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Schiaparelli and the dawn of astronomy

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Abstract. Schiaparelli is remembered by astronomers and scholars interested in ancient astronomy in particular for his fundamental contributions to the understanding of ancient Greek astronomy and for his pioneer work on babylonian astronomy. In the present paper we will highlight some of his studies and ideas about: a) the origins and the primitive astronomy in the context of the european archaeology and anthropology researches, b) the problems in the analysis of a cuneiform tablet, and c) the interpretation of the astronomical content of a verse in the Old Testament, with an interesting implication for the present day researches in cultural astronomy and archaeoastronomy.

Key words. History of astronomy - cultural astronomy - archaeoastronomy

1. Introduction

When G.V. Schiaparelli (1835 - 1910) was a graduate student he planned to write a general history of mathematics including astronomy. When he became astronomer and director of Brera Observatory, he had to change his ambitious ideas and make a plan for writing just the history of ancient astronomy. In any case, the task was very demanding, and, in order to do a good job, he affirmed that a scholar should have mastered not only astronomy but also ancient and classical languages. Indeed he mastered not only Greek and Latin, but also Hebrew and the Akkadian language. When he retired in 1900, he collected new historical material and corrected and revised his previous papers. Unfortunately, he could not complete the work, and his papers and several notes were published posthumously in three volumes, with the title *Scritti sulla Storia dell'Astronomia Antica* (*SSAA*), in the years 1925-1927. These volumes were and are still quoted by researchers working in the history of astronomy, and they have been reprinted recently. Scholars usually recognize in particular his fundamental contributions to the understanding of the ancient Greek astronomy.

I will talk about his contributions to the study of the beginning of astronomy. These are the topics that are currently part of archaeoastronomy, cultural astronomy and astronomy in culture, and they concern the study of the importance of the sky in past societies, as regards both the material culture (for example, the astronomical orientations of archaeological sites) and the immaterial culture (for example, the myths and the astronomical knowledge orally conveyed). This study is strictly linked with humanistic sciences: actually it gets a sense as long as this link does exist. Before discussing Schiaparelli's work on the origins of astronomy and primitive astronomy, I will illustrate some aspects of archaeology and anthropology

in the nineteenth century; of course, my description can only be very limited (and it will be probably biased). I will give then an example of the studies of Schiaparelli on babylonian astronomy, and finally I will discuss the identification of an asterism in the Old Testament, with an unexpected implication for the present day research.

2. Origins of astronomy and primitive astronomy

2.1. Background

I will refer to studies on tprehistoric archaeology and on the primitive populations of modern times. There is some relation between the two points, since the modern primitive populations sometimes are taken as a reference when attempting an interpretation of prehistoric populations. A few centuries ago, during the Age of Exploration, the Europeans met new populations in Africa, America, Australia and Oceania, and their opinion about them ranged from the concept of the primitive man as a "noble savage" (in Italian, *il buon selvaggio*), to the concept that primitive populations were not fully human beings. The second concept got some credit in the western world during the nineteenth century, and I will stress a little bit on this extreme case just in order to show the different attitude of Schiaparelli.

The fact could be represented by two men. One is Ota Benga (1883-1916), a congolese pygmy that was exhibited in an american zoo in 1906 as a sort of scientific demonstration of the missing link between monkeys and humans (see e.g. Bradford & Blume 1992). The other is John Lubbock (1834-1913), an influential person in the United Kingdom: he was a banker, an archaeologist, a biologist and a politician. His book on the prehistoric archaeology in England was used as a textbook for several decades. According to Trigger (1989), Lubbock misinterpreted Darwin's ideas, and declared that humans were not only culturally different, but they were different also in their biological capacities to utilize culture. He affirmed that technologically less advanced peoples were not only culturally but also intellectually more primitive from a biological point of view than were civilized ones. For biological reasons, within the European societies the criminally inclined and the lower classes were biologically inferior to the more successful middle and upper classes, and women were inferior to men. In conclusion, according to Trigger (1989), the Darwinian concept of natural selection, not yet well understood, could inspire the justification of the european class system, the gender discrimination and the colonialism. Actually, C. Darwin (1809-1882) had nothing to do with this "justification" since he declared very clearly the similarity of the human beings.

Colonialism was not a prerogative of United Kingdom, and several european countries had their own empire. For example, a recent book by Olusoga & Erichsen (2010) deals with the tragedy related to German colonialism in Namibia, the war of extermination against Herero and Nama people in 1904-1908, and the racial theories that had inspired it. But racial theories were not only German.

Lubbock's ideas were based on the faith in the never ending evolutionary progress of European society, intended as a sort of biological evolution, and in particular the british society. As remarked by Trigger (1989), in Europe this faith was shacked by the big social problems arisen from the industrialization in the last decades of the century.

Other European scholars were doing more sound studies of anthropology and ethnology. For example, apart from the monumental research on comparative religion by J. Frazer (1854-1941), *The golden bough* (Frazer, 1890; 1906-1915), L. Levy-Bruhl (1857-1939) was making an effort for considering the primitive societies no more as inferior societies. I think that the work of Schiaparelli on the primitive astronomy may be seen as a short astronomical complement to *La mentalité primitive* (Levy-Bruhl 1922).

What about Italy? Following the defeat of Adua in 1896 the Italian government decided to give up on most of its colonial projects, therefore no colonial empire existed yet in Italy. There were important italian anthropologists such as Paolo Mantegazza (1831-1910)

and Cesare Lombroso (1835-1909). Lombroso was in contact with Schiaparelli, and he cultivated some aspects of social darwinism; he illustrated the superiority of the white race in a book (Lombroso 1892). Just for the sake of completeness, I mention the italian social problems. They gave rise to the tragic turmoils in Milan in 1898, with hundreds dead men, and two years later, as a consequence, to the other tragic event, the king Umberto killed nearby Milan. This is the year when Schiaparelli retired, and devoted himself to the history of ancient astronomy.

2.2. Origins of astronomy according to Schiaparelli

When we read carefully his thirty pages on the primitive populations and their astronomy and we take into account the european and italian background, we are a bit surprised. We do not find racist opinions. Of course, Schiaparelli uses the language of his times, but he does not mention racial differences. Today we would say that Schiaparelli is politically correct, but at his times such an attitude does not appear to be so common. This is probably due to his own good sense, which is confirmed by his correspondence with the family, the friends and the colleagues.

Who invented astronomy? Schiaparelli says that the question is pointless. Every country found it, in the most suitable way for its needs. However, not all countries made the same progresses. Schiaparelli writes a striking sentence: *the man of the Palaeolithic that understood the periodicity of the lunar phases and counted the days in a lunar month performed an operation that was as scientific as that performed by a modern astronomer.*[1] The term scientific referred to the Palaeolithic man could seem a bit too strong, however it shows that, according to Schiaparelli, the intellectual capabilities of the mankind should have been the same right from the beginning, and they do not depend on the race.

We have had reports for four hundred years on the primitive countries made by a huge number of travellers, but unfortunately only very few have been able to really understand the astronomical knowledge of such populations.[2] Among Schiaparelli's sources there are many volumes containing the summaries of the reports of such travellers. In his essay he discusses the different use of Moon, Sun and stars, essentially for calendar purposes, by various populations, and he adds several interesting comments. I will just mention two examples. Populations at very northern latitudes such as in Disko Island (Greenland), where it is difficult to use the Moon, do not consider regular months; the Moon (as the Sun) cannot be seen during some periods of the year. The Jakuti, located at very northern latitudes as well (present day Sakha-Yakutia republic, Russia), have however a calendar with months of thirty days. Jakuti have kept the tradition of their ancestors, who came from Turkestan, located at much lower latitudes.

All the populations have their own interpretations of asterisms, star groups and constellations, or, as Schiaparelli says, have their own uranography. The following is his final complaint. The careful study of the sky performed by primitive men has produced a rough uranography. Wretchedly nobody has taken care to collect its relics, that are now disappearing with the wind of the european civilization. [3]

[1] "L'uomo dell'epoca paleolitica, che riconobbe l'andamento periodico delle fasi lunari e si studiò di trovare quanti giorni sono in una lunazione, compì un'operazione altrettanto scientifica ed altrettanto astronomica quanto può essere per un astronomo moderno il definire la rivoluzione di un pianeta o d'un satellite, o il periodo di intensità luminosa di una stella variabile" (*SSAA* III, p. 35).

[2] "Abbiamo da quattrocento anni in qua le relazioni d'infiniti viaggiatori, dei quali però una ben piccola parte ha avuto l'occasione o l'abilità di penetrare nella mente dei popoli veduti cosí profondamente da esaurire tutto il contenuto del loro sapere astronomico, esponendolo secondo verità. Onde avviene, che di tante notizie la massima parte è senza alcun valore, o almeno non può essere utilizzata senza confronti e senza rigoroso esame" (*SSAA* III, p. 38).

[3] "Questo studio così attento del cielo stellato fatto dagli uomini primitivi doveva dar origine ad una rudimentale e rozza uranografia. Di essa sventuratamente nessuno si è curato di raccogliere le

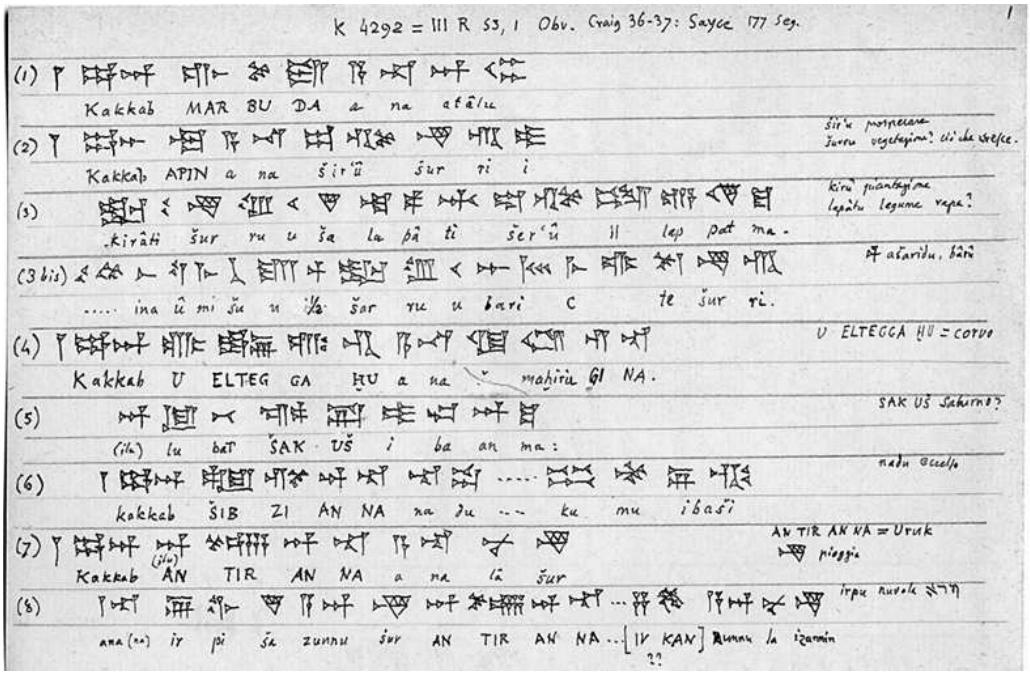

Fig. 1. A page with Schiaparelli's exercises in Akkadian language (Archivio INAF-Osservatorio Astronomico di Brera).

3. The dawn of babylonian astronomy

A review of some works of Schiaparelli dedicated to the origins and development of babylonian astronomy has been given during a meeting some years ago (Hunger 1997; DeMeis 1999). Hunger (1997) describes well the struggle of Schiaparelli for mastering the Akkadian language, and he points out that such a learning was not so easy a century ago, when the language was not yet sufficiently known. The famous astronomer has done a pioneer work on the identification of stars, planets and constellations; an example of his exercises is shown in Fig. 1. Schiaparelli is aware of the efforts done in Europe for deciphering the cuneiform tablets, and he recognizes the importance of the german jesuits (Strassmaier, Epping and Kugler) for the development of the methods of analysis. In particular, he recognizes the unique skillness of F.X. Kugler (1862-1929), as an astronomer and as an assyriologist, and we will see that in a certain sense he has been a good prophet.

Schiaparelli has done a struggling effort to resolve the puzzle of the Venus tablet of Ammisaduqa (tablet K160 in the British Museum, London, or Enuma Anu Enlil tablet 63), which contains omens related to observations of Venus. He has written a paper of about 130 pages on this small tablet, but he has preferred not to publish it. The tablet is a seventh century BCE copy from Nineveh of a previous text of an unknown epoch. Only the month and the day are recorded in the tablet of the first appearance and disappearance (east or west) of Venus, followed by the corresponding omen. No indication of the year is given, since it is not essential for the omen.

The tablet is divided in several sections by straight lines, and, for example, Schiaparelli translates the beginning of one of them (No. 11, lines 25-28) as follows: on the month of Shabatu, the day 12, Venus has been seen at

reliquie, che vanno ora rapidamente scomparendo al soffio della civiltà europea" (*SSAA* III, p. 58).

east. The astronomical observation is followed by the omen: the products of the ground are thriving. Then another observation follows regarding the day 16, and so on. The astronomical data by themselves are not sufficient to determine the epoch of the observations, which is the important goal of the study. To this end, at least one historical reference is needed. Schiaparelli's preliminary and unpublished conclusion, based on the mention in the tablet of the invasion of Umman Manda people, is that the astronomical observations were performed during the years from 652 to 637 BCE.

The reason for his being afraid can be found in a letter to a colleague. Millosevich has written a flattering letter to Schiaparelli, asking his permission to present part of his work on the tablet to the Accademia dei Lincei, that is the part that has been published in a popular german journal. In his reply, Schiaparelli does not consent, for several reasons, such as that the german article has been intended just for public outreach. Finally he mentions the most relevant one: according to new studies, it seems that the invasion of Umman Manda occurred well before the time assumed by him, and the readers would conclude that many of his conclusions are wrong. Therefore it is not the case to show his "exceptional smartness".[4] His self-irony should be noted, considering the 130 pages of a not published work.

It is Kugler that, after the death of Schiaparelli, will solve in part the puzzle, by identifying in the tablet the quotation of the reign of Ammisaduqa, about 1700 - 1500 BCE (see e.g. the Preface in Langdon, 1922). Schiaparelli has used the right methods of analysis of the text and the right astronomical methods, but the progresses in the knowledge of the Akkadian language in Europe has not been sufficient to allow him to solve the puzzle. Today the scholars are still fighting with the same methods, trying to narrow the time interval of 1700 - 1500 BCE.

[4] " ... Questa invasione è un fatto storico ... e sembra avvenuta intorno al 2000 o 2200 prima di Cristo. Certamente molti trarranno di qui la conseguenza che gli Umman-Manda risalgon a quell'epoca, e dichiareranno nulle parecchie delle mie conclusioni. Come vede, non è proprio il momento di mettere in luce quello che Ella chiama il mio acume eccezionale" (*SSAA* III, p. 124).

4. Astronomy in the Old Testament

4.1. A verse in the book of Job

Schiaparelli (1903) writes a book on the astronomy in the Old Testament that is quickly translated in German and English. In the book he discusses all the aspects of the astronomical knowledge of Hebrews, in particular the calendar and the feasts. A thorough review of the book has been given by Casaburi (1999). As written in the obituary by the Royal Society (Anonymous 1911), Schiaparelli has been a profound theological scholar. He knew all the sacred books of the principal religions, and made a deep study of the foundation and historical development of Christianity. So profound was his knowledge of these subjects, that Celoria asserted that there have been few men so competent as Schiaparelli to occupy a chair of comparative religion in Italy (Celoria 1910).

Schiaparelli discusses in detail the identifications of stars and constellations in various versions of the Bible (Hebrew, Targum, Peschito, LXX, Hexapla, Itala, Vulgata). Among them there is also the syriac Bible named Peshitto or Peshitta. A famous manuscript of this syriac bible of the sixth or seventh century is preserved in the Biblioteca Ambrosiana in Milan. The *prefetto* of the library, Mons. A. Ceriani, has published the manuscript in 1876-1883 and gives an help to Schiaparelli in his work (*SSAA* I, p. 149).

Here I will report only about a verse in the book of Job. The verse, Job (9, 9), is translated today as follows: "He has made the Bear and Orion, the Pleiades and the Mansions of the South" (catholic version, New Jerusalem Bible 1985), and "who made the Bear and Orion, the Pleiades and the chambers of the south" (methodist version, New Revised Standard Version 1989). Schiaparelli remarks the hebrew constellation names: *'asch* (Bear), *kesil* (Orion) and *kimah* (Pleiades), and discusses carefully the last two words, *chadre theman*

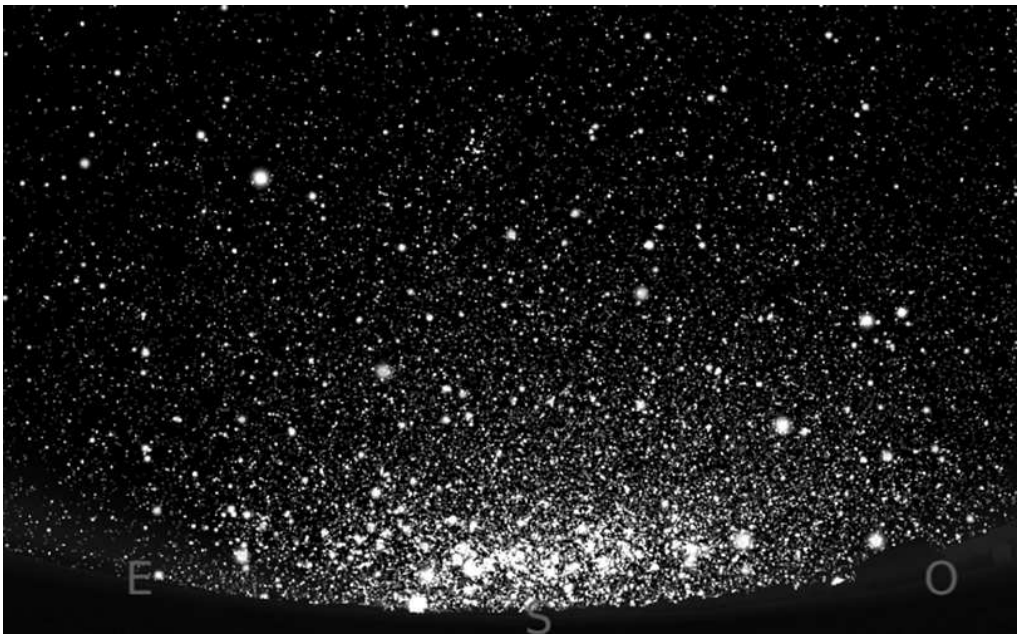

Fig. 2. A simulation of the sky visible in Palestine during biblical times (first millennium BCE; program STELLARIUM). The brightest stars near the orizon in the South-East direction are α and β Centauri and those of the Crux.

(Mansions of the South, or chambers of the south). He points out that *chadre* should be the private interior of a house, the innermost and reserved chambers, and *theman* the right direction or the south direction. Hebrews indicated the cardinal points as follows: east = front, south = right, west = back and north = left. Schiaparelli has a sort of inspiration, based also on some older interpretations of this verse. He writes that by these two words the author of the book of Job unquestionably wished (or better, wanted) to indicate some brilliant constellation among the most southernly ones.[5] Though his interpretation appears rather plausible, nobody knows what the author of the book really *wanted* to indicate; that is, his strong affirmation cannot be proved, but it cannot be disproved as well. This kind of impossibility is very common in archaeoastronomy and cultural astronomy, and the reason for this remark will be clarified in the next paragraphs.

Schiaparelli introduces an amazing discussion. He never travelled to the southern latitudes and he has not seen the southern constellations. He takes into account the testimony of other astronomers and scholars, such as the famous Alexander von Humboldt, in order to describe the brightest part of all the sky, that between Carina and Centaurus constellations. That part of the sky is defined by von Humboldt as the splendour of the southern heaven. In Italian it is defined as *gioja del cielo australe*; however, *gioja* could be misleading. The English edition is better, because it includes also the German term used by von Humboldt, *Pracht*, that is, "splendour". Schiaparelli points out not only the richness of the bright stars, but also that of the faint stars, quoting his own study on their distribution in the sky. Even the Milky Way is brighter there,

[5] "L'autore del libro di Giobbe senza dubbio ha voluto indicare qualche splendida costellazione fra le più australi del suo orizzonte" (*SSAA* I, pp. 206-207).

and the combined effect of all these stars is that of a diffuse twilight illumination. I show in Fig. 2 a simulation of the sky just to get a feeling of what the shepherds and peasant in Palestine, according to Schiaparelli, could have seen during biblical times, and then no more, owing to the effect of precession.

Schiaparelli thinks of an aurora australis sprinkled with brilliant stars. He reports directly in English an amazing quotation taken from the book of (von Humboldt (1858), pp. 146,147): "Such is the general blaze of starlight near the Cross, from that part of the sky, that a person is immediately made aware of its having risen above the horizon, though he should not be at the time looking at the heavens, by the increase of general illumination of the atmosphere, resembling the effect of young Moon" (*SSAA* I, p. 208). It is an observation by Jacob that referred by von Humboldt. W.S. Jacob, an engineer in India and amateur astronomer, is appointed director of Madras observatory in 1850. Before, he has been in contact with the royal astronomer of Edinburgh, Piazzi Smyth[6], who has presented his work on α Centauri to the Royal Society (Piazzi Smyth 1849). Von Humboldt takes the quoted text from that publication, and that publication contains other remarks by Jacob about this spectacular part of the sky.[7] Moreover, von Humboldt (1858) reports other similar impressions by the astronomer John Herschel (then working in South Africa). One could wonder, however, what are these astronomers and scientists really doing. It seems that they are sharing feelings and impressions, and they are not doing science. One must be very careful. To give importance to impressions can be risky, since it could give rise to excessive imagination; for example, when Schiaparelli writes *senza dubbio* (undoubtedly), this could be just imagination. On the other hand, to give importance to impressions is essential when dealing with archaeoastronomy and cultural astronomy; when I talk with archaeologists, I have to take into account their impressions. The evident contrast explains the intrinsic difficulty of archaeoastronomy. The contrast is felt more by astronomers rather than by archaeologists (for them it is just a matter of sound ideas or foolish ideas, and that's all). For (serious) astronomers and scholars of astronomy the situation is painful. I will just mention very briefly some dramatic aspects. Piazzi Smyth is also famous for having introduced a sort of cult of pyramids, and some archaeologists talked sarcastically about "pyramidology" and "pyramidiots", though they recognized politely at least the utility of his accurate measurements of the Great Pyramid of Giza (Wortham 1971). Bizarre speculations concerning the pyramids and other "mysteries", such as that of Atlantis, have a long life. Gian Rinaldo Carli (1720-1795) was an important economist in Milan and an exceptionally learned man. He affirmed that Atlas, king of Atlantis (the island supposed to be located in the Atlantic Ocean before sinking), along with the Atlanteans diffused the astronomical knowledge in the other continents (Carli 1783). I have to mention also the speculations of Norman Lockyer, Fred Hoyle and other famous astronomers about Stonehenge: the effect of their ideas has been to increase the separation between archaeologists and archaeoastronomers (see the Introduction, in Ruggles, 1999).

[6] C. Piazzi Smyth (1819-1900), son of the admiral Smyth, was born in Naples and took the surname of his godfather at the baptism, Giuseppe Piazzi, astronomer in Palermo and friend of the admiral.

[7] "This excessive splendour is caused not only by the profusion of first, second, and third magnitude stars in the neighbourhood, but by the extraordinary general breadth and brightness of the Milky Way thereabouts" (Piazzi Smyth 1849). The structure of the Milky Way, not yet kown in the nineteenth century, is often described by astronomers of that time as a sort of large ring surrounding us. The Solar System is not located in the centre of the ring, and, according to Jacob, we are closer to the southern part of the Milky Way.

4.2. Implications for present day researches

Let us go back to the astonishing description made by Jacob. Why could it be important? Hoskin (2001) pointed out the relevance of the stars of the group of Centaurus and Southern Cross in the Mediterranean basin during the

neolithic and bronze age. This has been usually considered a significant result. In our collaboration with archaeologists in Southern Italy we are suggesting the possible importance of such stars for some archaeological sites in Daunia. In spite of the difficulties mentioned before, it is possible to collaborate with archaeologists; they realize that only with the astronomical methods it is possible to extract some specific information from archaeological sites and findings (see e.g. Tunzi et al. 2009, 2010). In our case, we tacitly assumed, as Hoskin did, that the ancestors were interested, for some reason, in some bright stars or constellations. Schiaparelli, however, is telling us that the ancestors could have been impressed not by the stars but by the global light effect.

The stars were visible in Southern Italy, during Neolithic - Bronze Age, beginning from October to the end of spring of the present day calendar (Antonello 2010). For example, around mid October there was the heliacal rising of γ Crucis and that of α Centauri some days later. The heliacal setting occurred some days before the summer solstice. Such a region of the sky with its spectacular light effect was therefore visible during winter and spring. That is, during the long nights in winter time, when the Moon was not yet risen or was just set, the ancestors could enjoy for many hours a sort of twilight.

It is not easy at all to verify the Jacob effect, that was observed when the electric lightning did not exist. Today we have the light pollution. One could go to the sites with the largest telescopes and darkest sky. But even there the rooms inside the buildings are strongly illuminated, and it takes a lot of time to accustom the eyes to dark. To spend a lot of time outside by night in such places is a bit uncomfortable due to cool and often windy weather. Two hundred years ago the effect could be seen even from the centre of towns; so to speak, it was an everyday life experience. In any case, since subjective opinions should be avoided, I think that the only reliable solution today would be to make accurate simulations. The simulations require the use of the modern star catalogues containing many million stars, and the application of some astrophysics, since we have to take into account at least the Rayleigh scattering in the atmosphere. This is a long term project, and I show here just one simple example (Fig. 3). I have projected TYCHO2 (Hog et al. 2000) star brightness using IDL. It is possible to see that the brightest part of the Milky Way is located indeed at southern declinations, near the Southern Cross. When we include about 100 million stars of the UCAC3 catalogue (Zacharias et al. 2010, V < 16), the brightness of the Sagittarius region is similar to that of the Crux region. Therefore, a careful study is needed before drawing reliable conclusions.

5. Conclusion

Just a short final comment. In the fields of archaeoastronomy and cultural astronomy, that of Schiaparelli is not simply a legacy. As I tried to show in the last Section, today we are talking and interacting with him, and with the other scientists and scholars of the past. That is, in a certain sense Schiaparelli is still living. Is this just imagination? The affirmation that one can interact directly with ancient scholars is not new. For example, some centuries ago, Niccolò Machiavelli wrote a famous letter to Francesco Vettori, where he described his relationship with them, his asking questions and their kindly replying.[8]

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[8] "Venuta la sera, mi ritorno a casa ed entro nel mio scrittoio; e in sull'uscio mi spoglio quella veste cotidiana, piena di fango e di loto, e mi metto panni reali e curiali; e rivestito condecentemente, entro nelle antique corti delli antiqui huomini, dove, da loro ricevuto amorevolmente, mi pasco di quel cibo che solum è mio e ch'io nacqui per lui; dove io non mi vergogno parlare con loro e domandarli della ragione delle loro azioni; e quelli per loro humanità mi rispondono; e non sento per quattro hore di tempo alcuna noia, sdimentico ogni affanno, non temo la povertà, non mi sbigottisce la morte: tutto mi transferisco in loro" (Machiavelli 1513).

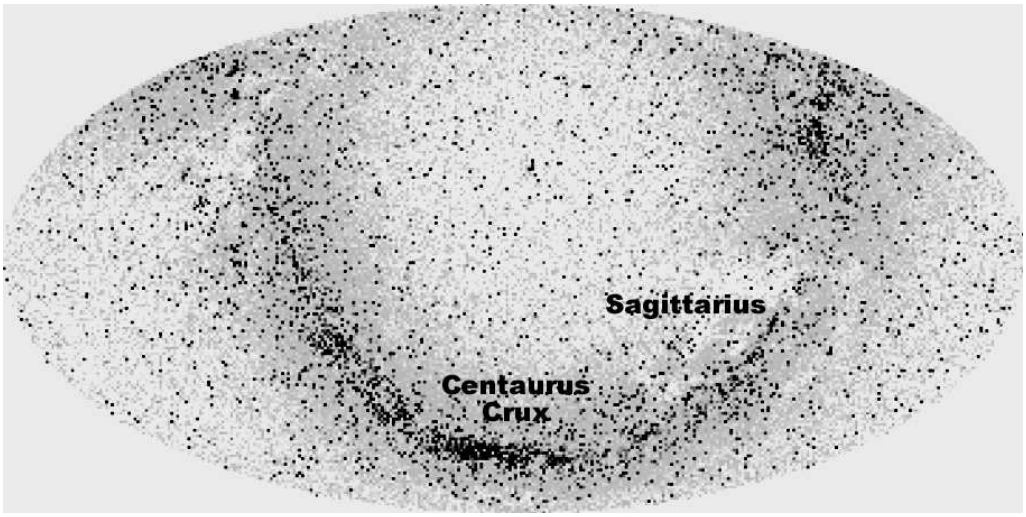

Fig. 3. Mollweide (equal area) projection of the brightness of about 2.5 million stars in the TYCHO 2 catalogue (V < 12 mag). Abscissae: right ascension; ordinatae: declination. Each point is one square degree. The brightest part of the Milky Way is that of the Centaurus - Crux region.

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