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Special Issue – Historiography of Physics

Guest Editors' Introduction

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Scientists are often interested in the history of their own fields. Physicists are no exception. When did the apple fall on Newton's head? What did Galileo mumble after his absolution? Did Einstein write a letter to Franklin D. Roosevelt? Who invented the calculus, Newton or Leibniz? How did Archimedes solve the problem of King Hiero's crown? These are questions that every physicist already heard. The standard answers, usually provided in classrooms as part of their cultural education, are anecdotes, chronologies, or verdicts about priority disputes. From those stories comes a sense of belonging to a community, and the young apprentice's identification with the heroes that embodied the values of that community.

Scientists also often write about the history of their own fields. Some classical examples are Jean le Rond d'Alembert's entries in the *Encyclopédie*, Joseph Priestley's book about electricity, the *éloges historiques* of Bernard de Fontenelle, Isaac Newton's biography by Jean-Baptiste Biot, Pierre Duhem's several historical books, and John Desmond Bernal's *Science in History*. Each of these narratives was written with a purpose in mind. To organize the human knowledge, to educate the new generation, to praise the deceased scientists, to support a specific worldview, to better characterize the meaning of the scientific enterprise, and to show the deep connections between science and society.

As Thomas Kuhn famously asserted in 1962, in the opening words of his book *The Structure of Scientific Revolutions*, "history, if viewed as a repository for more than anecdotes or chronology, could produce a decisive transformation in the image of science by which we are now possessed" (Kuhn 2012 [1962], 1). Kuhn was aware that historical narratives have always been a driving force behind all changes in the image of science and, in particular, of physics.

In the 20th century, as the history of science became an independent professional discipline, many new historiographical projects were put forward. They sought to better understand the distinctive aspects of science – its methods, values, and paradigms – and its dynamics – continuities, discontinuities, obstacles, and revolutions. Until the 1960s, the emphasis was on the Renaissance period and the Scientific Revolution. But since then, mainly

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because of the *Archive for the History of Quantum Physics* and the *Einstein Papers Project*, historians of physics began to write also about more recent periods. The *Science Studies* movement, from the 1980s, and the cultural approach to physics, which emerged in particular in the late 1990s, brought to the field useful sociological and anthropological concepts. The current image of physics is a consequence of those works. Historians of physics no longer seem to believe in notions such as progress and sudden revolutions. Science is no longer a monolithic project. The emphasis has been, in the last twenty years, on scientific communities, practices, subcultures, representations, values, controversies, strategies, constraints, trading zones, and instrumentations.

This special issue discusses the historiography of physics, emphasizing how different approaches to the history of physics produce different images of physics. The fifteen authors – who wrote this introduction, six articles, and one interview – come from different backgrounds, including physics, history, philosophy, and sociology. Their historiographical perspectives are diversified and represent some of the main current trends in the historiography of physics. We expect that this special issue will interest historians of physics, and also historians of other sciences, researchers working on the contextual approaches to science education, and historically-minded physicists.

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Since the early 20th century, historians and philosophers of science have discussed whether the mathematization of nature was a central feature of the Scientific Revolution in the 17th century. *Ciro Thadeu Tomazella Ferreira* and *Cibelle Celestino Silva* present a careful review of that discussion in their article *The Roles of Mathematics in the History of Science: the Mathematization Thesis*. They explain the perspectives of *Edmund Husserl*, *Alexandre Koyré*, *Eduard Dijksterhuis*, and *Edwin Burtt*. They also discuss the reception of the “mathematization thesis” in the historiographical traditions developed by *Thomas Kuhn* and *Richard Westfall*. At the end of the article, they address the works of some more recent authors such as *Gary Hatfield*, *Lorraine Daston*, *Steven Shapin*, *Yves Gingras*, and *Sophie Roux*.

In the article *Power relations in science: The Bohr and Wheeler-Everett dialogue on the foundations of quantum mechanics*, *Fábio Freitas*, *Olival Freire Jr.*, and *Iolanda Faria* present a case study in the history of quantum mechanics, namely, the discussion between *Niels Bohr* and *Hugh Everett*, whose PhD advisor was *John Wheeler*. Bohr was one of the founding fathers of quantum theory and did not accept Everett’s interpretation of the theory. Using concepts from *Pierre Bourdieu’s* sociology, the article convincingly argues that Everett sought to increase his scientific capital to defend his interpretations of quantum theory, but his “subversion strategy” was not effective.

In the article *The Writing of the History of Science from the Notion of Scientific Field*, *Ivã Gurgel* and *Graciella Watanabe* begin presenting some traditional debates in the historiography and epistemology of science – such as the internalism-externalism and rationalism-relativism oppositions – in order to discuss the relationship between knowledge and context. In the first part of the article, they review the philosophical treatment concerning the problem of the historicity of science. In the second part, the authors present what they call “Bourdieu’s sociological epistemology”, highlighting the concept of scientific field autonomy and defending its importance for studies in the history of physics.

Matt Waldschlagel, in the article *The Leibniz-Clarke Correspondence as a Case Study for the Historiography of Physics*, reviews the famous dispute between *Gottfried W. Leibniz* and *Samuel Clarke* about the existence of absolute space and time. From that case study and following *Don Garrett’s* characterization of the four aims that historians of philosophy might have, the author suggests that the history of philosophy may provide historians of physics

with invaluable inspiration. Historians of physics should not only interpret and contextualize works of physicists, they should also aspire to evaluate and apply those works in contemporary research, as historians of philosophy do.

In *Boltzmann and the Heuristics of Representation in Statistical Mechanics*, Cássio C. Laranjeiras, Jojomar Lucena, and José R. N. Chiappin reconstruct Ludwig Boltzmann's research program. They claim that to understand the turning point in Boltzmann's work circa 1872, one must pay attention to what they call "heuristics of representation". According to them, the shift from a kinetic to a statistical approach is a change of representation within the very same conceptual framework.

The relation between physics and philosophy is also the subject of the article by Eduardo Simões entitled *Wittgenstein: Physics and Philosophy*. The author argues that the standard literature about the *Tractatus Logico-Philosophicus* – one of the most important works of Wittgenstein – has ignored the important influence that Heinrich Hertz's book *The Principles of Mechanics* exerted on Wittgenstein. The proper acknowledgment of that influence sheds new light on three aspects of the *Tractatus*, namely, the ontological formalism of objects, the picture theory of language, and the image of science.

The special issue also brings an interview with Antonio Augusto Passos Videira, a professor of philosophy at the State University of Rio de Janeiro (UERJ). Having a large research experience in the area of this special issue, Videira presents his perspectives on the research in the history and philosophy of science and, in particular, of physics. He discusses the relationship between epistemology and physics in Ludwig Boltzmann's work, a theme about which he has been thinking for approximately thirty years. He also discusses possible forms of collaboration between scientists and philosophers, and the current challenges in the historiography of Brazilian science.

Reference

Kuhn, Thomas. 2012 [1962]. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.