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Dissemination and communication of astronomy in Naples: from the Enlightenment to social media

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Abstract

The dissemination of scientific knowledge is a usual practice for Neapolitan astronomers, having roots in the times when Naples did not yet have an Observatory. That tradition continues today to animate the initiative of the Capodimonte Observatory in disseminating astronomical culture to an ever wider audience of curious and passionate about the science of the cosmos. Among the many scientists who in Naples have deeply contributed to making astronomical knowledge accessible to all, Ernesto Capocci was undoubtedly the main protagonist of literary initiatives, including a science fiction novel, valid for the education and dissemination of astronomy. This article examines the role of Neapolitan astronomers in the educational outreach campaign of astronomical knowledge and the different modes of communication they used, from the Enlightenment to the contemporary age, to spread science in society.

Keywords: Popular Astronomy - Astronomical Outreach - Italian Astronomers.

Riassunto

La diffusione della cultura astronomica è per gli scienziati partenopei una tradizione che affonda le sue radici nei tempi in cui Napoli non aveva ancora una specola. Quella consuetudine continua ancor oggi ad animare l'iniziativa dei ricercatori dell'Osservatorio di Capodimonte per la divulgazione delle conoscenze scientifiche verso platee sempre più ampie di curiosi e appassionati della scienza delle stelle.
Tra i tanti scienziati che a Napoli hanno contribuito a rendere la conoscenza astronomica accessibile a tutti, Ernesto Capocci è stato

senza dubbio il principale protagonista di iniziative editoriali, tra cui un romanzo di fantascienza, per la divulgazione scientifica.
Questo articolo ripercorre, dall'Illuminismo all'età contemporanea, il ruolo degli astronomi napoletani e le diverse modalità di comunicazione utilizzate per diffondere le conoscenze scientifiche nella società.

Parole chiave: Comunicazione Scientifica, Divulgazione Astronomica, Astronomi Italiani

Introduction: The circulation of the sciences in Enlightenment Italy

In 1878 the Senate of the Kingdom of Italy discussed a law to allocate funds to purchase a new telescope for the Martian research of Giovanni Virginio Schiaparelli (1835-1910) at the Brera Observatory. During this discussion, the Neapolitan astronomer and senator Annibale de Gasparis (1819-1892) cited the witty answer that François Arago (1786-1853) gave to a lady asking him what astronomy was for: "Madam, astronomy can help bring down the price of sugar" (Senato 1878, p. 657). De Gasparis thus wanted to demonstrate how scientific research can directly benefit civil society, and astronomical knowledge needs to be shared with those who are not scientists using rigorous and impactful communication methods. Francesco De Sanctis (1817-1883), minister of Public Education, praised the astronomer of Capodimonte for giving a speech so high that it seemed to hear the music of the stars of which Pythagoras had spoken and for turning the discussion on a proposed legislation into a scientific party (Taddei 1878).
The dissemination of scientific knowledge, especially astronomical knowledge, has been a goal that astronomers have always faced with great attention and passion. Galilei's works had a broader intent than addressing only contemporary scientists and philosophers. Having chosen a literal form in a dialogic type and the Italian language instead of Latin, his books were also accessible to a large audience of non-specialists. They represented a way to communicate new concepts and astronomical discoveries to a broader audience; today it would be called education and information for the public. The encyclopedic vision of knowledge, typical of the Age of Enlightenment, prompted an acceleration in the communication of science, also broadening the audience to which it could be addressed. An example among many is the *Lettres a une princesse d'Allemagne sur divers sujets de Physique e de Philosophie* published between 1760 and 1762 by Euler.
In the eighteenth century, the debate on the living forces between Cartesians, Leibnitzians, and Newtonians animated the Italian scientific and cultural interest, finding in the Alma Mater and the Institute of Sciences and Arts of Bologna a center for comparison and paradigmatic reference (Cavazza 2013). Central was the role of Francesco Algarotti (1712-1764) in spreading Newton's new concepts of physics and optics even to an amateur audience. In 1737 he published in Naples *Il Newtonianismo per le dame*, a dialogue with a young marquise on physics, optics, and astronomy by the English scientist[1]. Algarotti dedicated his book to Bernard le Bovier de Fontenelle (1657-1757), the intellectual who brought science out from solitary laboratories and libraries of the erudite to introduce it in the circles and the salons for ladies. In the dedication, he emphasized that if "The temple shrine will always be addressed to the ministers and devotees of the deity", the scientific knowledge was to be disseminated

[1] Newtonianism for ladies, a series of lively dialogues on optics, was a milestone in the popularisation of Newtonian philosophy. For a broader understanding of Algarotti's work, his aims, and his experimental methodologies for the cultural promotion of Newtonianism (Mazzotti 2004).

to wider audiences: "The vestibule and other parts of the temple will still be open for the layman" (Algarotti 1737). The work had great success both in Italy and abroad. However, two years later, the book was included in the Index of books prohibited for moral indecency. In 1752 Francesco Maria Zanotti (1692-1777), a convinced Cartesian and pupil of Algarotti, published *Della forza de' corpi che chiamano viva*, a dialogue held in Naples with the main Neapolitan protagonists engaged in experimental sciences and age-old debate, such as Francesco Serao, Niccolò di Martino, Felice Sabatelli and Faustina Pignatelli[2]. The volume effectively testifies to both the different positions and the perimeter within which eighteenth-century science moved, no longer reserved exclusively for theologians and academics. The works tried to voice different experiences and sensitivities, involving men and women from various social and cultural backgrounds and sensitizing a broader interest in new physical knowledge, especially experimental (Schettino 1998).

In Naples, the scientific circle, formed around the collections of Ferdinando Vincenzo Spinelli (1691-1753), Prince of Tarsia, was animated by many Neapolitan scientists interested in conducting experiments on electrical phenomena and making astronomical observations. In Naples, there was no equal attention to the scientific commitment and participation in the debate on "vis viva" for the dissemination of knowledge of experimental physics and astronomy, except for the scientific-encyclopedic volume *Scienza della natura*, published in two volumes between 1774 and 1778 by Giovanni Maria della Torre (1712-1782). The only astronomical information for public use, printed in Naples, was the brief information and ephemeris reported from 1758 in the *Calendario della Corte*, which continued the publication of the *Discorso istorico* printed by some Neapolitan printers starting from 1721. It also contained *L'Almanacco Universale del Commentatore d'Urania, o sia del Segretario delle Zifre Celesti* (Zappella 2001, p.705). The oldest issues of the publication, those of 1721 and 1723, are kept in the library of Società Napoletana di Storia Patria. The volume of 1721 is printed in Milan and Naples and dedicated to Giuseppe Brunassi (1670-1740), Elected of the People[3] and Duke of San Filippo. It was published in Naples in 1723 by the printer Francesco Ricciardo and dedicated to the Marquis Ferdinando Emanuele Alvarez, regent of the Collateral Council.

The Neapolitan Observatory and astronomy for everyone

With the return to Naples of Giuseppe Cassella (1755-1808), scholar of Sabatelli, the volume *Dei principali movimenti e fenomeni de' corpi celesti* was published in 1788. It was the first Neapolitan publication with ephemeris calculated for the meridian of the city, containing scientific information and astronomical data helpful to astronomers and sailors. Cassella also wanted to make this publication "for the advantage of the public and for those who care about the progress of astronomical sciences" (Cassella 1788, pp. V-VI). After the years spent in Padua

[2] Francesco Serao (1702-1783), a Neapolitan scientist and philosopher, was a professor of anatomy and medicine at the University of Naples. He followed the thinking of Descartes. Niccolò di Martino (1701-1769) was a professor of Mathematics at Naples University. He was considered the undisputed leader of the Neapolitan Newtonians. Felice Sabatelli (1710-1786) was a professor of Astronomy at the University and the Navy Academy of Naples. Faustina Pignatelli (1705-1785), princess of Colubrano, was a Neapolitan noblewoman much appreciated by Voltaire and Lalande and had a close correspondence with Zanotti. She participated in the debate that divided the novatores Newtonians from the Cartesians with acute and original reflections of an epistemological nature. She was the second woman admitted to the Institute of Sciences and Arts of Bologna after Laura Bassi (Bottone 2019).

[3] The Elected of the People was a representative expressed by the Neapolitan districts ("Sedili") who participated in the city's municipal government (Tutini 1644).

learning the use of astronomical instruments with Giuseppe Toaldo (1719-1797), founder and first director of the Observatory of Padua, Cassella returned to Naples as a royal astronomer and professor of nautical astronomy at the Academy of Navy and mechanics at the Royal College of Artillery. In 1791, he obtained permission from Ferdinand IV, king of Naples, to realize the Neapolitan observatory at "the building of the disused Royal Studies, intended by His Majesty as the General Museum and Academy of Arts and Sciences" (Gargano et al. 2012, p. 17). The architect Pompeo Schiantarelli (1746-1805) realized the astronomical tower and sundial project. Due to static problems, the Observatory was not built. However, the astronomical calendars redacted by Cassella had a wide echo and diffusion, also obtaining a flattering judgment from the Academy of Sciences, Letters, and Arts of Padua. In 1799 the *Calendario repubblicano per l'anno I della Repubblica Napolitana*, drawn up by Cassella, also introduced the civil and political innovations, including the new constitutions, that the new regime wanted to achieve.

For the support given to the Republica Napoletana in 1799, the professor of astronomy and nautical sciences at the University of Naples, Ferdinando Messia de Prado (1757-1810), was exiled to France. However, with the arrival on the throne of Naples of Giuseppe Bonaparte in 1806, he was first reinstated to the chair and, in 1809, appointed as director of the Astronomical Observatory of Naples, decreed by Bonaparte on 27 January 1807 at the ancient monastery of Naples San Gaudioso in Caponapoli (Capaccioli et al. 2009). In the *Calendario dell'anno 1810 pel Regno di Napoli fatto nell'Osservatorio di S. Gaudioso*, Messia de Prado indicated that the ephemeris had a scientific and civil use peremptorily: "In this calendar, there will be neither predictions nor omens. It is now time to stop deceiving the people with the names of that vain doctrine, which is called Astrology" (Messia de Prado 1809, p. 3). The text marked a further step for Neapolitan scientists to educate in the sciences of the sky and bring more people closer to the knowledge of astronomy. In 1811, Federigo Zuccari (1783-1817), a pupil of Barnaba Oriani (1752-1832) in Brera, was called to the direction of the Observatory by Joachim Murat, king of Naples from 1808, who wanted to give the oldest Neapolitan scientific institution a new and magnificent building on the Miradois hill, not far from the royal palace of Capodimonte. The splendor of the building and the rich and modern collection of astronomical instrumentation also attracted the attention of the nascent Neapolitan periodical press. Thus, the editor of the magazine *Giornale degli annunzj*, founded in 1813, invited Zuccari to give scientific explanations for unusual and ordinary astronomical phenomena seen in the sky. "What is believed to be a new star is none other than Mars" - Zuccari argued - "The people considered it a new guest of the Royal Palace of Urania. When the knowledge to recognize the identity of the same object is lacking, the imagination multiplies it and makes two or more according to appearances" (Zuccari 1813).

In addition to the articles in the Neapolitan newspapers, Zuccari modified the Calendar's structure by introducing a series of "Discorsi", astronomical essays, also of a popular nature, to train and educate a public increasingly interested in astronomical issues. In the five essays he published before his untimely death, Zuccari dealt with the main celestial phenomena, the rotation of the Earth, stellar positions, the measurement of time, and astronomical instruments.

The first astronomical observation, made on the night of 17 December 1819, marked the conclusion of the construction works of the new Observatory. The astronomer Carlo Brioschi (1781-1833) observed the star Alpha Cassiopeiae with a repeating circle of Reichenbach from the eastern dome. The

Fig. 1: Portrait of an Official of the Nunziatella. In the background a terrestrial globe, some books, a geographical map, and a compass. Oil painting on canvas, first half of 19th century, Neapolitan school. Credits: Charterhouse and Museum of San Martino.

king of Naples, Ferdinand I (1751-1825), and the Crown Prince, Francesco di Borbone (1777-1830), were among the first persons to visit the new monumental building. They arrived on Miradois Hill "to see the completed observatory" (Ferdinando I di Borbone 1821) on 28 July and 10 August 1821, respectively. The Observatory became a reference point for astronomical studies and a cultural stronghold for its neoclassical architecture, its panorama, dominating the city and the Gulf of Naples, and the instrumental collection of the highest order in Europe. Intrigued by the beauty of space, Italian and foreign travelers frequently asked Brioschi to visit the Observatory during their stay in Naples and observe the sky with the powerful Capodimonte telescopes. Moreover, some Neapolitan professors, such as those of mathematics from the military academy of Nunziatella, annually took students on educational visits to the Observatory (Fig. 1) (Amante 1831). Already in 1820, the Minister of the Interior, Giuseppe Zurlo (1757-1828), urged Brioschi to define a calendar of biweekly openings of the Observatory for "young people eager to learn astronomy" (Zurlo 1820).

The Cultural Astronomy of Ernesto Capocci

The main Neapolitan protagonist of scientific dissemination activities was Ernesto Capocci (1798-1864). He was a prominent figure in the Neapolitan cultural, political, and scientific life of the first half of the nineteenth century. He was an accurate and open-minded scholar. He looked carefully at the European experiences of the time, combining "the love of beautiful literature... with the worship of science" (Zanella 1880, p. 134). Capocci made a series of editorial initiatives to educate and disseminate scientific knowledge. A precursor of science fiction novels, the astronomer of Capodimonte, was also among the first scientists to translate the astronomical notions of the Divine Comedy into a popular text, explaining Dante Alighieri's profound cosmographic knowledge in a simple and accessible way to all.

Capocci was Zuccari's nephew. As early as 1815, he began to attend the Naples Observatory dealing with meteorological surveys and then observing and studying comets. In 1825 he published his first volume of scientific popularization: *Dialoghi sulle comete scritti in occasione delle cinque apparse nell'anno 1825* (Dialogues on comets written in occasion of the five comets appeared in the year 1825). Presenting the work to the Council for Public Education on 8 December 1825, the typographer Nicola Pitrelli and the royal reviewer Girolamo Pirozzi wrote that Capocci has strived "to raise our minds to greatness with a beautiful method and pleasant expressions" (Capocci 1825, p.88). Under the pseudonym of Noreste, an

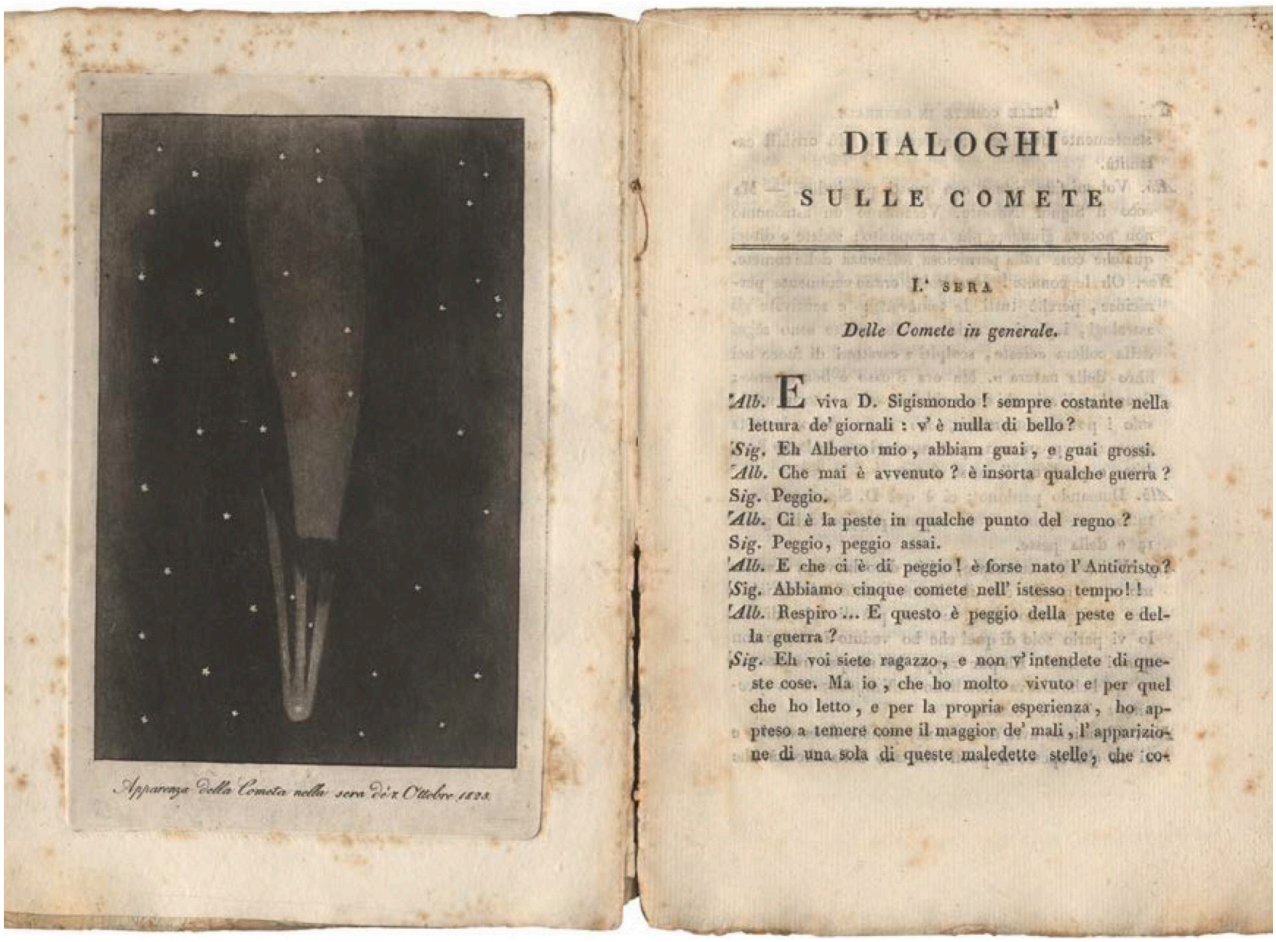

Fig. 2: Engraving of comet C/1825 N1 from *Dialoghi sulle comete* by Capocci (Naples, 1825). Capocci began to observe it from the Capodimonte Observatory on the night of 25 August, calculating its orbital parameters some days later (Notizie 1825). The comet was intrinsically very bright, reaching magnitude 2-3, and had an exceptionally long period of visibility to the naked eye. In Capocci's observation of 7 October, the comet's tail appeared "divided into three branches: the two lateral ones were unequal in length, and so encircled the nucleus, which seemed to form a parabola, in whose focus was the nucleus. The third branch, the main one, stood out in the middle of the other two with more intense light... After a few days, these branches merged into one" (Capocci 1825, pp. 30-31). Giacomo Leopardi also observed this comet as a letter to his brother testifies. Credits: Private collection of Maurizio Capocci, the descendant of the astronomer.

anagram of his name, Capocci took as a pretext the discussion that arose in a coffeehouse on the five comets[4] seen in Naples to explain to two gentlemen those celestial phenomena and the scientific knowledge of the time on the comets, simple and effective way (Fig. 2). Capocci wrote in the preface of Dialoghi: "The many chatters that I had to hear in this regard... the desire to break down prejudices, unfortunately still common, and to spread the taste for astronomical things, unfortunately still a pilgrim, led me to publish them... They are adapted to the ordinary intellect to make them acceptable... on the other hand, they contain everything a scholar could wish to know about comets" (Capocci 1825, p.1).

[4] The five comets that appeared in 1825 are c/1825 K1, C/1825 N1, C/1825 P1, 2P/Encke, and C71825 V1. The comet c/1825 K1 was discovered by Jean Félix Gambart (1800-1836) on 19 May at the Marseilles Observatory in the Cassiopeiae Constellation. C/1825 N1 was discovered by Jean Louis Pons (1761-1831) on 15 July from a Lucca bell tower in the Tauri Constellation. C/1825 P1 was discovered by Pons on 9 August from Florence in the Aurigae Constellation. 2P/Encke, named Encke comet or the comet of the ready return, was predicted by Johann Franz Encke (1791-1865) and observed by Benjamin Valz (1787-1867) in Nimes on 13 July in the Tauri constellation. C71825 V1 was discovered by Pons in Florence on 7 November in the Eridani Constellation (Kronk 2003, pp. 69-80).

In dialogue with Alberto and Sisgimondo, Noreste explained the general advantages of astronomical studies in other fields such as physics, meteorology, mechanics, navigation, and geography. The scientist argued that "astronomy saves the ignorant from the fears inspired by the sight of an eclipse or a comet". Therefore, "astronomy must be highly esteemed in a civilized kingdom, and an observatory is of the utmost importance". To Alberto's objection, who argued that the knowledge achieved by astronomy is sufficient for the needs of society, and "the observatory is rather a luxury thing ... and not at all necessary", Noreste replied that "people can do without everything, even macaroni!". Finally, the astronomer stresses that "if astronomers wanted to think about their own business, they should reconcile themselves with Astrology and credit it with the common people, making every effort to extend the empire of this arcane science" (Capocci 1825, pp. 48-50). Capocci seemed to want to resume Messia de Prado's introduction to the Calendar of 1810.

After having experimented with the way of the historical novel, by publishing in 1839 *Il primo viceré di Napoli* in which Capocci narrated the chivalrous events of the challenge of Barletta, the Capodimonte astronomer conceived in 1845 *Annuario del reale Osservatorio di Napoli* (Almanac of the Royal Observatory of Naples), a publication intended to broaden the spectrum of scientific information also to sciences related to astronomy. In Capocci's intentions, the volume of an encyclopedic type was "destined to go to everyone's hands... both for the improvement of the mind... and practical uses" (Capocci 1845, p. 3). The astronomer proposed wide dissemination of astronomical, meteorological, geographical, and statistical knowledge, making them simple and accessible. The publication, however, was short-lived, printed for only two years. During the decade in which he ruled out the scientific activities of the Observatory for the support given to the liberal uprisings of the Risorgimento, Capocci devoted himself with greater intensity to literary studies and initiatives for the dissemination of astronomy and scientific culture (Capaccoli et al. 2009). In 1853 he published *Quadro del Sistema planetario solare* (Plate of the solar planetary System), a graphic plate with the physical parameters of planets, comets, and asteroids "for the education of youth and to aid memory". The panel enjoyed great appreciation, including that of Angelo Secchi (1818-1878), director of the Observatory of the Roman College, and a good sales success, so much so that the publisher asked Capocci to write a user manual for explaining the scientific contents of the "lithographed sheet with great skill" (Capocci 1853, pp. 1-2). He published a broad erudition work three years later, *Illustrazioni cosmografiche della Divina Commedia* (Cosmographic description of the Divine Comedy), a volume of notable cultural impact on literature and the popularization of science. It brings out simply Dante Alighieri's profound astronomical knowledge, which emerges in a long sequence of triplets distributed in the three Cantiche. Distinguished and well-known scholars and scientists dedicated academic essays to the study of the astronomical elements present in the poem of Dante, including the date of the journey to the Christian afterlife. Pisa's young and promising mathematician, Galileo Galilei (1564-1642), stands out among many scholars. In 1587 he held two conferences at the Florentine Academy *Around the figure, place, and dimension of the hell of Dante*. With scientific accuracy and poetic grace, in crossing the three otherworldly realms, Capocci set himself a different goal: to make all the astronomical references described by Dante popular and recognizable by anyone, even "by those who are not profound analysts". Aware of the excellent task and the work: "it is not an undertaking to be taken lightly", Capocci structured his celestial journey in a dialogical form accompanied by Beatrice, an

attentive reader of Dante, who confided to the astronomical guide that "she had never been able to understand what those lines of the poem that speak of astronomy mean. I am amazed" - Beatrice argues - "how no Italian astronomer has ever thought of studying specifically and clarifying the true meaning of such enigmatic passages of the Poem" (Capocci 1856a, p. 1; Olostro & Gargano, 2015).

A year passed, and Capocci began a new literary adventure. Anticipating the publication of Jules Verne's novel *De la Terre à la Lune* eight years later, Capocci became the forerunner of the literary vein of science fiction. In fact, he published in 1857 *Relazione del primo viaggio alla Luna fatto da una donna l'anno di grazia 2057* (Report of the first journey to the Moon made by a woman in the year of grace 2057). It is a refined story by the Neapolitan scientist conceived through the report of the astronaut Urania (Olostro & Virgilio 2001). Accompanied by the astronomer Arturo and the crew of the balloon Giordano Bruno, she wrote, just "happily arrived and settled in this delightful part of our small earth system!" (Capocci 1857, p. 1), about his journey to his terrestrial friend: Ernestina. Capocci's pamphlet, in its essentiality of 22 pages in 16°, is inherent as a work in which the scientist's astronomical knowledge and the extraordinary ability to predict modalities and needs emerged. Only astronomy and engineering that emerged in the twentieth century had to and knew how to face. The Journey to the Moon by Capocci attracted the attention of mid-nineteenth-century readers to the unprecedented challenges offered by the new astronomy and new industrial technologies. At the same time, the story intrigued and interested the public for research and studies on the Solar system in which the astronomer Annibale de Gasparis was one of the main protagonists of the time. The long series of planetary discoveries made by the Capodimonte Observatory allowed de Gasparis to make the sky of Naples "the favorite garden of asteroids" (Gargano 2023, p. 3).

To his intense literary production, Ernesto Capocci added a fruitful collaboration with Neapolitan newspapers and magazines, such as *Il Nomade*, *Lucifero*, and *Poliorama Pittoresco*, to name just a few. Like his uncle Zuccari, Capocci took up every hint given by discoveries or surprising celestial phenomena to divulge astronomical knowledge. He wrote about the formation of the asteroid belt between Mars and Jupiter, comets, the phases of the Moon, and eclipses. In particular, Capocci published in 1856 the article: "Il più grande cannocchiale del mondo" (The biggest telescope in the world) in the magazine *Il Nomade*. He dwells on the technical innovations that make it possible to obtain increasingly powerful scientific instruments, like the 182 cm Leviathan telescope constructed in 1840 by Lord Rosse, William Parsons (1800-1867) at Birr in Ireland, and on the need to combine economic, public and private, and scientific efforts. Then Capocci proposes the construction of an international "Cosmic Observatory" in the Peruvian Andes to carry out new research and discoveries "inside the nebulae or in the valleys of the Moon, or the holes of the solar photosphere" (Capocci 1856b, 1856c). This idea took shape a hundred years later, when the astronomers Walter Baade (1893-1960) and Jan Oort (1900-1992) thought, in the spring of 1953, to establish a large observatory shared between their two countries. The following year, astronomers from six European countries signed a declaration to establish a European observatory in the southern hemisphere, in the Chilean Andes. This scientific decision was followed by the ESO agreement signed by Belgium, Germany, France, the Netherlands, and Sweden on 5 October 1962. Italy's entry into ESO took place only on 24 May 1982, due to the decisive role played by Franco Pacini (1939-2012), a Florentine astronomer who had led ESO's scientific division since 1975. Thus, 126 years after Ernesto Capocci launched the farsighted idea, Italy officially became a member of the most important international organization in the astronomical

field (Blaauw 1991).
On the death of Capocci in 1864, Annibale de Gasparis was appointed director of the Capodimonte Observatory. He was a famous astronomer throughout Europe for discovering nine asteroids; the last discovery was Beatrix in 1865, the asteroid dedicated to Dante Alighieri. De Gasparis made every effort to upgrade the Institute and gave new impetus to meteorological and geomagnetic measurements. Although he was a pure celestial mechanic, he broadened the scientific horizons of the Observatory towards astrophysical studies of the stars, supporting the foundation of the Society of Italian Spectroscopists, the first scientific society dedicated to the new science (Chinnici 2008). The political role of Gasparis and Capocci, both senators of the Kingdom, in the new Italian institutions resulted in a partial renewal of the scientific instruments of the Neapolitan Observatory.
The role of de Gasparis in disseminating astronomical research and discoveries made at Capodimonte was very different from that of Capocci. While his teacher had published volumes and articles to popularize astronomy, de Gasparis was the protagonist of poems and literary works on his planetary discoveries. This is documented by the poems of the magistrate Giovanni Chiaia (1799-1888), the poetess Giovanna Milli (1825-1888), and the Rieti canon Giovambattista de Santis, as well as the dedications of Angelo de Meis (1817-1891) and the prince of Marano, Vincenzo Caracciolo. Recounting de Gasparis' discoveries in verse and prose, these works testify to his unanimously recognized scientific value. Even the humorous newspapers of the time, such as *Arlecchino*, *Il lampione*, and *Il Palazzo di Cristallo*, wrote joking and burlesque articles on de Gasparis and his discoveries. Thus, the astronomer became the protagonist of enigmatic games or indicated as Minister of Foreign Affairs jointly with Plato as Minister of Education and Giuseppe Verdi as Minister of Navy (Gargano 2023).

The social astronomy of Azeglio Bemporad

With the arrival at the direction of the Capodimonte Observatory of Azeglio Bemporad (1875-1945), the initiatives to disseminate astronomy received a further new stimulus. Bemporad was an astronomer with an international background. After graduating from the Scuola Normale in Pisa in 1898, he first became an assistant at the Turin Observatory and then, from 1900 to 1903, at the Astrophysical Observatory Potsdam and Heidelberg-Königstuhl Observatory in Germany, where he collaborated with Max Wolf (1863-1932) taking an interest in celestial mechanics. In 1904, Bemporad became an astronomer at the Astrophysical Observatory of Catania, continuing practical-theoretical research in astronomical refraction and the photometric curves of some variable stars. Furthermore, he was involved by Annibale Riccò (1844-1919), director of Catania Observatory, in the extraordinary project of "Carte du Ciel". His patient measurements and reduction of over 4000 plates made it possible to obtain the positions of 174,107 stars, published in the *Catalogo Astrofotografico per la zona di Catania* (Astrophotographic Catalog for the Catania area) in 64 issues between 1907 and 1942 (Chinnici 2022).
In 1912, he was appointed as director of the Observatory of Capodimonte, where he continued to reduce data of the photographic plates taken in Catania. A convinced supporter of the New Astronomy: Astrophysics, Bemporad had to fight against the Neapolitan scientific environment still tied to the traditional studies of position astronomy. In addition to addressing the scientific activities of the Observatory toward stellar astrophysics, he encouraged the presence of pupils and students in Capodimonte to facilitate school teaching. In 1915, he wrote to Bruno Cotronei (1863-1937), superintendent of the schools of Naples, asking him to solicit "the professors

of physics in the high schools and technical institutes of Naples to lead their students to visit the observatory at least once a year to have an idea (clearer than they can learn from books) of those elements of astronomical geography that form an essential part of the physics program... very unknown to the teachers themselves" (Bemporad 1915). Despite the difficult period of war, due to the partial occupation of the Observatory by military engineers to position lookouts, spotlights, machine guns, and cannons in anti-aircraft function, the schools arrived in Capodimonte to attend didactic lessons of Bemporad and other astronomers of Capodimonte. In addition, many citizen groups and some associations, both Neapolitan and not only, requested visits, observations, and meetings at the Neapolitan observatory. In 1916, Bemporad also wrote to Melania D'Abro Pagratide (1857-?), Inspector of the Regina Elena hospital and the Carminiello territorial hospital of the Italian Red Cross, inviting her to "lead the convalescent soldiers in small numbers (15 or 20 to maximum) to visit this Observatory [to] show Venus… the spots of the Sun… with explanations proportionate to the average of the cultural level of the military". In the letter, Bemporad stressed that about 5,000 convalescent German soldiers had visited the Heidelberg Observatory in 1915: "As usual, therefore, we arrive late, but always on time since the war is far from over" (Bemporad 1916). With the conclusion of the First World War, the appointments in the Observatory with schools (Fig. 3), associations, groups, and astronomy enthusiasts had a substantial increase in the belief that the Observatory also had a moral and social function. Bemporad wrote in a letter that a lady "told me that the Brera Observatory in Milan is strictly forbidden for the public to enter the evening visits. Here too, it was before my arrival. I wanted to change the rules because the government manages the Observatory, and we all pay taxes!" (Bemporad 1927).

Fig. 3: Visit of the Royal School for Women "Eleonora Fonseca Pimentel" of Naples during the Festival of the Trees on 26 April 1929. In the foreground is Azeglio Bemporad, who gave an outdoor lecture for the students. Credits: ASOC, *Album Fotografico*, 1

Social communication of astronomy for generations YZA

In 1989, CERN in Geneva tested a new protocol for data communication: HTTP. It was an effective way to transmit and share experimental data and scientific results. As this technology has become accessible to everyone for free, how people interact on a global scale has also changed. First, the hypertext sites, then the thematic blogs and search engines, and nowadays the vast and varied social media ecosystem has transformed the traditional way of accessing information. The communication and dissemination of scientific knowledge have also found new and more direct ways to address the public. Researchers involved in these activities have experimented with new approaches to train and educate children born between the end of the last century and the first decades of the

third millennium: Millennials, Zoomers, and Generation Alpha.

The digital ecosystem plays a significant role in disseminating scientific knowledge and the most relevant results in the different fields of the STEM (Science, Technology, Engineering, Mathematics) disciplines. Vast literature and proven effectiveness of its use have led to the development of an articulated science of communication that allows scientists and science communicators to build effective strategies to reach different types of users, also modulating the type of content they intend to circulate (Fontaine et al. 2019).

The long and incisive tradition of the Naples Observatory in teaching and scientific communication, briefly described in the previous sections, has allowed the Capodimonte astronomers to adapt the dissemination of astronomy to the new ways of disseminating information, balancing the scientific rigor of contents and communicative effectiveness. In the middle of the second decade of the third millennium, the Neaples Observatory opened its social channels on Facebook, Instagram, YouTube, Twitter, G +, and Flickr platforms. Later, it focused its communication on the first three social media platforms. The constant interaction with users, the publication of scientific content that arouses curiosity and interest, and the promotion of educational activities and multidisciplinary initiatives have allowed the social pages of the Capodimonte Observatory to grow steadily over time. In addition to the traditional credibility and reliability of the research conducted by the oldest scientific institution in Naples, the social pages offer users and astronomy enthusiasts a clear and compelling tool to interact directly with researchers.

From the data collected on 25 May 2024, the Facebook (Fb) and Instagram (Ig) pages of the Observatory of Capodimonte have 22821 and 3080 followers, respectively, while the YouTube channel (Yt), essentially dedicated to sharing the scientific seminars, interviews and public conferences, has 599 subscribers. Comparing that performances with similar pages, which have 5.300 (Fb) and 1.600 (Ig) followers on average, these numbers make the Capodimonte Astronomical Observatory the research institute by far the most followed among all the departments of the National Institute for Astrophysics, of which the Observatory is part. The Fb page of Capodimonte Observatory has about 25% followers of the INAF page and 3 times that of Cagliari Observatory. Moreover, it has also more followers than all the institutes of the Italian research bodies present on social platforms. Even the coverage of the contents proposed on the Observatory's social pages indicates numbers of constant and growing attention. In the period 25 May 2021-24 May 2024, the pages covered 1.127.358 (Fb) and 13.454 (Ig) people, while in the period 5 March 2012-24 May 2024, the contents of the Yt channel were viewed by 209.985 users. Even the audience of followers on the Fb and Ig platforms shows a distribution that indicates a strong interest in the content offered in the age groups between 25 and 45 years, with a prevalence of female audiences, 62% (Fb) and 60% (Ig). Based on the kind of communication and audience, it is possible to estimate potential followers to grow to 37600.000 - 44.200.000 users.

Despite having a distinctly local diffusion, the social pages of the Naples Observatory intercept followers from many other Italian cities and, albeit with small percentages, reach the interest of users residing in other European countries (e.g. 0.5% United Kingdom, 0.4% Franch, Germany, and Spain on Fb and 0,6% Spain, 0,4% Franch, Germany on Ig) than in other continents (e.g. 0.2% United States on Fb and 0,4% Brazil on Ig). The analysis of the posts, which range strictly from scientific topics to astronomical phenomena and social events, also shows how broad the interest of social media users is. The astronomical posts on Facebook with the most impressions are the photo of a shining spring full Moon (26

Fig. 4a: The Golden Moon of 26 May 2021 rose from the slopes of Vesuvius in the most viewed post of the Capodimonte Observatory ever. The photo, taken by the astronomer of Naples Enrico Cascone, was also published by other social pages, such as those of the US Consulate in Naples and Scabec, reaching over 200 thousand fb users.

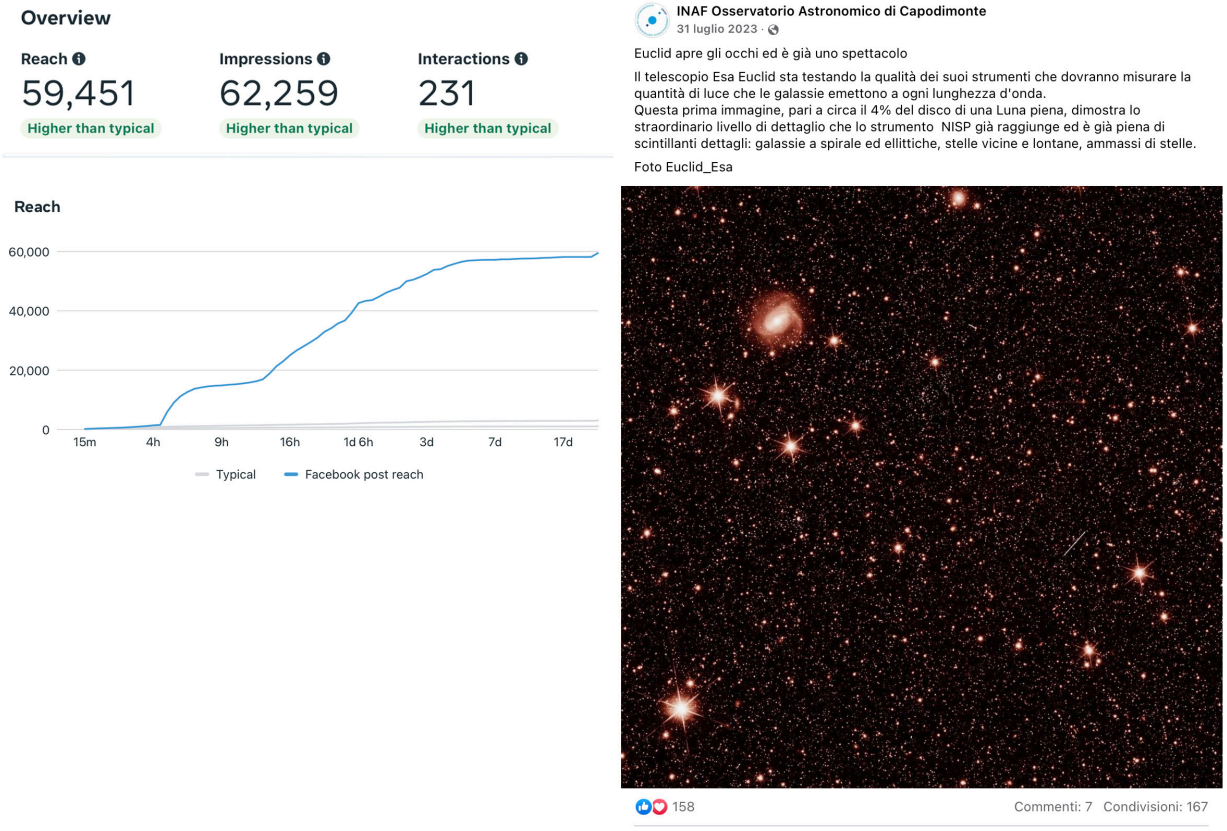

Fig. 4b: "Euclid opens his eyes and it's already a spectacle" is the title of the Fb post about the first light of the Esa space telescope. The post reached about 52500 people in three days.

Fig. 5: A well-attended scientific conversation by Margherita Hack held in the Auditorium of the Capomonte Observatory on 2 September 2003 on the occasion of Red Planet Night; Mars had reached its minimum distance from Earth, approximately 55.7 million km. Credits: Astronomical Observatory of Capodimonte.

May 2021) seen by about 97500 people (fig. 4a), and the first image of the European space telescope Euclid (31 July 2023) with 59.387 people reached and 62.211 visualizations (fig. 4b). But the post with the most impressions and visitors on the Observatory's Fb page is related to a dramatic social event: the death of a promising young musician, killed by a 16-year-old during a parking dispute (1 September 2023) with 658.285 people reached and 691.042 visualizations. On the Observatory's Ig page, however, the first three posts concern the European Researchers' Night (24 September 2023), the late tribute to Piero Angela (13 August 2022), and the official assignment of the new director of the Observatory (12 January 2024), with 1914, 1874, 1557 impressions respectively (data from Meta insight @oacn.inaf).

The interest in astronomical topics on social platforms will certainly not replace the curiosity to look at the sky with a telescope, take a lesson at the planetarium, and explore the museum and ancient library collections. Nevertheless, social communication acts as a multiplier effect. The increasing number of followers on social media is associated with a growing request to visit the Observatory. It is testified by the over 6000 students who participated in the educational activities, the three monthly dissemination and cultural initiatives attended by 250/300 people per evening event (Fig. 5). In the pandemic period, a large turnout of visitors to the *Stelle di Re* (Royal stars) exhibition[5], in 2021. Added to this is, the vast echo of the scientific themes presented in the radio program: *Notizie dallo Spazio* (News from Space), broadcast live weekly on a local radio since September 2020, and the collaboration with the Bellini Theater in Naples, from 2023, with the column *Il cielo sopra il Bellini* (the sky over the Bellini) in *The Belliner* magazine, in which astronomers write about peculiar and engaging astronomical topics, demonstrate that, in summary, the stars and astronomers of Capodimonte continue to be unbeatable influencers.

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[5] In addition, a virtual exhibition was also created (available at: http://stelle-di-re.inaf.it), and the catalog *Stelle di Re* (Napoli, 2021) and the manuscript of the poetess Giuseppa Guacci (1807-1848), wife of the astronomer Antonio Nobile (1794-1863): *Lettere di Michelangelo al padre: ovvero la celeste dottrina dell'astronomia*, (Napoli, 2021) were also published.

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