a worry and an almost morbid passion for all those who tried to decipher what it meant. Stars, cruel gods far removed from human life, disinterested in their lives, their pains and sorrows but ready to retaliate their wrath at any moment and at the same time ethical models of detachment from imposed afflictions and consequently from the surrounding volitional reality. Beyond this reading in a purely Hellenic key, the celestial vault has always been a challenge since the origins of human civilization, just think of the knowledge of the ancestors of the Upper Palaeolithic and Mesolithic periods, who were already able to take into account, albeit with due limitations, the phases of the moon: Alexander Marshack in *Roots of Civilisation*, 1991, well describes this behavior with some engravings found on bones from the Congo, dating back to the Mesozoic, and from the Dordogne, from the Aurignacian period. The unambiguousness of this material leads to the rather clear unraveling of a complete synodic cycle and more: flora and fauna are often associated with the corresponding phases, indicating an awareness that the lunar body punctuates, and influences in some way, life on Earth. The same thing, in this key of interpretation, can be said for certain species of birds, migratory birds in particular, which use precisely their innate perception of the firmament to orient themselves, thanks to the use of the typical shape recognition region.

These ancestral astronomers measured themselves, according to what modern astronomers have been able to establish, mostly by the synodic cycle of the moon, which marks what we know today as months, whereas numerous accredited theories establish an almost total lack of knowledge of its sidereal cycle, i.e. its trajectory along the zodiacal belt, established at 28 days. However, these assertions conceal, despite the evidence provided, numerous pitfalls within them because they focus attention on a man who is indeed ancient, but centered in a

given epoch and in a precise place, giving rise to gradualist and diffusionist theories that underlie discovery and its gradual propagation, but this is not the case: to return a truly complete picture of the world in ancient times is almost impossible because epochs, rhythms, splendours, and declines followed one another incessantly so that what man had discovered, was then shortly forgotten or simply rediscovered elsewhere, with other languages and other attitudes. This leads us to wonder, then, how the interpreters of the heavens in the mists of time approached it, what emotions, what thoughts ran through their arcane minds as they made their observations. Of this, unfortunately, there is no trace, nor could we account for it, even though it is intrinsic to human ephemeral nature to ask oneself from the very beginning the great questions arising from the very mystery of existence and  $\tau\delta\ \delta\upsilon\nu$ , but a good lead is certainly that of religions, of the cults of those times. Not wishing to deal in this one with the specifics of these complex, albeit fascinating, questions rooted in human spirituality, unraveling in the celestial immensity, we can now turn our gaze to a question that rises rather directly: if this was the knowledge concerning the moon, seemingly perfect and glacial in its whiteness, what can we say instead about the constellations and why do we turn precisely to them? Because the ones we know today, clearly before the advent of aerospace and astrophysical technology, have come down to us directly in the astronomical compendium that is Ptolemy's *Almagest*, dated 317 AC, and it is precisely the combination of Ptolemy's vision together with his revision of Aristotle's cosmology that Nicolaus Copernicus managed to demolish (though not in his direct intentions). In constructing such a text, however, Ptolemy himself drew on older sources such as the *Catalogue of Hipparchus II*, the works of Aratus of Cilicia and Eudoxus, who had even been able to construct the well-known *Sphere of Eudoxus*, c. 370 BC, a globe on which the constellations were almost as closely positioned as they are today. Before them, many other connoisseurs of the heavens, such as were also Hesiod and Homer, turned their attention to reading them, first and foremost the Egyptians. One only has to look at the circular *Planisphere of Dendera* (currently on display in the Louvre Museum, Paris) to realize this: dated around 1800 BC by scholars from the University of Utrecht and bearing a marvellous bas-relief entanglement, it depicts the twelve current constellations of the zodiac, some of them with immediate iconographic representations.

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Returning, however, to the lives of astronomers, we cannot but start with Claudius Ptolemy, the Alexandrian astronomer, astrologer, and geographer. The *Almagest* is the work that certainly shaped scientific thought, astronomy in particular, throughout the West until 1543 with its geocentrism approved even by Plato, even though the astronomer Aristarchus of Samos, 4th century BC. ca, had already elaborated in a work, which has however been lost, an entirely different hypothesis, namely a concrete heliocentrism, which, however, remained so in order to also be able to explain the alternation of the seasons, attributing to the Earth its own diurnal rotation around the inclined axis with respect to the plane of orbit around the sun and a revolution on a circumference, a figure endowed with perfection, around the sun and the so-called fixed stars. Seleucus of Seleucia, c. 2nd century BC, on the other hand, a philosopher and astronomer of Babylonian origin, undertook, according to indirect sources, however, especially Plutarch, a veritable crusade not only to support heliocentrism as a hypothesis, but as a true description of the cosmos, even attempting to give a mathematical demonstration of it, probably starting from his incessant study of the tides, thought to be influenced by the phases of the moon, and then hinting, as if that were not enough, at the infinity of the cosmos. A historic battle later waged in the 16th century by Giordano Bruno. *Avá ημα*, theories that were bizarre and gnoseologically lacking in rigour in the description of celestial motions and thus rejected with absolute fervour first by Plato and Aristotle, unwavering supporters of geocentrism, and then by Ptolemy, who not only took over definitively in late antiquity and the Middle Ages from natural philosophy but also guided navigators and travelers for centuries who sought the right course in the dark night veil. What was the turning point that then led a young mathematician and religious man of Polish origin to publish the work destined to subvert this anthropocentric consideration of the world? Certainly, the outcome was not immediately dramatic, also because the Aristotelian Ptolemaic system was not limited to only certain knowledge, but went much further: in addition to adhering to the description of creation in Genesis according to the Church, it also perpetuated the idea of the world in the daily lives of the people of the time, and a clear example of this can easily be found in *Orbis Sensalium Pictus*, 1658, by Giovanni Amos Comenius, a Czechoslovakian-born pedagogue, philosopher, educator, and teacher: in the text, considered to be the first illustrated book for

children and young people, the author combines the learning of a language with practical notions concerning the world and man, and it is for this reason that he includes a beautiful depiction of the Earth placed at the center of the cosmos, around which the rest of the celestial bodies are placed. Man, as a result, is perceived as being at the center of the cosmos: this is the dominant perspective to be overcome.

Mathematically complex, too complex to be used in immediate life: this is the first reading that Andrea Osiander assigns to *De Revolutionibus Orbium Coelestium* in the preface *Ad lectorem* in which the Polish astronomer would have been far from personally supporting the hypothesis of the sun as at the center of the universe (albeit still static for the time being) as real, but only intending to create a model of calculations to facilitate the reading of the Aristotelian Ptolemaic system, thus safeguarding appearances. And yet, the Copernican Planisphere tells a very different colourful story: that of the year 1660 is an effective depiction, though one that follows the many burdensome events that have taken place in the meantime, of a new cosmos, a new universe, a new world with which man must live. By maintaining the right sensitivity towards humanity at this stage of events, he finds himself being jolted from the position of the favoured creature of a God who created him in his own image and likeness, to one he shares with all the rest. It is no coincidence that, in the words of Sigmund Freud, heliocentrism is the first of the three great wounds to human narcissism, or, in the words of Pirandello in *Il fu Mattia Pascal*, 1904:

Copernicus, Copernicus (...), has ruined humanity, irretrievably. By now we have all gradually adapted to the new conception of the infinity of our smallness, to considering ourselves less than nothing in the Universe, with all our beautiful discoveries and inventions (...). The Earth, poor thing, tired of turning, as that Polish canon wants, without purpose, had a little impatience (...). (Luigi Pirandello, *Il fu Mattia Pascal*, p.11).

Returning to our astronomers, another highly skilled disrupter of the European night skies was the English physician and observer William Gilbert, who in turn was able to heavily influence the thought and work of the much more famous Florentine astronomer Galileo Galilei, thanks to his writing *De Magnete*, in which he was experimentally able to depart from an outdated Aristotelian cosmology, showing the effects of magnetism on the Earth. An Earth that is now far from being considered at the center of an ordered *κόσμος*, in which all the

planets up to Saturn revolve around it in perfectly concentric circles, outside of which nothing exists: the last sphere, that of the Prime mover, traces the limit of the celestial vault. It, whenever we witness a phenomenon, we see its boundaries because they are defined by the form, so if we see a space, we also see its limit. Thus, the occurrences of the sublunar world, in Aristotelian Ptolemaic cosmology, are intertwined and have for centuries laid down the laws for interpreting even lunar events, in the belief that this was the safest and most objective way. *De Magnete* goes much further than this, in fact, in Liber 6 the Earth's rotation is described, thus rejecting the Aristotelian crystalline spheres, searching instead for its origins in the energy released by magnets and pointing the finger of the changing seasons against the movement of the Earth's axis, accompanied by the detection of the inclination of the Earth's poles with respect to the ecliptic.

Having now laid some epistemological and gnoseological foundations, we can return to where we left off at the beginning of our journey: having ascertained that we are in the Serenissima and having familiarised ourselves with the liveliness of its ever-changing scientific, academic life, out of breath from having climbed all the steps of St. Mark's bell tower, we finally reach the top and can now point our telescope lent to us by Sarpi, hoping it is even a little powerful like that of that mathematics professor with the long beard, who seems to be so dear to Doge Leonardo Donà and whose exploits travel on the lips of all the powerful, whether they work at the Arsenal or in the best circles of the lagoon city, towards a promising velvet-covered vault, dyed an astonishing deep blue. We huddle into our clothes, the winter wind blowing at almost a hundred meters altitude can be brutal, but then again, this is where he has performed numerous demonstrations of this striking instrument, so we can't really back down. We extract from the leather saddlebag our long, white quill with the tip slightly black-dyed at the end, and then the small inkpot well stocked with the ebony liquid: the night is going to be particularly long and laborious. After finishing the final calibrations and giving the last coat of polish, we are ready to meet the surprises of the firmament. First data: January 1610, twilight occurred at 18:06, visibility conditions: almost perfect. Immediately here is the star of this sidereal display, its milky glow lends itself well to our lenses: the moon is at 100 percent of its phase, this evening it rose at 17:54, and it is in Gemini, the northernmost. Close to Orion, Castor and Pollux

twinkle placidly: the Alexandrian has classified them as magnitude 2, while Baiero in his *Uranometry*, 1603, has placed the former among the  $\alpha$  and the latter among the  $\beta$ , although Pollux does indeed seem a little brighter. Let's note and continue. But let's not forget the sun, which rose today at 07:53 and set early, at 16:38. Let us move on to the other bodies: Mercury today is in Ophiuchus, the Serpent, *Serpentarius*, forming almost a single constellation: already the ancients in their myths spoke of it and even Ptolemy immediately threw himself into the description. It is usually quite easy to observe as it is very wide, but today nothing can be done: we will have to wait until spring. Venus is also there today, rising at 06:03 and setting at 14:52. Mars, on the other hand, rose at 10:25 and set a little while ago at 20:46. It is positioned in Aquarius, already known to the Mesopotamians and myths concerning Ganymede have been circulating since ancient times. It is not clearly visible on this clear night as well, but it is at its best in the autumn when it shines between Pegasus and the Southern Fish: the lucky star of the king, it points to it with relative ease. Let's move on to Jupiter: it rose at 01:45 and set at 12:33 and is in Virgo. For it, too, Babylonian, Egyptian, and Greek myths are lost *dans la nuit des tempes*, but this evening Spica seems to be particularly generous in its brilliance and one does not have to venture far with the telescope between Regulus in Leo and Antares in Scorpio: behind the brightest star here, distant glimmers suggest that there may be much more behind it. Other worlds, perhaps.

We shake our heads slightly and smile with a hint of blame at our own thought: other worlds, what an absurd idea. We regain our concentration. After Jupiter, which has not convinced us so much, we catch a glimpse of something, tiny dots that seem to revolve around it, just as the moon does with the Earth. No, it can't be possible. Something must surely have soiled the lens. With a cloth, we give it a quick wipe, and this time we come across

Saturn. Saturn seems to be a little unusual in itself, it appears enveloped by something strange, which seems to give it an unusual bizarre shape but in any case today it rose at 03:29 and set at 13:28. It is in Libra, also shrouded in primitive stories and whose meaning of justice will never go out of fashion. It has always been quite useful, the Latins used it to better understand the equinoxes. The Austral and Boreal Planets, however, are unfortunately reluctant to show themselves in their splendour, as they will pull themselves together in the

transition to May. Uranus then recently rose at 20:39 and will set tomorrow at 10:30. It is located in Leo which people of Mesopotamia, Egypt, Greece, the Romans, and many others already narrated in centuries past. The story of the Lion of Nemea, defeated by the hero Hercules, above all. It shines brightest during the spring, perhaps the one that shines brightest of all, but also during the rest of the year it can be found with ease. Regulus, its chest, shows us all its splendour, we descend to Denebola, its tail, and then return to Algieba, its neck. Sitting hieratic and enigmatic like the Sphinx in the vault of the dark ether, Leo is giving us a truly celestial vision tonight.

There doesn't seem to be anything else of note to observe, so, chilled and our hands numb and reddened by the biting air, we put our gear back in our saddlebags and collect our copious notes, before descending the craggy stone steps back our rented room, where the promise of a blazing fireplace and a steaming bowl of rice and sardine soup makes us quicken our pace, pawing impatiently in the winter gloom. Reflections accompany us along the way: we have chosen to believe what the professor of mathematics at the University of Padua is trying to show everyone: a new *κόσμος* is possible, Aristotle and Ptolemy did not really hold the only key, there is more. So much more. Our eyes, though often fallacious, really do not seem to lie. We are endeavouring to apply a new method to verify our knowledge: we observe, note down and draw conclusions based on our findings. It is undoubtedly much more effective than the old one, faster, and more precise. Of course, if the professor was right, what could we possibly believe in now? We are no longer the center of the cosmos, just an appendage of it, the motions we have studied so far are no longer correct, the crystalline spheres, demolished already by that well-known Danish astronomer, of whom we often hear, along with the German. Where will man end up at this rate? What role would God then play in this new design? And yet, the telescope has allowed us to peer into the empyrean letting us glimpse a *φύσις* beyond our imagination. Then, if it is true that the Polish system is correct, and this is what we want to believe, there is still a long way to go and the dialogue with the Word is only just beginning, after all, it should be limited to teaching our souls how to enter Paradise and not what it looks like, how the ether moves. Right? His Word is a mystery, cryptic and abstruse, of course, but is it possible that it is not in accord with His own work? *Ἀρχή* has always been a great affliction for philosophy,

and the concomitance with the Word perhaps simplifies the question a little, but at the same time raises so many other questions that cannot now be postponed.

All these questions, however, can wait, now it is time to foretaste our dinner in the warmth, as we disappear behind the door of the inn, escaping the icy and merciless grip of the silent and inscrutable Venetian lagoon. Celestial bodies that shine their wanderings in the glacial wintertime, the only witnesses of our passage.

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