IL NUOVO CIMENTO **49 C** (2026) 217
DOI 10.1393/ncc/i2026-26217-x

COMMUNICATIONS: SIF Congress 2025

Forgotten makers of progress: Rediscovering J. G. Hofmann's legacy in the dialogue between science and technology

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received 16 January 2026

Summary. — In 2024, at the Deutsches Museum, I had the opportunity to study a "mystery" instrument crafted by a certain J. G. Hofmann, an optical instrument maker active in nineteenth-century Paris. That work sparked research that led me to reconstruct Hofmann's life and work. Hofmann was internationally celebrated in his time and his instruments can be found in several of the world's most prestigious collections. Indeed, his devices were appreciated by renowned scholars and employed in major scientific expeditions, such as the Italian mission to Sicily for the 1870 solar eclipse and that to Muddapur, led by Tacchini, to observe the 1874 transit of Venus. This paper provides a telling example of how stories like Hofmann's underscore the essential interplay between science and technology, where scientific instruments extend human perception, while new discoveries drive the invention of more refined tools. This mutual reinforcement drives innovation forward, in a virtuous cycle. Reflecting on Hofmann's role thus sheds light on the ongoing dialogue between science and technology —a dynamic partnership that pushes the boundaries of knowledge and shapes human understanding.

1. – Introduction: a little-studied instrument maker

The origins of this study date back to about two years ago, when I was asked to analyse a "mystery" object at the Deutsches Museum in Munich, with the task of reconstructing its biography [1]. The object was a small monocular instrument —essentially a rangefinder— dating to the mid-nineteenth century. What rendered it particularly enigmatic and challenging, however, was its maker: a certain J. G. Hofmann, based in Paris, whose initials were engraved on the instrument. Although his name is known among specialists, his biography and professional activity has never been systematically reconstructed.

Consequently, the question "Hofmann, who was he?" became a Manzonian-style inquiry that aroused my curiosity. This marked the beginning of the present research. Starting in Munich, I consulted the collections of numerous museums, examined the archives of several institutions, searched through contemporary books, articles, and periodicals, and even contacted private collectors. The investigation soon expanded well beyond its initial scope. It led me from Munich to Paris, Dortmund, Coimbra, Padua,

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Rome, New York, Saint Petersburg, and many other locations, enabling me to gather extensive information on Hofmann and to identify over 110 instruments attributed to him, now dispersed across Europe and the United States.

I would not be able to provide in four pages a comprehensive account of the biography of Jean George Hofmann (1823–1892) [2], a German-born maker of optical instruments who was active in Paris during the second half of the nineteenth century. However, in this paper I will try to show how Hofmann was, in his own time, one of the most prominent and highly respected figures in his field, alongside renowned French instrument makers such as Chevalier, Pellin, Duboscq, and Lerebours & Secretan.

2. – Reconstructing the life and work of J. G. Hofmann

Indeed, from the documents collected, it becomes clear that Hofmann crafted numerous high-quality instruments, both by making "standard" devices and improving existing instruments, as well as by creating new ones. This is evident from the letterhead of his shop [3], where he listed several perfected instruments —for example, his magnificent *chambre claire*, *i.e.*, camera lucida— and fifteen inventions of his own —such as the *lunette bi-prismatique sans tirage*, literally, prismatic telescope without draw, used by Napoleon III during his Italian campaign in 1859. His expertise earned him awards at the International Exhibition of London (1862) and the Exposition Universelle of Paris (1867) for the excellence of his prisms and polarizing crystals. Moreover, the University of Freiburg conferred upon Hofmann an honorary Doctor of Philosophy degree on 16 January 1875 for his great merits in optical physics [4]. Last but not least, Hofmann's name appeared in an article published in *Nature* in 1878, in which an improved version of the camera lucida produced by the Paris-based instrument maker was presented [5].

Furthermore, he was entrusted with the construction of innovative instruments by several prominent scientists of the time, such as Janssen, who commissioned him the first examples of his "pocket spectroscope" [6], and Wild, who tasked Hofmann with creating the initial models of his polaristrobometer (especially in its portable, handheld version) [7]. The latter functioned as a polarimeter, saccharimeter, and diabetometer, making it essential in an era when insulin had not yet been discovered and the food industry —thanks to the spread of sugar beets— was beginning to engage in the large-scale production of alcoholic beverages and sugar-containing products, striving to ensure consistent and high-quality standards. Several of Hofmann's instruments achieved commercial success, including his direct-vision spectroscope, Wild's polaristrobometer (sold in large numbers), and the same rangefinder mentioned at the beginning of this paper —called *longue-vue militaire* or *lunette-cavalier*—, which was probably the first prism telescope made in series, with approximately 1000 specimens made by Hofmann. Such widespread recognition also led to some drawbacks. Indeed, Hofmann's devices "received the honours of counterfeiting" and that was why, as recommended, "No instrument should be accepted if it does not bear the signature and address of Dr. Hofmann."

3. – Hofmann and the scientific community

His craftsmanship was highly sought after by the leading scientists of his time — including Huggins, Secchi, Babinet, Stoney, and Ångström— who relied on Hofmann's instruments for their research and discoveries. For example, regarding the direct-vision spectroscopes built by Hofmann, it was written that:

> A [superior] form of the instrument has been contrived by Hoffmann [sic], of Paris, the very able constructor to whose skill the investigators of the higher

> optics have been so much indebted, and who has furnished to Father Secchi and to Mr. Huggins the instruments which have enabled them to prosecute so successfully the spectral analysis of stellar and nebular light [8].

Moreover, in March 1863, the Irish physicist and astronomer Thomas Romney Robinson strongly recommended Hofmann's spectroscopes to William Parsons, 3rd Earl of Rosse, for his studies in stellar spectroscopy [9]. And Secchi, in a letter sent to Hofmann, wrote: "Your pocket spectroscope has been received very positively here. Mr. Angiglioni, an optician in Rome, wishes to purchase half a dozen of them" [10]. Again, in another message, he stated: "Your prisms are excellent; all those who wish to study the spectra of stars will need to use them" [10]. And, in a third dispatch, he declared:

> I am still waiting for your spectroscope [...] . It is impossible for me to obtain such good ones elsewhere. I want it to be as perfect as the one Mr. Morren showed me in Marseille, which is remarkable [...] . I tested your spectroscopic prism with the large telescope at the Paris Observatory; it did not fail to prove its quality. So please hurry, and make me one of those beautiful works that you know how to create [10].

Words almost verging on adulation... yet indicative of Hofmann's exceptional skill.

4. – Hofmann's instruments in the service of spectral astronomy

Finally, through his instruments, Hofmann contributed to two of the most significant astronomical undertakings of the second half of the nineteenth century, both closely connected with Sicily and Palermo. In 1870, the Italian National Commission —following the suggestion of Secchi— commissioned Hofmann to construct a direct-vision spectroscope for the scientific expedition to Sicily organized to observe the total solar eclipse of 22 December of that year [11]. According to Giuseppe Lorenzoni —assistant to Giovanni Santini at the Padua Astronomical Observatory—, this instrument (judged excellent by him) enabled the observer to "clearly distinguish the two components of the D line and nearly all the lines shown in Van der Willigen's map." For the first time after the unification of Italy, a group of Italian scientists worked together in a coordinated effort, gaining substantial experience in the field of astronomical spectroscopy, which had until then been little developed in the country. As a result of the scientific achievements obtained, the Society of Italian Spectroscopists was founded in 1871. This was the first professional association specifically devoted to physical astronomy —a field that would later become more widely known as astrophysics— and it promoted the publication of the first *Memories* dedicated to this discipline. The journal was published in Palermo in 1872 by Pietro Tacchini, then adjunct astronomer at the Palermo Observatory —which at that time was equipped with some of the finest astronomical instrumentation available in Italy and beyond. The scientific reports produced were of such a high standard that they enabled Italy to distinguish itself and to attain international prominence in physical astronomy research. This success led to the foundation of the Royal Observatory of Catania —the first in the Kingdom of Italy devoted to physical astronomy— and to the establishment, at the University of Catania, of the world's first academic chair in astrophysics.

After the 1870 expedition, the instrument was acquired by the Padua Observatory and, in 1874, was used by Antonio Abetti, a member of the Italian scientific expedition led by Tacchini that successfully travelled to Muddapur, India, to observe one of the rarest astronomical events: the transit of Venus across the solar disk [12], which occurred on 8–9 December 1874. As Abetti later reported,

> The instrument I used is an excellent direct-vision spectroscope by Hofmann, coupled with the Starke[–Mertz] equatorial telescope of the Padua Observatory, whose objective has an aperture of 117 mm and a focal length of 1.65 m. The entire system was employed in all the spectroscopic observations carried out here [13].

5. – Conclusions: instrument makers and the science-technology dialogue

Certainly, Hofmann cannot be considered a "scientist". However, without a doubt, he was a brilliant craftsman, and his manual skill and talent significantly contributed to the technological progress of his time. In this sense, Hofmann's story offers an extraordinary opportunity to reflect on the profound connection between technology and science. Indeed, his instruments enabled important advances in several fields —including polarimetry, spectroscopy, and astronomy— while the evolving needs of researchers stimulated the development of increasingly refined optical devices. This case provides valuable insight into how scientific progress has often relied on the expertise and ingenuity of instrument makers, whose work made new forms of observation and measurement possible.

As Hofmann himself wrote to Secchi in 1872, "While leaving to the scientist the glory of the experiments and discoveries, it nevertheless seems to me that [...] to leave the humble instrument maker entirely in obscurity [...] [would not be altogether just]" [14]. Therefore, alongside the great scientists —whose importance is in no way diminished— due recognition should also be accorded to those craftsmen and instrument makers (often overlooked) who provided scholars with the devices necessary for their research. From my perspective, Hofmann is undoubtedly one of them.

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