The *Formelle di Ercole* on St Mark's main facade and their possible astronomical meaning

Gloria Vallese

Abstract. In the mid-thirteenth century, the exterior of St Mark's Basilica in Venice was adorned with a valuable collection of sculptures; among them are the '*Formelle di Ercole*', a couple of rectangular bas-reliefs depicting some of the Herculean Labours. One of them, representing *Hercules with the Erymanthian Boar*, is a late-Roman original from the fourth century CE. Its counterpart on the opposite side of the main facade, depicting *Hercules with the Cerinithian Hind and the Lernaean Hydra*, long thought to be of the same age, it is now considered a skilful imitation created in Venice in the thirteenth century. In the present study, we propose to highlight the possible and hitherto unnoticed astronomical content of both bas-reliefs. By creating their imitation, the thirteenth-century Venetians meant to show to the discerning eye that behind the Roman original there was an astronomical myth of which they were still aware; to the point of being able to articulate the same language in a piece similar in style, but slightly different in content. The astronomical iconography of both pieces, and their calculated arrangement on the facade, were coordinated so as to describe the orientation of the building, with reference to constellations and celestial events in the real sky. This kind of content seems to have been more familiar than nowadays to the general public of the Middle Ages, when the practice of celestial navigation, used not only for long maritime journeys, but also for long or short displacements by land, was part of everyday life. The two '*Formelle di Ercole*' on St Mark's facade were not mere ornament, as they have been considered so far, but also (or above all), sophisticated astronomical devices, readable at two levels: one accessible to the generality of the observers, the other addressed to a more learned and discerning eye. Once deciphered through iconographic analysis, integrated with tools such as Stellarium and Google Earth, the two St Mark's '*Formelle di Ercole*' may work as an innovative key to explore the forgotten astronomical contents of the very Greek myths from which they originated.

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In the thirteenth century, St Mark's Basilica in Venice was significantly enlarged and renovated. Its external walls were encrusted with rare marbles, adorned with a forest of pillars and a c of sculptures, in part

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expressly commissioned, in part *spolia*, some of which very ancient and illustrious, such as the well-known four bronze horses of the classical age, brought in from Constantinople during the Fourth Crusade, or the Roman-Egyptian porphyry statues of the Tetrarchs.[1]

The collection included the two *Formelle di Ercole*' (*formelle* = rectangular bas-reliefs), placed in a symmetrical position on the main facade. The one on the left, *Hercules bringing the Erymanthian Boar to Eurystheus*, is a Roman late-antique original (fourth century CE).[2] Its pendant on the opposite side of the facade, showing the hero with the Ceryneian Hind on his shoulder and the Lerneian Hydra at his feet, has long been considered a late-Roman original too; but more recent philology has recognized in it a skilful imitation, created in Venice in the thirteenth century (Fig 1.).[3]

By means of a combined use of iconography and technological instruments, such as Google Earth and Stellarium, we can bring back into light the possible and hitherto unnoticed astronomical content of both bas-reliefs.

Placing the late-antique *Hercules* and their own modern imitation side-to-side, the thirteenth-century Venetians made an implicit statement: they proved not only that they were still aware of the astronomical myth behind the Roman sculpture, but also that they were able to articulate its same language in a non-identical piece.

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[1] Otto Demus, Lorenzo Lazzarini, Mario Piana, Guido Tigler, *Le sculture esterne di San Marco* (Milano: Electa, 1995), No. 85; Luigi Sperti, 'Reimpiego di scultura antica a Venezia: proposte e ipotesi recenti', in: Niccolò Zorzi, Albrecht Berger, Lorenzo Lazzarini, eds, *I tondi di Venezia e Dumbarton Oaks/Arte e ideologia imperiale tra Bisanzio e Venezia* (Venezia: Viella-Centro Tedesco di Studi Veneziani, 2019), pp.161–88. Also useful the several essays collected in: Ettore Vio, ed., *San Marco: la basilica di Venezia: arte, storia, conservazione* (Venezia: Marsilio, 2019).

[2] Demus et al., Le s*culture esterne*, No. 85.

[3] Demus et al., Le s*culture esterne*, No. 91*;* Monica Centanni, 'Due tappe del viaggio di Ercole in Italia tra XIII e XV secolo: Venezia, Rimini', in Luca Carlo Rossi, ed., *Le strade di Ercole. Itinerari umanistici e altri percorsi*, Seminario internazionale per i centenari di Coluccio Salutati e Lorenzo Valla (Florence: SISMEL Edizioni del Galluzzo, 2010), pp.189-210

Fig. 1. The two '*Formelle di Ercole'* on St Mark's Basilica in Venice; below, their location on the facade. Photos: Courtesy Pino Usicco. Graphics: own work.

With their astronomical theme, and their calculated disposition on the facade, the two pieces addressed a general public who was generally familiar with the sky, and accustomed to reckon its orientation from the Sun and the stars. To this public, if read against the horizon of the real sky, the two *Hercules* bas-reliefs conveyed the message:' Facing this building, you are facing NE'. But the system composed by the two pieces was designed to give to a more educated observer (say, to a geographer, an astronomer, an expert navigator) the orientation of the building (and consequently, of the observer himself), accurate almost to the degree; we will see how more in detail below. Such a level of accuracy, we must hasten to add, far exceeded the needs of the common practice of celestial navigation; it was a pure exhibition of knowledge and skill, meant to impress the discerning eye.

Since the nineteenth century, the two '*Formelle di Ercole*' have been widely commented. They have been seen mainly as an early case of appreciation of classical sculpture, remarkable in that it anticipates by some centuries the Greek and Roman revival of the Italian Renaissance,

and all the more striking for the placement on the façade of a church. The art historian Erwin Panofsky, among the founders of iconology, chose St Mark's '*Formelle di Ercole'* as an example of what he defined the 'iconographic disjunction' that occurred during the Middle Ages: according to him, in the Venetian imitation piece the classical theme (Hercules) and the classical style are evoked, but separated from their original content and endowed with a new meaning, that is, transformed into an allegory of the soul saved by Christ.[4]

However, the approach proposed here, which sees in the two '*Formelle di Ercole'* an astronomical subject, and in their disposition on the facade a geolocal device, explores a different path.

In antiquity, it was the mathematician and geographer Eratosthenes (c.276–c.195/194 BCE) who explicitly stated that the hero among the stars, the constellation in human figure also called *Engonasi* or *Engonasin* ('Man on his knees') was to be identified with Herakles (Latin: *Hercules*), the hero of the *Labours* myths.[5] Among the poets and artists of the same epoch, however, the connection between Herakles and astronomy seems to have been far more undefined, not much more than a vague literary trope.

And yet for the Venetians of the thirteenth century (possibly as heirs of navigators, the inhabitants of the ancient Roman port cities overlooking the Adriatic sea), the connection between Herakles and the astronomy of navigation seems to have never been completely lost.

Not by chance, Hercules was a prominent character (indeed, the only human character) in the iconography of Venetian *patere* and *formelle*, bas-reliefs which represent stars and constellations, put along the streets and waterways to favour geolocalization.[6] *Patere* representing *Hercules fighting the Nemean Lion* are fairly common; some are to be found on the other facades of St Mark's itself.[7] All of them, as far I have been able to

[4] Erwin Panofsky, *Studies in iconology/Humanistic themes in the age of Renaissance* (New York: Routledge, 2018 [1939]), p.xxvii.
[5] Ian Ridpath, 'Hercules', in *Star Tales: Revised and Expanded Edition* (Cambridge: James Clarke & Co Ltd, 1989), http://www.ianridpath.com/startales/hercules.html [accessed 14 August 2024]
[6] Discussion and previous bibliography in: Gloria Vallese, 'Patere and formelle in Medieval Venice: towards an astronomical reading', Culture and Cosmos, Vol. 27 no. 1, Spring/summer 2023, pp. 73-89, www.CultureAndCosmos.org [accessed 14 August 2024]
[7] Demus et al., *Le sculture esterne*, No. 69 and 79; Alberto Rizzi, *Scultura esterna a Venezia. Corpus delle sculture erratiche all'aperto di Venezia e della sua laguna* (Venezia: Stamperia di Venezia editrice, [1987]), p.727.

ascertain up to now, are displayed as to indicate the point of sunrise at the summer solstice, that is, the azimuth in which the Sun (symbolized in the patere by a lion), in its apparent annual journey towards north along the horizon, is confronted and forced to reverse course by the constellation *Hercules* rising in arms in front of it.

The origins and age of the myths of Herakles' *Labours* (ἆθλοι) are uncertain.[8] The mythical tradition reports that, in a fit of madness provoked by the enemy goddess Hera, Herakles had slain his wife and children; after coming back to his senses, he had consulted the oracle in Delphi, to know what to do to atone for his deed. The answer had been that he should serve for twelve years his far kin Eurystheus, king of Tyrins, after which he would become an immortal.

Herakles went to Eurystheus, who imposed to him a series of *Labours*, (their order and number, except for the first, the *Killing of the Nemean Lion*, are uncertain), some of them so arduous to appear almost impossible. Herakles carried out them all; after which, as the oracle had predicted, he was accepted into the heavens among the immortals.

One of these missions was to capture alive the huge and ferocious Erymanthean Boar, which is the subject of the left *formella* on St Mark's facade, the Roman original one. The formella adheres strictly to the iconographical canon for this *Labour*, which appears to have been established since the early apparitions of the theme in the visual arts, in exemplars of black-figure Greek vases (Fig. 2).[9]

In a seemingly odd choice, however, rather than represent the main battle, the iconographical canon focuses on an apparently minor episode: the hero is showing the already conquered Boar to Eurystheus who, according to the myth, is so scared at the sight of it, that he runs to his cellar and hides into a pithos buried in the ground. Only later he emerges, shamefully, to acknowledge that the mission has been accomplished.

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[8] Robert Graves, *The Greek Myths* (London-New York: Penguin Books, 2018 [1955-1960]), pp.446–519; John Boardman, Olga Palagia, Susan Woolford, 'Herakles', in *Lexikon Iconographicum Mythologiae Classicae* (München und Zürich: Artemis Verlag, 1998), Vol. IV.1, pp.728–838; John Boardman, 'Herakles Dodekathlos', in *Lexikon Iconographicum Mythologiae* Classicae, (München und Zürich: Artemis Verlag, 1998), Vol. V.1, pp.5–16.

[9] Wassiliki Felten, 'Herakles and the Erimanthian Boar', in *Lexikon Iconographicum Mythologiae Classicae* (München und Zürich: Artemis Verlag, 1998), Vol. V.1, pp.47–48.

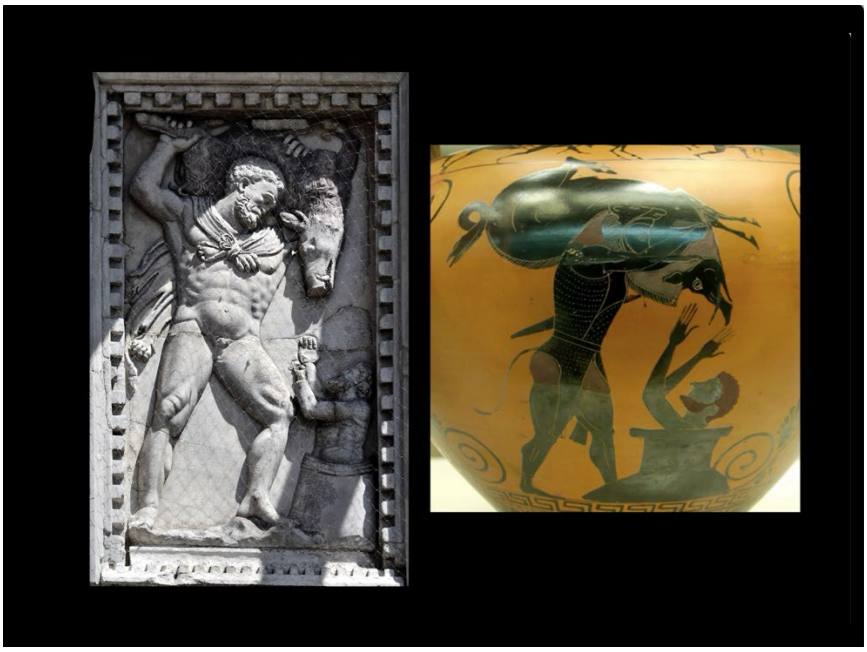

Fig. 2. *Hercules, the Erimanthean boar, and Eurystheus*. Left: Late-Roman, fourth century CE, Venice, St Mark's Basilica, main facade; right, Attic black-figure amphora, sixth century BCE, London, British Museum. Photos: Courtesy Pino Usicco; Jastrow 2006, via Wikimedia.

Why was this bizarre, even grotesque, minor incident, preferred for representation not only in the *formella* in Venice, but in the vast majority of the art tradition, beginning from the Greek archaic vases?

The hypothesis that the myths of the *Labours* describe, in metaphor, the interaction of the celestial *Hercules* and some other constellations, offers a plausible explanation: the King lowering himself into a pithos appears to be, as we are going to see, a metaphor for the setting of Vega/*Lyra*, which is a very conspicuous event in the night sky, corresponding to the Sun transiting its summer solstice setting point under the horizon.

It may be useful to remember here that among the many visualizations of the constellation *Lyra* and/or its main star Vega (apart from the Greek musical instrument from which it derives its present-day name), there were an Eagle (the 'falling Eagle' of the Arab folkloric star-lore), a tortoise, and

(far lesser known, but not less popular before the modern standardization of the constellations), a bi-ansated vase.[10]

Scrolling the vast collection of examples collected in the *Warburg Iconographic Database*, we observe that Vega/*Lyra* as a vase remained well alive during the Middle Ages; it is recurrent in the illustrated manuscripts of Al-Sufi, *The Book of the Fixed Stars*, and also found on islamicate globes of the same age.[11]

As for the pithos in which King Eurystheus, according to the mythological sources, took refuge, it was nothing other than a large terracotta vase, used particularly in the Mediterranean Bronze Age palace economy for storing or shipping wine, olive oil, or grains; pithoi were kept half-interred in the cellars, because the natural cold of the earth helped the preservation of the contents. Moreover (and, perhaps, more important for its symbolic in the frame of the *Erymanthean Boar* myth), pithoi were also used in Middle Helladic as coffins for human burials, in Mycenae, Crete, and other areas around the Mediterranean.[12]

The iconography of Vega/*Lyra* as a vase, a vase connected with human burials, helps us to identify the other main character in the *Labours* myths considered as astronomical tales, i.e., Vega/*Lyra* as Eurystheus the King.

Not entering in any phylological discussion concerning Hercules' *Labours'* myths, their literary and visual sources, age, provenance, or derivation, let's now just proceed to our simple experiment: reconsider the whole corpus of the tales with instruments of our age, the virtual planetariums which allow us to see the sky as it appeared in different places and epochs.

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[10] Vega/*Lyra* as a vase: 'Vultur Cadens', '*The Warburg Iconographic Database'*, https://iconographic.warburg.sas.ac.uk/category/vpc-taxonomy-017046 [accessed 14 August 2024]; other visualizations: Anon., 'Lyra', 'The Warburg Iconographic Database,' https://iconographic.warburg.sas.ac.uk/category/vpc-taxonomy-017045 [accessed 14 August 2024]; Ian Ridpath, *Vega and Altair, the flying eagles*, in *Star Tales: Revised and Expanded Edition* (Cambridge:, James Clarke & Co Ltd, 1989), http://www.ianridpath.com/startales/vega-altair.html [accessed 14 August 2024].

[11] Andrea P. A. Belloli, 'Constellation 8. The Lyre (*Lyra*)', in Emilie Savage-Smith and Andrea P.A. Belloli, *Islamicate Celestial Globes/Their History, Construction, and Use* (Washington, DC: Smithsonian Institution Press, 1985), pp.144–46.

[12] Giorgos Vavouranakis, 'Funerary Pithoi in Bronze Age Crete: Their Introduction and Significance at the Threshold of Minoan Palatial Society', *American Journal of Archaeology* 118, no. 2 (2014): pp.197–222.

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Revisiting Hercules' *Labours* by means of Stellarium, we can see if and how they could have appeared in Venice's sky in 1250 CE, that is, around the date in which the two Hercules bas-reliefs, the ancient and the new, were displayed on St Mark's renovated facade.

Of course, what happens in this particular sky could not fit other epochs and latitudes; but I think we are lucky enough in having, as a point of departure, at least one precise point in space and time in which the astronomical content of the myth seems to have been still alive and recognized; tests for other sites and epochs can be the object of further investigation.

At the beginning of this experiment, I had only one or two firm points. One was the identification of the Greek hero of the myths with the constellation *Hercules*, which had to appear, and to act coherently, in all the ten/twelve narrations.

Second, and no less important, was the 'internal coherence' principle: not only one narration, but all the ten/twelve *Labours* had to obey to the same general rules, i.e., to apply the same body of metaphors when translating the celestial events into phases of the narrative. It is at this test of the internal coherence that some identifications of celestial objects proposed in the following pages (which, taken singularly, could no doubt appear somewhat tenuous), obtain a higher level of credibility.

Keeping these principles as a basis, I did a large number of trials, and put together a vast body of observations and comparisons, of which, in what follows, I can only skim the surface.

The results, I must admit, were rather surprising. In short: all the *Labours'* mythical tales appear to describe one single situation, the winter solstice night from sunset to dawn. Their purpose appears to be to monitor the course of the Sun under the horizon: the peak episodes of each *Labour'*s tale describe, in metaphor, some horizontal or vertical alignment of stars, corresponding to the transits of the invisible Sun at some meaning 'stations 'along the horizon (essentially the cardinal and solstitial points).

In the tales, these 'stations' are metaphorized into material props: they become pillars, trees, doors, mountains. Moreover, the travel of the celestial bodies across the sky is associated with psychological and biological conditions/feelings: the ascent is associated with happiness, hope, increasing speed, increasing health and strength; the upper culmination, with triumph, reign, maximum strength, maximum power, and maximum happiness; decline, with weakening, vulnerability, fatigue, sadness, and suffering; and lower culmination, with maximum effort and trouble, near-death agony, and hard struggle.

These metaphors occur consistently in all the Hercules' tales; we are going to see examples in the two *Labours* analysed at length here.

One objection, however, comes immediately to the mind: if all the tales describe one and the same night, why ten or twelve? Would not a single tale have been enough?

Possible answer: on one particular night, some stars/constellations may not be visible because of the weather, or the orography of the place; hence a whole body of tales about the same situation, which allows the observer to switch from one narration to the other, depending on the portion of the sky which is accessible to him.

This reference to the practical needs of celestial observation is further corroboration (if more was needed) of the fact that the *Labours* myths likely predate the Greek civilization: they appear to have been inherited from a nomadic age, in which they were not mere literary entertainment, as they became later, but valuable memorization tales, apt to preserve and transmit a body of precise notions of observational astronomy. It is strange to think that when the Greek poets of the classic age started to tell in words (or to depict in art) Hercule's *Labours*, which they did so effectively, the connection with this kind of background had already been almost entirely lost.

Let us now revive the account of *Hercules and the Erymanthian Boar* as it could be seen in the sky of Venice, 1250 CE. If we set Stellarium for 12-21, sunset, facing W, we can watch an opening scene that is common to all the celestial *Labours.* As the Sun descends to -6°, and the sky begins to grow darker, Vega/*Lyra* (our Eurystheus), appears above the NW horizon; a little later, as the darkness increases, Hercules (Alpha *Herculis* or Rasalghethi, the head of the constellation) appears in front of him (Sun at -9°).

The king and the hero seem to confer from the opposite sides of the invisible vertical line that marks the summer solstice setting point of the Sun. This invisible boundary becomes, metaphorically, the 'door of the Royal palace', or 'of the citadel', as mentioned by the literary sources.

As the darkness continues to grow, the hand of Hercules (Omicron and Xi *Her*) becomes visible between the two, across the gap of the door – open and upturned, as if asking, or begging, for something (Sun at -12°) (Fig. 3).

What the hand receives, this time, is the mission to capture and bring back, alive, the unconquerable gigantic Boar ravaging the land of Erymanthus: which, as in response to this dialogue, comes in light in that very moment on the Meridian at north, in position of upper culmination.

Fig. 3 Eurystheus (Vega), and Hercules (Rasalgethi), meet at the summer solstice setting point of the Sun (blue dotted line), the 'door of the palace', or 'of the citadel'; Hercules' hand extends across the gap. Sun at -12°. Map: Stellarium.org. Graphics: own work.

As we shall see from the following steps of the narration (and verify from the internal coherence of the whole *Labours'* corpus of tales), this character, the Boar, can only be identified with the constellation *Cassiopeia*: its different stars provide the right metaphors and alignments for all the pivotal scenes of the story. We therefore, in what follows, try this identification, even if it conflicts with a different corpus of Greek myths and with the present-day dominant visualization, which sees in Cassiopeia the vain Queen, mother of Andromeda and wife of Cepheus.

Having received his mission, Hercules sets to travel, and reaches the foot of the high mountain haunted by the monster Boar. One version of the myth has it that, once there, he scares the Boar out of the bushes where it was hiding by means of mighty shouts. Also this odd little portion of the mythical tale happens to be valid for the latitude of Venice in 1250 CE: because we observe that, as Hercules' head (the star Rasalgethi) touches the Northern horizon just before setting, *Cassiopeia* seems to follow its movement, and transits the Meridian with its westernmost star Caph, thus entering into decline. According to the body of metaphors that rule all the *Labours*' myths, 'entering into decline' for a star or constellation implies

'weakening, loss of power, vulnerability'. And indeed, from that moment on, the Boar/*Cassiopeia* loses the condition of maximum power and invincibility that it enjoyed at the beginning of the narration. In metaphor, 'called out' of its safe refuge by Hercules' head, it becomes vulnerable, accessible; the 'shouts' in the mythical narrative being a striking and easy-to-remember figure of speech, and precisely a synecdoche, to evoke the constellation's head (the shouts come from the mouth, the mouth is in the head, so shouts=head). So that, in the following hour, Hercules succeeds first in putting his knee on the animal's back (Tau *Her*, the foremost knee, reaches a vertical alignment with Schedar, Alpha *Cas*); then to haul it onto his shoulder (Beta *Her* or Kornephoros, the shoulder, enters in vertical alignment with Eta *Cas*, the back of the animal).

Soon after, the crucial scene follows, so often depicted by artists: Hercules' hand offers the Boar to Eurystheus, who sees the horrible head gaping just above him (vertical alignment of Caph, Vega, and Hercules' hand). The Sun, invisible under the horizon, is now transiting cardinal point W (Fig. 4).

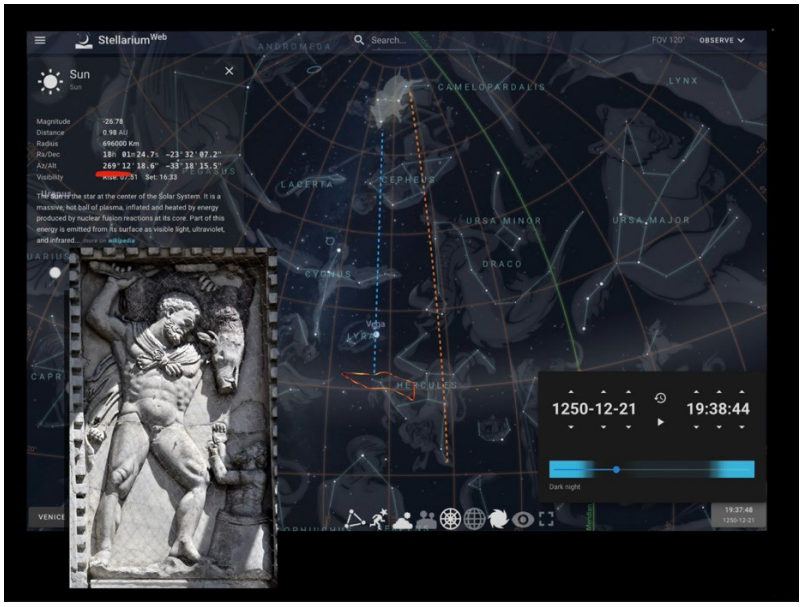

Fig. 4. Hercules' hand shows to Eurystheus/Vega the conquered Boar/*Cassiopeia*. The Sun, under the horizon, is transiting cardinal point W. Map: Stellarium.org. Graphics: own work.

And so (because of this peculiar vertical alignment in the sky), we understand why all the major renditions in the visual arts (and St Mark's Late-Roman *formella*) so insist on showing the Boar's head 'gaping from above' on the frightened Eurystheus.

According to all the mythological sources, the King is so scared at that sight, that he runs to his subterranean refuge, i.e., to the pithos interred in the cellar, and disappears under the ground (some versions even say that he slides its lid shut above himself). It appears that, in metaphor, the mythical tale is telling here that Vega/Eurystheus touches the horizon and sets; during this celestial event (Vega from +00° to -00°) the Sun, invisible under the horizon, travels from 296° to 302° of azimuth, that is, reaches its summer solstice setting 'station' (Fig. 5).

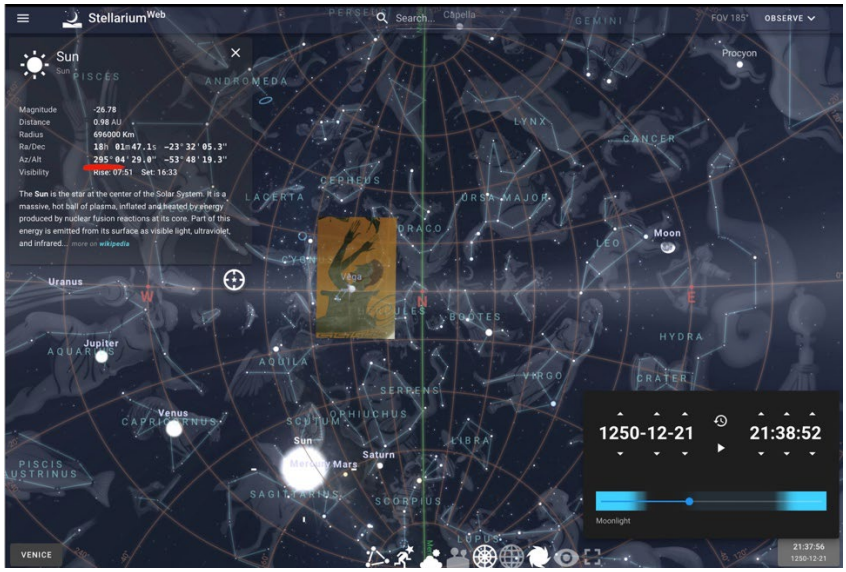

Fig. 5. Eurystheus/Vega sets. The Sun, under the horizon, is transiting its summer solstice setting point. Map: Stellarium.org. Graphics: own work.

The next 'post', or 'station', of the travel, i.e. ,the Sun reaching midnight, is not described in the *Erymanthean Boar* tale; possibly because the several celestial signs for midnight (e.g., some remarkable vertical and horizontal alignments between *Cassiopeia* and the *Big Dipper*) are so widely known (familiar, even in our day, to every scout), that the myth did not care to dwell on them.

Be that as it may, the next step of the narration, or remarkable alignment, occurs some hours after midnight.

The invisible Sun reaches cardinal point E, as Hercules and Eurystheus meet again, this time at the opposite, or eastern, door of the Palace (i.e., on the vertical of the summer solstice sunrise).

Again they stand one in front of the other; and again Hercules extends his hand across the threshold. The scene is in many ways symmetrical in relation to the one at the beginning of the tale, but we immediately notice that the power relationship between the hero and the King has changed: they are now on the same level, in a striking horizontal alignment between Vega, Rasalgethi, and Hercules' hand. We also observe an embarrassing situation: the monster Boar, alive, is still loose within the doors of the palace!, and forms the fourth element of the alignment (Fig. 6).

Fig. 6. Hercules (Rasalgethi) and Eurystheus (Vega) meet at the 'exit door of the palace', or 'citadel' (the summer solstice rising point of the Sun, orange dotted line). Also Hercules' hand, and Boar/*Cassiopeia*, are part of this alignment. The Sun is transiting at cardinal point E. Map: Stellarium.org. Graphics: own work.

Hercules' hand, here, appears no more to be asking, or receiving; rather, perhaps, taking leave, or asking if the mission has been accomplished.

According to the myth, the envious and sadistic cousin responds in the affirmative; but the hero is kindly invited to bring the monster away with him.

And this Hercules does. He leaves, heading south; and as the star Kornephoros, its right, or 'action', shoulder, transits E, inside the palace the Boar/*Cassiopeia* seems to follow its movement. *Cassiopeia* exits its lower culmination at N, and begins to ascend again: in metaphor, as the myth narrates, the hero frees the Boar, which 'runs back to its mountain'.

As the Sun elevates from -12° to -6°, the scene of the previous evening repeats in reverse: Hercules moves away first, ascending, and fades; King Eurystheus remains, and we have some moments to contemplate him, alone, at his palace's door (Sun at -6°). As the Sun emerges from below the horizon, he too slowly fades.

It would be interesting to show how this narrative scheme, with its articulation of alignments and transits of celestial bodies through meaningful celestial 'posts' or 'stations', repeats in all the twelve myths of the *Labours*. Space does not allow consideration of all the narratives in detail here, but all of them were tested, in order to verify the general coherence of the interpretation. So I savoured some of the epic moments which must have remained so unforgettably impressed on the minds of the little boys to whom they were told in the ancient times; told and pointed out in the sky while they happened. Because in the sky you can literally watch the *Labours* unfold! And many details that in the literary versions sound odd, or as the loose strands of some lost narration, seem to reconnect, and to regain unexpected sense. You can, for example, literally watch Hercules choking the monster Lion in the crook of his elbow, and then make his memorable reappearance at the door of Eurystheus, wearing the dead Lion's head as a helmet. What a scene!

Another unexpected surprise is that, in the sky, all the *Labours* happen simultaneously; all the monsters are there at the same time, all the battles are fought and won in the same span of time.

We cannot dwell on these general aspects any longer; let us rather briefly touch upon the essential aspects of the *Labor of the Ceryneian Hind* narrated in the second *formella*, and come to some final observations about the geolocal meaning of the two pieces on St Mark's facade.

As with the *Erymanthian Boar*, also with the *Ceryneian Hind,* the more commonly represented moment in the visual arts is an oddly marginal one: Hercules, wrestling bare-handed with the Hind, happens to break one of its

antlers during the scuffle.[13] This because the Hind too must be captured alive, so Hercules cannot use any of his admirable weapons, gifts from the Gods, against it. He can only wrestle it bare-handed. After a breathtaking chase, he finally succeeds in putting a knee on its back, and grabs it by the antlers; but one of them, unexpectedly, breaks in his hand. This causes the goddess Artemis, to whom the Hind was consecrated, to complain to him about the maiming of her animal. The hero pleads her indulgence, and obtains permission to bring the animal to Eurystheus as proof that the labour has been accomplished. After this, the Hind too, like the Boar, will be set free, alive and unscathed (except for the antler, which can still be seen broken to this day in the sky…).

The apparently marginal incident, barely mentioned in the literary sources, yet so persistently emphasized in the visual arts, cues us to a possible identification of the legendary Hind with the constellation *Taurus* (also supported by the celestial dynamics, and by the internal coherence within the corpus of the *Labours*). A keen observer may have noticed that one of the long horns of *Taurus* the celestial Bull is, in fact,‘ broken’, i.e., interrupted and slightly deviated at mid-length by a tiny star, Tau *Tauri*. This star culminates at S at a crucial point of the celestial narrative of this *Labour* (Fig. 7).

The identification with *Taurus*, by the way, also takes care of the curious problem of the gender of this *Labor*’s prey, which has perplexed many commentators. A few sources describe it as a stag, but the large majority talk of a hind; which, being a female deer, should not have antlers… . But, as far as the figure of *Taurus* in the sky is concerned, that is not a problem: the long beautiful glistening (‘golden’) antlers are easily visible, while the sex of the creature is not shown.

Let us also note that, in the corpus of the celestial *Labours*, Hercules and Eurystheus/*Lyra* are constant characters, while other constellations may appear in a different tale with another identity: this is also the case with *Taurus*, which reappears in another myth as the Cretan Bull.

[13] Wassiliki Felten, ‘Herakles and the Kerynithian Deer’, in *Lexikon Iconographicum Mythologiae Classicae* (München und Zürich: Artemis Verlag, 1998), Vol. V.1, pp.48–54

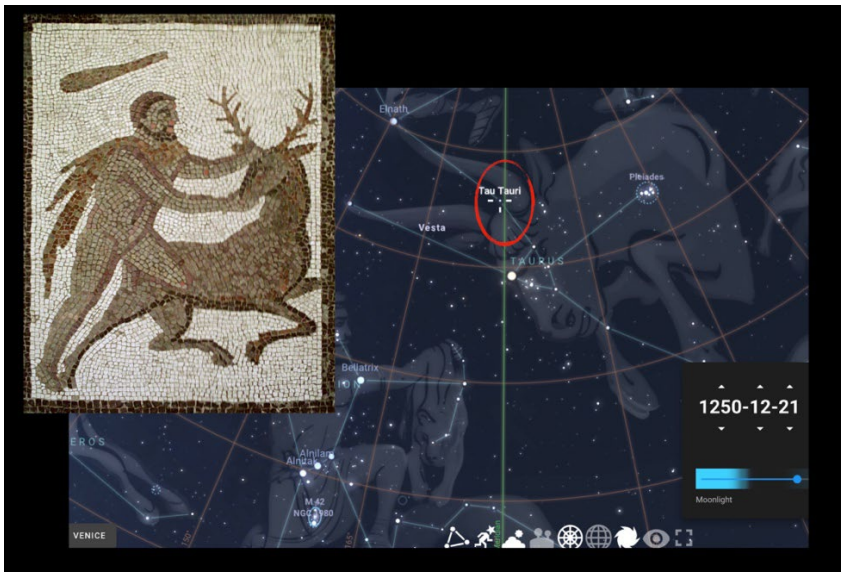

Fig. 7. *Hercules and the Ceryneian Hind.* Greek-Roman floor mosaic from Llíria, third century AD. Madrid, National Archaeological Museum of Spain. Celestial map: Stellarium.

The beginning of the narration is identical to the one already seen: as the setting Sun descends from -6° to -12°, Vega/Eurystheus the king comes in first, then Rasalghethi/Hercules appears in front of him.

Once more, Hercules' hand extends to Eurystheus across the gap of the door; and again, as if magically evoked by their dialogue, the gigantic supernatural prey appears: this time, the Hind/*Taurus*, whose golden horns, dappled pelt (the Pleiades), and bronze hooves (well, actually just one hoof) light up in that very moment, glistening above the opposite horizon.

As Hercules leaves in pursuit, the Hind darts with all its legendary speed in the opposite direction, towards south.

This time, Hercules must run literally all across the world to overtake the animal. According to the mythical sources, at one point in his long pursuit he even touches the snowy land of the Hyperboreans, in the far north.

If we watch the event in the sky, we see that, actually, it is only on reaching cardinal point north that Hercules succeeds at last in putting his knee on the Hind's back, and grabbing it by one of its antlers.

The celestial sphere in profile shows where the two main characters are located in this pivotal scene: Hercules, low north ('in the frosty land of the Hyperboreans'); the Hind, high south ('on the top of the mountain'). The large red-orange Aldebaran (Alpha *Tauri*), is shining high on the meridian at south, and this is probably why some versions of the myth say that on the top of the mountain the Hind, hot from running, is 'breathing burning flames'…

In that very moment the Sun, invisible under the horizon, reaches its summer solstice setting point (Fig. 8).

Fig. 8. *Hercules*' knee and Aldebaran/*Taurus* align on the meridian. Celestial map: Stellarium.

Immediately after culmination, however, *Taurus* enters into decline (i.e., in metaphor, begins to weaken and become vulnerable). In the mythological accounts the Hind, once having reached 'the top of the mountain', begins to pant and to be thirsty, and slows down its flight. This is why Hercules finally succeeds in putting a knee on its back; after a few moments, the star Tau *Tauri* transits the Meridian. The antler breaks!

Unlike the vast majority of the visual renditions, however, the thirteenth-century Venetian *formella* does not focus on Hercules putting the knee on the Hind's back and grabbing, or breaking, its antler.

Rather, here the hero is shown carrying the Hind already subdued on his shoulder, while treading on a winged, double-coiled dragon, unanimously identified as Hydra.

Why this deviation from the iconographic canon? Because, by means of this peculiar choice of details, the *formella* comes to represent the same astronomical moment as its late-Roman pendant on the opposite side of the façade. More precisely (since, as we have seen, that representation condenses two slightly different events), the corresponding moment is Eurystheus disappearing into the pithos/the setting of Vega.

Let us see how, At Venice's latitude, the constellation *Hydra* rises due East in vertical posture, its head pointing upwards (while it sets horizontal, head and body parallel to the horizon). Therefore, the rampant *Hydra* shown in the *formella* tells the observer:' You are facing East' (which is, geolocally speaking, correct). Moreover, the *formella* shows Hercules' left foot trampling the Hydra's breast and wing (i.e., aligning with the star Alphard, Alpha *Hya*, 'the heart of *Hydra*'; surrounded by the fan of other smaller stars, very aptly appearing to represent a wing. These stars were later to become the constellation *Telescopium*) (Fig. 9).

Fig. 9. Anonymous artist, thirteenth century: *Hercules carries the Hind, threading on the body of Hydra*. Venice, St Mark's Basilica, main facade. Photo: Pino Usicco. Celestial map: Stellarium. Graphics: own work.

Hercules' other foot points to, or aligns with, the area between the two coils along *Hydra*'s body. As these alignments happen, Vega is at +00° above the horizon; which is to say, the 'new' *formella* comes to represent the

astronomic moment corresponding to Eurystheus lowering himself into the pithos on the opposite side of the facade. In other words, in the two *formelle* we are seeing exactly the same sky, at the same hour, only facing the horizon from a different angle (as we can see if we compare the Stellarium clock windows in Figs 5 and 9). We could hardly find a more persuasive proof of the fact that the thirteenth-century Venetian builders recognized an astronomical subject in the Roman *formella*, and knew how to articulate its language in a new composition.

Let us now imagine medieval travellers in front of St Mark's Basilica. Seeing *Hercules* vs *Boar/Cassiopeia* on his left, and *Hercules* vs *Hind/Taurus* on his right, because of where these celestial events take place in the real sky, they would have read them as indicating that S was on their right (which is, geolocally speaking, correct).

Actually, with the help of a little and hitherto unexplained companion sculpture, the two '*Formelle di Ercole*' and their disposition on the facade told him something more.

Below the *Erimanthean Boar* on the left, St Mark's builders added a new bas-relief, expressly made, showing two lions back-to-back, with the heads turned back (Fig. 10).[14]

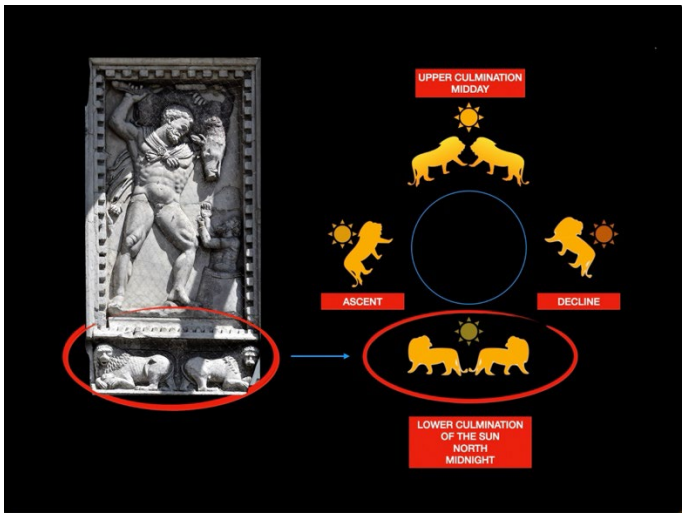

Fig. 10. The '*Two Lions*', thirteenth century bas-relief added under the late-Roman *Hercules and the Erimanthean Boar*. Photo: Pino Usicco. Graphics: own work.

[14] Demus et al., *Le sculture esterne*, No. 86.

In the language of the *patere* and *formelle*, this reads: 'Sun/Lion at its lower culmination = north-midnight'.[15] The *Ceryneian Hind* bas-relief on the opposite side of the facade, on the other hand, has no corresponding piece added under its base; this results in an intentional dissimmetry, which had a precise meaning. Noticing it, the observer would have said: 'On my left, I have a celestial event happening at north; and north (the Two Lions back-to-back) is visible (or 'included in my view'). On my right, I have an event happening at south; but south is not visible/not included in my view'.

This suggested a navigational train of reasoning: 'If this facade was aligned due north to due south, I should see both; since I only see north, this means that the facade is a little skewed, and, facing it, I am facing NE'. This, if we check with instruments, is actually the case.

'You are facing NE' was good enough geolocal information for the average passer-by. To a professional navigator, however (to an astronomer, or to a geographer), the two *Hercules* pieces, plus their 'Two Lions' companion, offered far more precise information; precise enough, in fact, to tell the viewer their orientation (and the alignment of the building) almost to a degree.

How? In the Roman *formella*, Hercules' heel (Iota *Her*), the one facing Vega/Eurystheus, is shown on the façade exactly superimposed with north (on the vertical between the 'Two Lions' added at its base).

If our selected observers knew that in the moment described, i.e., at the setting of Vega, Hercules' heel is at -17° to north, or if they knew how to ascertain this value (and, if they did, they were no doubt part of a selected audience), they could have predicted the direction that they were facing almost to the degree. Indeed, once that angle was known, a simple Euclidean train of reasoning would have brought them to conclude that they were facing the opposite horizon at: 90°-17°= 73°; which, again, is true, according to our modern instruments (i.e., if, for example, we check the orientation of the Basilica with Google *Earth*) (Fig. 11)

[15] Conventional postures to describe the ascent, upper and lower culminations, and decline, of the Sun and of the constellations: Vallese, 'Patere and formelle', pp.79–81.

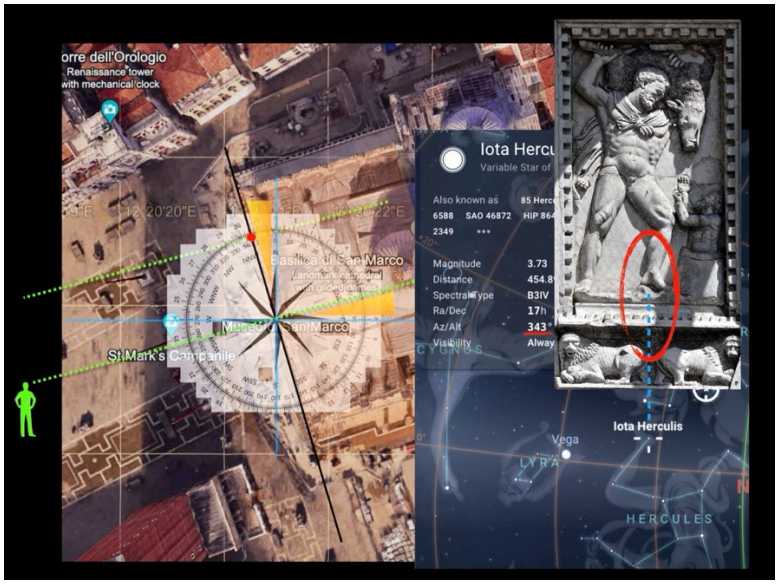

Fig.11. Hercules' foot (Iota *Her*) superimposed to north-midnight. Photo: Pino Usicco. Celestial chart: Stellarium. Satellite map: Google *Earth*, map data © 2023 Google. Graphics: Own work.

This is, no doubt, so astonishing that, despite the satisfactory geometric demonstration, we might find it a bit *outré*; or, to put it another way, too beautiful to be believed. Were it not for the fact that other parts of St Mark's Basilica, and some of the most elegant Venetian private houses of the same era, display in their ornamentation the same double level of possible reading: one level with sufficient geolocation information, intended for the general public; and a further level, conveying much more precise information, designed as a challenge to the skills of more learned and demanding observers. All this very much recalls the initiatory astronomical riddles at the beginning of many chapters of Dante's *Divina Commedia*: which are, in fact, products of the same age, in the same taste.

Conclusions

The two '*Formelle di Ercole*' displayed on the facade of St Mark's Basilica in Venice, one late Roman, the other from the thirteenth century, are not just mere ornament, as it has been believed until now. If we analyse them, using iconography integrated by technological tools of our time, such as Stellarium and Google *Earth*, we can see that they very likely have an astronomical content. We can see also that they were displayed on the

façade not randomly, but so as to convey geolocal information to the observer, addressing a general public accustomed to reading the night sky to deduce orientation.

The restitution of the long-forgotten astronomical/geolocal sense to the '*Formelle di Ercole*' contributes to putting St Mark's thirteenth-century renovation in a different light. Up to now, the display of new and antique sculptures on the refurbished thirteenth-century Basilica has been seen as essentially decorative, the creation of a sort of open-air treasure meant to impress by wealth and power. Thus described, it appears as an operation, all things considered, that was primitive, even a bit barbaric, in its mixing the new and the antique with no better apparent purpose than ostentation.

The display of wealth and power was, no doubt, intended; but was, it appears, collateral to a far more refined design: namely, a description of the geometry and orientation of the building by means of navigational astronomy. This was a common language for all the different nations that converged on Venice, then a growing Empire founded on long-distance trade.

Moreover, the tight system formed by the two *Formelle di Ercole,* and their calculated disposition, can become a new key of access to the astronomical content of the Greek myths themselves. Reconnected to the night sky, many odd or loose strands of the *Labours* tales seem to reconnect. We can also recover some content that, through the literary sources, came to us blurred, or was altogether lost. For example, we are surprised by Hercules' respectful attitude towards the wondrous supernatural creatures that he is compelled to subdue, by his almost (compatible with the situation) delicate handling. Also, his unostentatious prowess, his steady patience in submitting again and again to the hard trials which will bring him atonement, transpire in the celestial narrations with a peculiar clarity, not to be found elsewhere. Thus does the mighty grip of fate which lies behind his interactions with Eurystheus, as we watch them both being driven by the mysterious inflexible impulse that regulates the motions of the heavens.

The larger-than-life human characters in the sky, their gestures, entrances and exits, evoke (as is to be expected) those of ancient Greek theatre, to which the origins of visual narratives of this kind are probably strongly connected.