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The Role Of The History Of Science In The Understanding Of The Concept Of Light

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Abstract

Today and in an educational dimension, the history of light plays a key role in teaching modern sciences of matter. Whether it is a discipline involving molecules, atoms, particles, elementary particles ... (usually matter and energy), the learner is primarily interested in the mechanism of a theory and mathematical proofs rather than the origin of the theory in question or why it was discovered, where and when. Returning to these historical facts could solve some learning problems of phenomena intimately tied to the concept of light. These problems are most likely related to the deliberate negligence of their history in the educational process. Indeed, teaching the history of science would only make science friendly. The work we have done describes the evolution of the concept of light and its interaction with matter as a factor of technological innovation from antiquity to the middle of the 20th century. This period is a testimony to the true development of spectroscopy we know today.

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1. Introduction

The progress achieved in spectroscopy today is a series of reflections, philosophical thoughts and intense research work carried out since the time of Aristotle on the concept of "light", but also intellectual conflicts on the validity of certain theories, the authenticity of the authors and the questioning of the dates associated with several discoveries due to the death of the author before the publication of his work. Spectroscopy is a sprawling science because its

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historical development, closely linked to that of light and matter, is embedded in the development of multiple disciplines: astronomy, astrophysics, sciences of matter, optics,... In fact, a step is taken whenever the matter and the light interact reciprocally or matter-radiation in general. Otherwise, the bibliographies incorporating the historical line of light concept in general are not very common.

2. Problem statement

Light emerged almost non-existent to the observation, and then passed to the consideration, evolving in a context of worship and sublimation, to reach that of scientific development and finally the concrete and material exploitation. Progress seen in light related sciences urges us to look at how this simple and intangible fact may become in the course of its history a factor in technological innovation? The answer to this question leads us to understand the role of the history of light in the progressive and practical understanding of its scientific concept.

3. Purpose of study

The work we carry out is set to highlight a way to better understand the evolution of the concept of light and its interaction with matter from history and thus understand this paradoxically abstract and concrete concept. This trend started from antiquity to the middle of 20th century when it became a factor of technological innovation, which reflects the real time development of spectroscopy that we know today.

4. Background

4.1. General background: Understanding a scientific concept from its history

The history is itself, that is to say, it is the beginning, the start, the home, the source and inspiration. Epistemology for its part, as defined by Piaget, is "the study of the constitution of valid knowledge" (Piaget, 1967, p. 6), which will evolve after into a social constructivist vision. It is also a scientific culture "which is a set of knowledge and skills in science and technology that citizens and society make their own and use" (Council of Science and Technology, 2002). Khun insinuates that the history and epistemology, used to approach effective science, are indistinguishable. Indeed, we cannot speak about science learning if its history does not exist, and we cannot talk about effective learning of science if it is not approached from epistemology and history. To reconcile with the teaching of science, we remind, that around the 80's, science had adopted epistemology for the critical study of scientific contexts and thus the reflection on knowledge and inevitably its history.

4.2. Specific context: Understanding the concept of light for its history

In developing the historical steps through which light passes, we find ideas that could considerably influence the world of science if they had been interpreted in their times, starting with the theory of mock emitted by Lucretius more than 2050 years ago, which was later banned by the theory of vision of Ibn Al Haytham. However, it is now considered the first implicit hypothesis of the electronic transition, a fundamental principle of spectroscopy. At the end of the first century, Heron described in the shade the first laws of reflection more than six centuries before they were formalized by Shell and Descartes. Discoveries also by Harriot discreetly again after his death. These discoveries in physical optics immediately influenced reflections on the nature of light, the main concern of physicists and chemists since the second half of the 17th century. At this time, the brilliant theory of Huygens on the wave aspect of light, known as the ancestor of quantum physics, has been eclipsed by that of Newton, supported by the popularity of its author defending a particle nature. It was not until the arrival of Louis de Broglie in the 20th century that the two theories were reconciled through his postulate on the wave-particle duality. Discoveries succeeded after leaning towards the study of the absorption of light by matter and interference phenomena, the invention of the spectroscope, the implementation processes to capture light (photography) then the coupling of spectroscope and telescope which opened a new field of study in the analysis of celestial bodies. In the 20th century, interest in the light lead to countless achievements resulting from the quest for chemical elements by spectral

analysis, followed by the identification of the various forms of light which, during this revolutionary period, took the name radiation.

5. Methods: Literature review

History of light is so old that written documents tracing its lineage were hard to find, and which inform about dates and authors of the discovery, sometimes different from one book to another. The analysis of hundreds of writings: books and articles, ancient and recent in English, French, German and even Latin enabled us to trace the historical path of the light from a single visible and intangible phenomenon to an important lever in technology.

6. Results

From massive literature search we can subdivide the birth and history of light, essentially related to spectroscopy, in four periods marking its evolution until the middle of last century: - Period of optical physics: Translation of the concept of light from the abstract to the concrete

- ✓ Period of spectroscopy prism or diffraction grating: study of light phenomena and their appearances
- ✓ Period of atomic spectroscopy: Development of spectroscopic instrumentation in the analysis of the macroscopic and microscopic matter
- ✓ Period of the Fourier transform spectroscopy: Advanced spectroscopic techniques by computer analysis The findings were reported in the form of summary table

Table 1. Chronology of light

Chronology	Fields and disciplines	Light / radiation	Matter	Interaction
-3 centuries	Linear optical	Theories of vision		Philosophical reflection on the phenomenon of "light"
Before the beginning of the 1st century	Physiological optics	Eye vision		Study of the eyeball by assimilation to optical diopters
1st century	Geometrical optics	Laws of reflection and refraction		Behavior of light
2nd half of the 17th century	Wave optics	Wave and particle theories of light		Debate on the true nature and physical appearance of the light
Early 18th century	Laws of spectroscopy	Beginnings of the absorption and emission spectroscopy		Interaction between matter and radiation
Early 19th century	Spectrochemistry and astrophysics	Celestial radiation		Reflection of the celestial bodies from their radiation
	Spectral classification	First spectrum atlas		Classification of the chemical compositions of the stars by their radiation
2nd half of the 19th century	Atomic spectroscopy		Atomic models	Modeling of elementary matter
Early 20th century	Quantum physics		Electronic transitions	Dynamics of the small infinite in quantum mechanics
1st half of the 20th century	Quantum chemistry		Molecular geometries	Design shapes and sizes of the molecules by quantum computing
2nd half of the 20th century	Digital spectroscopy		Coupling spectroscopes to computers	Analysis of matter by recording the behavior of its infinitely small components

As can be seen in the table above, the reflections on the physical and imaginary world began thousands of years before our era. The matter was the first to be studied by the first thinkers because of its predominance. Then, they turned to the imaginary, ie, the light, the colors and all that is visible but intangible, and with the development of

philosophical thought on the matter and light, the recent theories of light were born. A philosophical thought which became the key to understanding the concepts of light in the educational process.

7. Conclusion

Long before the ancient Greeks to the present day through the Roman Empire, Persia, Egypt and the Middle Ages, various theories and hypotheses defined the concept of light. Thus, the history of spectroscopy involved many thinkers and philosophers who helped build the image of the light we know today as leading factor in technological development. Studying history in science in curriculum, including the teaching of science of matter, probably help understanding the concept of light or radiation. However, because of its intangible nature, it could hardly find a deep interest to learners. Otherwise, this study could offer them the opportunity to go beyond the superficial understanding of what light is. Long before the ancient Greeks to the present day through the Roman Empire, Persia, Egypt and the Middle Ages, various theories and hypotheses defined the concept of light. Thus, the history of spectroscopy involved many thinkers and philosophers who helped build the image of the light we know today as a leading factor in technological development. Studying history in scientific curriculum, including the teaching of science of matter, will probably help to understand the concept of light or radiation. However, because of its intangible nature, it could hardly find a deep interest to learners. Otherwise, this study could offer them the opportunity to go beyond the superficial understanding of what light is.

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