Transversal
International Journal for the Historiography of Science

Transversal: International Journal for the Historiography of Science, 4 (2018) 174-181
ISSN 2526-2270
www.historiographyofscience.org

Interview: Olival Freire Jr.[1]

Olival Freire Jr., born in Jequié, Bahia, Brazil, in 1954, is a full professor of physics and history of physics at the *Federal University of Bahia* (UFBA), Brazil. He was a former president of the *Brazilian Society for the History of Science* and former president of the *Commission for the History of Modern Physics* of the *International Union of History and Philosophy of Science*. Having worked as secretary of the *National Council for Science and Technology* at the Brazilian *Ministry of Science, Technology and Innovation* during president Dilma Rousseff's administration, and currently *Dean of the Office for Research, Creation and Innovation* at UFBA, and council member of the *History of Science Society*, Olival Freire Jr.'s main research interests include the intersection between science and politics, the history of the foundations of quantum theory, the history of physics in Brazil, and the role of history and philosophy of science in science teaching.

Interviewed by

Gustavo Rodrigues Rocha[2] in April 2018

DOI: http://dx.doi.org/10.24117/2526-2270.2018.i4.15

Gustavo Rodrigues Rocha (GRR): You have been interested since the very beginning of your academic and scientific career in the history of the foundations of quantum theory, beginning with your master's thesis concluded in 1991 on the interpretations of quantum theory between 1927-1949, under the supervision of Dr. Amélia Império Hamburger, until your most recent book, *The Quantum Dissidents: Rebuilding the Foundations of Quantum Mechanics 1950-1990*, published in 2015. How and why was your attention first drawn to that topic? What fascinates you so much about the history of the foundations of quantum theory?

---

[1] Olival Freire Jr. is a Professor of Physics and History of Physics at the *Federal University of Bahia* (UFBA). Address: Institute of Physics, Rua Basílio da Gama, 6 Salvador – BA – 40110-040 – Brasil. E-mail: olival.freire@gmail.com

[2] Gustavo Rodrigues Rocha is a Professor of Physics and History of Physics at the State University of Feira de Santana – UEFS (Brazil) and a Visiting Scholar at the University of California, Berkeley (USA). Address: Universidade Estadual de Feira de Santana – UEFS, Av. Transnordestina, S/N, Campus Universitário (Módulo 5), Departamento de Física (DFIS), Novo Horizonte, Feira de Santana/BA, Brazil, 44036-900. Emails: grrocha@uefs.br and grrocha@berkeley.edu

Olival Freire Jr.: I began university studying Electrical Engineering in 1972 and then halfway through the second year I changed to Physics. This decision was influenced by the beauty, some times the mathematical beauty, of physical theories. Thus since my early studies I have been attracted by the theoretical, conceptual, and mathematical side of physics. Later on, though still at university, I realized that quantum physics did not fit into the classical physics theoretical framework and I also was aware of the controversy about the interpretation of quantum theory and its philosophical and even ideological overtones. All of this remained in the background of my mind. In 1978, I got my first undergraduate degree but I had become engaged in political activism against the military dictatorship and postponed taking a master's degree for a few years. It was only around 1986 – 1987 that I began seriously to think about a master's degree. At this time I had already decided to look for a masters in philosophy or history of science instead of a masters in physics. In this decision I was very influenced by the reading of a book on science and philosophy in the former USSR, written by the American historian of science, Loren Graham. This book was a revelation to me as it brought to the fore the existence of an ongoing controversy over the interpretation of quantum theory, among Marxist physicists and philosophers, with strong components of conceptual aspects but also with philosophical implications. I took two courses at the Federal University of Bahia in 1987 prior to beginning my master's degree at the University of São Paulo. The first was about the History of the scientific thought, with Felippe Serpa, where we read from Galileo to Freud via Newton, Marx, and Darwin. On this course I wrote a paper on the origins of Newtonian Mechanics. The second one was Quantum Physics I, with Aurino Ribeiro, where I was introduced to the full strength of the quantum controversy. On this course I wrote a short monograph on the interpretation of quantum mechanics by the Soviet physicist Vladmir Fock. Influenced by these readings and courses I took the decision in early 1988 to start a masters at University of São Paulo – USP under Amelia Hamburger on the epistemological aspects of quantum mechanics.

GRR: David Bohm's scientific biography was the topic of your PhD dissertation (1995). Bohm seems to have been a figure within your research interests that somehow combines both of your earliest interests in science and politics. Bohm was actively involved in Communist organizations, having been exiled during the McCarthy era in US, as well as in the foundations of quantum theory, as Bohm developed in the early 1950s his causal quantum theory program. How did you first come across Bohm's scientific biography and become interested in Bohm's interpretation of quantum mechanics?

Olival Freire Jr.: You may remember that Bohm lived in Brazil for three years in the early 1950s teaching at USP. He was then exiled in Brazil having escaped McCarthyism as he had lost his position at Princeton University. In addition, Amelia Hamburger had taken courses given by Bohm and was interested in Bohm's later philosophical reflections on creativity. Furthermore, while I was doing my master's degree I became acquainted with Alberto da Rocha Barros who had spent time with Bohm in London in the late 1980s. We talked a lot about Bohm's later research program, about wholeness and implicate order and the subsidiary role geometry should play in this program. According to Bohm and Rocha Barros algebraic and even more basic ideas should lead the way in this program instead of geometry. Thus it was quite natural, considering my background interests in history, politics, philosophy and the quantum debates, to consider Bohm and his ideas as a topic for research. Furthermore, everything Bohm

had written was in English, which presented fewer linguistic obstacles. However, as somebody trained in physics, I should say that I was never interested in Bohm's causal interpretation of quantum mechanics as I had always been attracted to the idea of overcoming deterministic descriptions in science. What attracted me to Bohm's causal interpretation was that I saw in it a good case to exploit the complexity of the production of science. It was a case where physics, philosophy, politics, ideology were inextricably intertwined. After I began my PhD studies I also realized its value as a case of scientific controversy as through the work of John Bell this controversy served to engender breakthroughs in our understanding of quantum theory. That is, it has been a fecund rather than a sterile controversy.

GRR: You have been using, at least since your 2009 paper, "Quantum Dissidents: Research on the Foundations of Quantum Theory circa 1970", the very political expression "dissidents" to refer to those physicists such as David Bohm who did not accept the shut-up-and-calculate attitude of post-war physics and wanted to involve themselves in the debate around the foundations of quantum physics. Along the same lines, although from a different perspective, David Kaiser published his thrilling book *How the Hippies Saved Physics* (2011). What do you find most interesting about the generation of the hippie/dissident/outcast physicists in comparison with the founders of quantum physics?

Olival Freire Jr.: Initially I used the term "quantum dissenters," in a 2006 paper on the first experiments on Bell's theorem. "Dissenter" was a term Popper had used as early as 1982. In 2009 I began to use the term "quantum dissidents" in the title of this paper you mentioned. The term proved appealing as the journalist Andreas Trabesinger published an article in *Nature* reporting my paper and quoting the term "quantum dissidents." More recently the term gained certain traction as Adam Becker used it for a full section of his book, "What is real?". I like the term because it has overtones referring to political dissidents in the 20th century, whose causes were eventually accepted. In the 2009 paper and in my 2015 book "Quantum Dissidents" I explored the metaphor citing the examples of Martin Luther King, Nelson Mandela, and Luiz Inácio Lula da Silva. At the time I was very impressed by the election of Obama – the first President of the US from African-American background – forty years after Martin Luther King's murder. Now, regarding the generation of the 1960s and 1970s (Bohm is from an earlier generation) my first remark is that the physicists who matured at those times did not live under the moral authority of the founding fathers of the discipline. In addition, the quantum dissidents were propelled by certain societal changes (the hippies, 1968, protests against the Vietnam War) which enabled the physicists' community to accept such themes. However, these dissidents still had to face the indifference of the discipline, or rather the stigma – according to Bell – surrounding the hidden variable issue, i.e. the issue whether quantum mechanics was a complete theory or not. This was hard as their professional reputations were at stake. Indeed some of their careers suffered lasting damage for their work on the foundations of quantum mechanics. Thus they were notable for their independence of thinking and their resilience.

GRR: Max Jammer's *The philosophy of Quantum Mechanics* (1974) was one of the first thorough attempts to chronicle the history of the foundations of quantum theory from its origin up to around the period Jammer was writing his seminal book. Your own work, *The Quantum Dissidents* (2015), seems to have taken up from around where Jammer left his narrative, and expanded it covering the timeframe from 1950s to 1990s. What would be the

next step to move forward? A history of quantum computation/information? A history of quantum gravity, as actually now being pursued by Alex Blum and Jürgen Renn at the Max Planck Institute for the History of Science in Berlin? What else?

Olival Freire Jr.: *Quantum Dissidents* should not be considered a kind of a follow-up to Jammer's *Philosophy of Quantum Mechanics* because while the latter was an encyclopedic work covering almost all subjects concerning the interpretations of quantum mechanics, the former dealt with a more specific topic, namely how and when foundations of quantum mechanics as a topic for research moved from the margins of physics to its mainstream. Consequently I chose people and episodes I considered influential in this process leaving aside topics of interest but not influential in my story, such as quantum logics and quantum optics. The history of quantum information and quantum gravity are very relevant for historical research nowadays. In the same direction, it would be interesting to have a follow-up of Jammer's book. We already have the *Compendium of Quantum Physics*, edited by Daniel Greenberger, Klaus Hentschel, and Friedel Weinert. However, this work, useful as it is, is composed of short entries which are not necessarily historically informed. Thus I am thinking of an encyclopedia or a companion volume.

GRR: The *Archive for the History of Quantum Physics* (AHQP) was the direct result of the project "Sources for the History of Quantum Physics" which began in the early 1960s directed by T. Kuhn with the assistance of L. Allen, P. Forman, and J. Heilbron – a very comprehensive collection of interviews, unpublished manuscripts, correspondences, and so on –, covering the history of quantum physics up to the early 1970s. More recently, C. Lehner, J. Renn, and M. Scheffler advanced the *Quantum History Project* (QHP) at the Max Planck Institute for the History of Science which made available online the AHQP collection and added an enormous quantity of primary and secondary resources. What would be in your opinion the next big step regarding the empirical sources and archives for the history of quantum physics?

Olival Freire Jr.: The AHQP focused on physicists and debates till the mid 1930s. Thus actors such as David Bohm and Hugh Everett were not considered for interview. We have now a number of interviews which are deposited at the AIP Center for the History of Physics. Some of these interviews were made by myself, by Joan Bromberg, and by others. I think you are going to deposit the interviews you have done there. Therefore an upgrade in this effort would be a nice idea. Furthermore, we need to identify, collect, catalogue, and deposit papers from physicists who have been active since the 1950s. We have the David Bohm Papers at Birkbeck College and Rosenfeld Papers in Copenhagen but there is a conspicuous absence of papers by the late John Bell. Without doubt, we need a concerted effort to save these sources for later generations. In the past, in the 1960s, we had figures such as John Wheeler supporting the AHQP project. Today we need wider support than just the small community of historians of quantum mechanics to launch a similar project.

GRR: You edited with Osvaldo Pessoa Jr. and Joan Bromberg in 2010 the Jabuti Prize awarded book, *Teoria Quântica: Estudos Históricos e Implicações Culturais* (*Quantum Theory: Historical Studies and Cultural Implications*), and published your most recent book, *The Quantum Dissidents: Rebuilding the Foundations of Quantum Mechanics 1950-1990*, in 2015. What's next? What have you been working on more recently?

Olival Freire Jr.: I am now working on an old project, a new biography of David Bohm. This project was first thought of almost twenty years ago when Basil Hiley, Bohm's long-time assistant, dissatisfied with Bohm's biography by F. David Peat suggested I write a second biography. Hiley was dissatisfied because the biography did not pay enough attention to Bohm's scientific ideas, instead it had focused too much on the details of Bohm's personal life. We met each other at the University of São Paulo at a workshop dedicated to David Bohm and with Michel Paty we were both lunching at the Physics Institute when the suggestion was made. At that time the idea did not grab me as I had other plans at the time. I love reading biographies but I also feared writing one due to the difficulties intrinsic to this kind of historical work. Then in 2015 when my *Quantum Dissidents* was published I was approached by the publisher to write a biography of one of these dissidents. I decided the time was ripe for the challenge and Bohm was the natural candidate.

GRR: As an undergrad physics student in the 1970s and early 1980s, you lived during the Brazilian military dictatorship (1964-1985), having moved earlier in 1969 from Jequié to the capital of the state of Bahia, in the middle of the so-called "Years of Lead" (1968-1974), the most violent and repressive period of the dictatorship. You soon got involved in the student movement and affiliated yourself to the Communist Party of Brazil (PCdoB) in 1973 to fight against the dictatorship. How do you think those earliest political experiences shaped your interests in and approaches to the history of science?

Olival Freire Jr.: My earliest passions were theories in science, particularly physical theories, and politics, which led me to an interest in history and philosophy. For years these interests marched in parallel without much interaction. Only in the mid 1980s, when I decided to begin my master's degree did these interests merge in my aspiration to take graduate courses in history and philosophy of science. Thus I think my background in history, philosophy, and politics was an advantage for my studies and research. History of sciences is a highly interdisciplinary field requiring familiarity both with the science contents as well as with the contextual, that is historical, sociological, etc., aspects in which science is practiced. Thus, while not planned in advance, I think my previous political activism brought something to my research in the history of science.

GRR: You have also been working on the history of physics (and science more broadly speaking) in Brazil. Do you think there would be any important lesson to the historiography of science that you may have learned over the years from studying the history of science in developing countries such as Brazil?

Olival Freire Jr.: I have recently been working, on a more limited basis, with the history of physics in Brazil around the World War II and the Cold War. With Indianara Silva we have published a paper in *Revista Brasileira de História* on the visit of Arthur Compton to Brazil in 1941. This visit was well known among physicists and historians of physics but it was always strictly related to Compton's scientific interest in the research of cosmic rays. This was the main topic of work by the young team of Brazilian physicists led by Gleb Wataghin in São Paulo. We were making research archives in the US attentive to the relations between science and diplomacy in the context of the World War II and found documentary evidence that Compton's trip was supported by the US as part of its foreign policy. Thus, we have argued, in this episode, science and diplomacy were equal parts, which was so far unknown among us. Some of my

students have written master's theses on H. M. Nussenzveig and the diffusion of quantum optics (Climério Paulo da Silva Neto) and on Sergio Porto and the uses of laser (Walker Santana). I have been working on the history of physics under the military dictatorship. Some of this work has been done with Antonio Augusto Videira and the late Aurino Ribeiro Filho. José Eduardo Clemente's dissertation on the Physics Institute at Federal University of Bahia during the dictatorship was the first product in this direction. And last but not least, I have worked on the stay of David Bohm in Brazil in the 1950s.

The lesson I would consider the most important is the challenge to frame science in the history of Brazil, *tout court*, to quote an expression used by Carlos Ziller Camenietzki when, 15 years ago, we attempted but eventually failed to write a collective work on science in Brazilian history. This lesson is not unfamiliar to the historians who worked with the scientific institutions in the 19th and early 20th centuries, I am thinking of Maria Amelia Dantes, Silvia Figueroa, Margaret Lopes, and Ana Maria Ribeiro de Andrade, among others. It is no novelty for those in Fiocruz who work with the history of medicine in Brazil. In conclusion we need more history of science in Brazil, a history where science is framed in the history of Brazil.

GRR: You helped to found in 2000 one of the most important graduate programs in Brazil for the study of the history of science, i.e. the *Graduate Program in History, Philosophy and Science Teaching UFBA/UEFS*, which is also unique as it is devoted to the research area on history and philosophy of science as applied to science education. Could you please tell some more about the development and the importance of this graduate program?

Olival Freire Jr.: The creation of this program of graduate studies at UFBA/UEFS was favored by the expansion of programs dedicated to science teaching by CAPES, the Brazilian agency dedicated to the evaluation and funding of the graduate studies in Brazil. It was one of the first to be created in the new area of knowledge called "science teaching." The singularity of our proposal was that it focused on the interactions among the fields of science teaching, history of science, and philosophy of science. We were not the first researchers in Brazil to go in this direction, indeed my masters supervisor, Amelia Hamburger, worked in this approach and people in Santa Catarina were doing similar research. However, we were the first program to be explicitly dedicated to this interaction. In fact, we published our proposal in *Science & Education - Contributions from History, Philosophy and Sociology of Science and Mathematics*, which was the journal edited by Michael Matthews dedicated to this approach. In Brazil we were strongly supported by most of the CAPES advisors who visited Salvador, namely Nilson Machado, Ubiratan d'Ambrosio, Marco Antonio Moreira, and Arden Zylbersztajn. They thought history and philosophy of science was part of the research in science education. The program began as a masters course but it grew rapidly and PhDs were included and it got the rating 5 from CAPES, which is not bad. However, I think times are changing. The program has stabilized but lacks punch to make it better. It is my view that this program needs an overhaul. And in the field of science education in Brazil some want to dig a divide between history and philosophy of science, on the one hand, and science teaching, on the other hand. Undoubtedly some good research in science education can be produced without contributions from history and philosophy but I am sure that the interaction among these fields can be beneficial for all. In the history of science pedagogy has become a true object of study, see for instance David Kaiser's works. In philosophy of science there is a full field dedicated to the practice of science. And most of the debates plaguing science education, such as

realism versus instrumentalism and students' beliefs about the nature of science, or still the relations between science and religion, would be better informed if these issues are approached taking into account contributions from history and philosophy of science. In short, I regret the appearance of this divide, which had seemed to us to pertain to the past.

GRR: You have spent long stays abroad as postdoc and visiting scholar in institutions on both sides of the Atlantic, such as the *Université Paris Diderot*, PARIS 7 (1996-1997), *MIT* (2004-2005), and *Harvard* (2005). How would you compare, as someone having a perspective from outside both research centers, the European and the American approaches to the history of science? Do you think there have been any differences in approaches to and trends in the historiography of science as developed on both sides of the Atlantic?

Olival Freire Jr.: Generalizations are always rather risky, but let me try to answer your question. On the French side, at least among the people I have interacted with, there is a strong tradition of merging history of science with philosophy of science, or rather more precisely, history of science with epistemology. Furthermore, history of science is usually thought of from the perspective of history of concepts, scientific ideas, but this trend is not insensitive to the social dimensions of scientific practice. In this direction I am thinking about the kind of history of science developed at the former *Equipe REHSEIS* nowadays *Sphère*. More concretely, I am thinking of the work done by Michel Paty, Olivier Darrigol, Karine Chemla, Jean-Jacques Szczeciniarz. On the other hand, I cannot frame everything done in France in history of science in this scenario, as the work done by Dominique Pestre cannot be included in this sketchy framework. In the same vein, Patrick Petitjean is part of the *Equipe Sphère* but his work on science and empire is more socially oriented. Anyway I have the impression that in France there is always a tension regarding the philosophical assumptions taken by each approach to the study of science, while in the US I do not feel such a tension of the same strength. From my experience with scholars based in the US, I have the impression that they are more flexible in making a mix of history of science as a strictly historical discipline but very influenced by sociology and philosophy of science. I am thinking of the work of people such as Paul Forman, David Kaiser, Alexei Kojevnikov (now in Canada), Joan Bromberg, Peter Galison, and Sam Schweber. Again, this is very rough view, an impressionistic view, about differences among the kinds of history of science being produced in these countries.

GRR: Thank you so much.

References

Freire Jr., O. Tenório, Robinson M. 2001. A Graduate Programme in History, Philosophy and Science Teaching in Brazil. *Science & Education* 10 (6): 601-608.

Freire Jr., O. 2003. A Story Without an Ending: The Quantum Physics Controversy 1950-1970. *Science & Education* 12 (5-6): 573-586.

Freire Jr., O. 2004. The Historical Roots of "Foundations of Quantum Physics" as a Field of Research (1950-1970). *Foundations of Physics* 34 (11): 1741-1760.

Freire Jr., O. 2005. Science and Exile: David Bohm, the Cold War, and a New Interpretation of Quantum Mechanics. *Historical Studies in the Physical and Biological Sciences* 36 (1): 1-34.

Freire Jr., O. 2006. Philosophy Enters the Optics Laboratory: Bell's Theorem and its First Experimental Tests (1965-1982). *Studies in History and Philosophy of Modern Physics* 37: 577-616.

Freire Jr., O. 2009. Quantum Dissidents: Research on the Foundations of Quantum Theory circa 1970. *Studies in History and Philosophy of Modern Physics* 40: 280-289.

Freire Jr., O. 2015. *The Quantum Dissidents: Rebuilding the Foundations of Quantum Mechanics 1950-1990*. Berlin: Springer, 356p.

Freire Jr., O.; Pessoa Jr., Osvaldo (Org.); Bromberg, Joan (Org.). 2010. *Teoria Quântica: Estudos Históricos e Implicações Culturais*. 1. ed. Campina Grande: EDUEPB e Livraria da Física, 454p.

Osnaghi, Stefano; Freitas, F. H. A.; Freire Jr., Olival. 2009. The origin of the Everettian Heresy. *Studies in History and Philosophy of Modern Physics* 40: 97-123.

Pessoa Jr., Osvaldo; Freire Jr., O.; Greiff, Alexis de. 2008. The Tausk Contoversy on the Foundations of Quantum Mechanics: Physics, Philosophy and Politics. *Physics in Perspective* 10 (2): 138-162.