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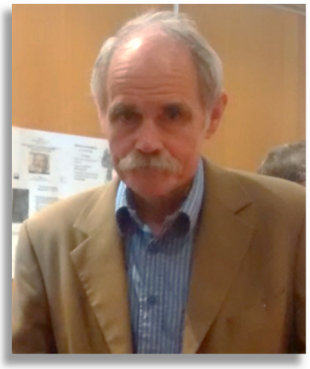
Interview: Helge Kragh[1]



Born in Copenhagen in 1944, Helge Kragh has been emeritus professor at the Niels Bohr Institute (Denmark) since 2015. He is a former professor of history of science at Aarhus University, University of Oslo and Cornell University. Kragh holds doctorates in science and philosophy. His publication list includes more than 600 items, written for specialists as well as the public. Most of his research is in the history of 20th century physics, chemistry, astronomy and cosmology, that is, in the history of the physical sciences since about 1800, but he has also contributed to the history of technology, science-religion studies, and for the special interest of *Transversal: International Journal for the Historiography of Science*, historiography of science. Kragh has been active in the organization of International History of Science and is a co-founder of the *European Society for the History of Science*. In 2008-2010 he served as president of this organization.

Prof. Helge Kragh at Lille (France) in July 2015

Interviewed by
Gustavo Rodrigues Rocha[2] in April 2017.

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Gustavo Rodrigues Rocha (GRR): You published a book titled *An Introduction to the Historiography of Science* in 1987 which is still to date a work unique in its kind. How did you come to write it?

> **Helge Kragh:** At the time I was a high-school teacher of physics and chemistry, without any kind of training in history, historical method or history of science. But I felt a need to understand the history of science in its broader contexts and especially its historiography and relation to general history. I think the book was basically an attempt of self-education and to understand what is special about history of science and its methods. I read a great many books without finding one that satisfied my needs and so I decided to write one myself.

GRR: Many years after your book on historiography of science: what is the place of historiography of science in the history of science? Where is the current historiography of science heading towards?

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Helge Kragh: These are complex questions. For the last several decades there has been much interest in integrating history of science and general history, or coordinating the two, and today many historians of science are trained in history. I consider this a healthy development. There have been various trends, from social and cultural history over constructivist history to so-called contextualist history. There is probably no general trend or tendency in current historiography of science except that some kind of contextualism is characteristic for much history of science published in monographs and the more prestigious academic journals such as *Isis*.

GRR: You have been interested in the science-religion dialogue, being a board member of the Science-Theology Dialogue Forum, and having written fascinating books on these topics such as *Matter and Spirit in the Universe* (2004) and *Entropy Creation* (2008), and published compelling papers on subjects such as Pierre Duhem and Catholic faith, and natural philosophy, theology, and cosmology. Religion can play an important role in how people think about the world, is it okay if I ask you about the religious environment that you grew up in? What religion (if any) were you brought up in? Did your religious views change over time?

Helge Kragh: I was not brought up in a religious milieu but was (like most Danes) born into the Lutheran-Protestant church. Religion did not play much of a role and when I was in my early twenties I left the church; not because I became an atheist but just because of lack of interest and a certain dislike of organized religion as practiced in my country. My interest in religion is of relatively new date and mostly a result of my studies in history of science which showed how important Christian religion has been for the development of science (and at some stage also Islam). Especially after I turned toward history of cosmology I began thinking about religion in connection with, for example, the perennial question of the origin of the universe. Although I do not believe in traditional religious dogmas I have sympathy and respect for religious thought whereas I have no sympathy for hard-core atheism and materialism. Somehow, it seems to me, there must be something above and beyond the physical universe, a mystical spirit or divine principle. If this principle is called God, I believe in God. But this god has no interest at all in human beings. In a sense, my kind of religiosity is somewhat the same as the one Einstein expressed on various occasions.

GRR: You have also cosmology as one of your primary interests and have published an entire book on grand theories in physics, namely, *Higher Speculations* (2011). It is not uncommon for people to search in cosmology some insights on big questions or some sort of big picture. It's an inclination not far from theology for instance. How do you think the science-religion dialogue interest and your passion for cosmology (and maybe grand theories in physics) are all related in your works? Would you say you have a common motivation driving all these interests and somehow bringing them together? If yes, how so?

Helge Kragh: As mentioned, my interest in religion is indeed related to my interest in cosmology but mostly through the scientists and philosophers who have thought about the universe. To understand these thoughts and their relations to theological questions as they have developed since early Christianity, one needs to know about theology. I am not so naïve to believe that I can say something original about the origin of the universe, for example. But of course I have thought and written about it. I am rather sure that the ultimate origin of the universe cannot be explained in scientific terms. That is impossible. From this one cannot infer a creative divine being, however. And even if such a being existed (which is an appealing possibility) the God-hypothesis rests on faith and cannot possibly be justified scientifically. I share the belief of most experts that one cannot use science in the service of religion, nor religion in the service of science. By and large I am a supporter of what is called the "independence thesis" in the science-religion discussion.

GRR: You wrote a biography of Dirac published in 1990. You also wrote about 25 year later, after your first comprehensive and detailed account of Dirac's life and contributions to science, a second book about Dirac's legacy in cosmology and geophysics, namely, *Varying Gravity* (2016). How did you get interested in Dirac's scientific biography? What about Paul Dirac fascinated you so much?

Helge Kragh: I actually also wrote a third book on Dirac, a small and popular one called *Simply Dirac* and published in 2016. For a long time ago I became interested in the early attempts to formulate quantum mechanics in agreement with relativity, which led me to the Schrödinger equation and the Klein-Gordon equation; from there it was natural to examine the origin of the Dirac equation and the physicist who found it. At the time when I started my work on the biography, Dirac was still alive but I failed getting in contact with him. He was a remarkable scientist and a person whose life, science and mentality fascinated me. Apart from being a genius, he also had a peculiar personality. And of course, by following Dirac's career one also follows important parts of the development of modern physics. I found his cosmological hypothesis to be particularly interesting even if we know today that it is wrong. Another aspect of his work which attracted my interest was his idea of so-called beautiful mathematics in physics. But contrary to Dirac, I do not think there is much substance in the idea.

GRR: You were appointed professor of history of science and technology at Aarhus University, Denmark, in 1997, where you remained until very recently moving to the Niels Bohr Institute in 2015 (being there an emeritus professor ever since). Was this position at Aarhus University eagerly anticipated? Did they have a chair in the history of science and technology at Aarhus University before you arrive?

Helge Kragh: I had no connections to the History of Science Institute in Aarhus before I was employed in 1997, except that I served for one year as curator of an associated museum of history of science and medicine. But I had previously been associate professor at Cornell University, USA, and full professor of history of science at the University of Oslo, Norway. At Cornell I had an office next to the one of Hans Bethe, the famous physicist. Most of the time since my graduation, I had worked as a high school teacher. Aarhus University had since about 1965 had a chair in history of science, occupied by Olaf Pedersen who was a specialist in medieval and ancient exact sciences. It was his chair I took over in 1997, when I terminated my position in Aarhus. The chair has now been replaced by a professorship in science studies.

GRR: You published in 1999 what I consider to be the finest one single volume on the history of physics in the 20th century, namely, *Quantum Generations* (1999). Was this a long-term project? When did you start writing this volume? What were your motivations behind *Quantum Generations* (1999)? How was the reception of the book?

Helge Kragh: It was not my idea to write the book, but Princeton University Press wanted a book in connection with the turn of the century and they asked me to write it. So I wrote the book pretty quickly, it took me about a year's hard work I think. I rather liked it because I had myself missed a broad and comprehensive account of the development of modern physics. The book was quite successful and has been translated to five or six other languages, including Japanese and Chinese. It has also been used for courses in history of science. Some reviewers thought there was too much social history in it, while other reviewers found it to be too technical and internalistic; others again found that there was too much about quantum physics and too little about materials physics. But I could not please everyone. It is probably the most sold of my books, but the best one, in my own estimation, is *Cosmology and Controversy* from 1996.

GRR: You have also helped to found the European Society for the History of Science around the early 2000's (having been its president during the term 2008-2010). How was that? What main roles did you play in its foundation?

Helge Kragh: I had earlier served as assistant secretary for the International Union of History and Philosophy of Science (IUHPS, Division of History of Science), so I had some experience with organizational work. The idea of creating the European Society for the History of Science (ESHS) was due to the French historian Claude Debru, and not to me. But I supported the idea from the beginning and was active in the process that made ESHS a reality. For several years I had worked

as editor for the journal *Centaurus* which later became the official journal of ESHS. I was vice-president and then president for the organization which is today a rather strong and successful one with biannual conferences that attract many students and scholars. I attended the last one that took place in Prague in 2016.

GRR: You have recently published three more books on cosmology, namely, *The Weight of the Vacuum* (2014), *Masters of the Universe* (2015), and *Varying Gravity* (2016). What is your perspective on the present (and maybe future) state of the standard model of cosmology?

Helge Kragh: As a historian and not a scientist I don't need to have an opinion about current theories in physics and cosmology. But I can judge the theories from a historical point of view. The hot big bang standard theory is undoubtedly very impressive and probably true as far as it goes. The big bang is no longer a matter of debate, but one needs to keep in mind that the big bang is not the same as the creation or absolute beginning of the universe. While the standard model is reliable I am much less convinced by its extensions to the time regimes even closer to the magical moment $t = 0$. Inflation is not yet proved and pre-inflation scenarios seem very speculative. The same is the case with various theories of a universe before the big bang, although such theories cannot be ruled out. It is too early to say with certainty that the age of the universe is finite.

GRR: You have also been interested in historical and alternative models in cosmology, such as your study on the scientific controversy between big-bang theory and steady-state theory, as presented in *Cosmology and Controversy* (1999), and your recent reevaluation of Dirac's hypothesis of a varying gravity, as presented in *Varying Gravity: Dirac's Legacy in Cosmology and Geophysics* (2016). Don't you think that there is very little room today for proposing, investigating and researching alternative models in cosmology in the mainstream institutions? If yes, why do you think this is the case?

Helge Kragh: Yes, you are right, there is little room for alternatives of the standard model, but there is plenty of room for alternatives at or below the Planck timescale. More importantly, from a historical and sociological point of view it doesn't matter so much whether or not the alternatives are reasonable or not. The very fact that there are such proposals makes them of interest. I have a certain weakness for alternative ideas, not because I think they are valid but because they tell us something about science and the psychological state of scientists. The modern idea of the multiverse is controversial and it is precisely for this reason I am interested in it.

GRR: What have you been working on or involved in nowadays (books or papers you have been writing)? What may be your next projects or research interests?

Helge Kragh: I recently published a paper (in *Journal for Astronomical History and Heritage*) on Zwicky's and others' ideas of "tired-light" hypotheses designed to keep the universe static. And shortly there will appear a detailed investigation (in *Annals of Science*) of Bohr's hypothesis of energy non-conservation ca. 1930, including his somewhat desperate attempt to explain stellar energy production. For half a year ago I published a biography of a leading nineteenth-century Danish chemist entitled *Julius Thomsen: A Life in Chemistry and Beyond*. My main work at present is however the preparation of a collaborative volume of the history of modern cosmology to be published by Oxford University Press in 2018. I am co-editor together with Malcolm Longair, a British astrophysicist, and write some of the chapters. I am also working on the status of astrophysics and cosmology within the Nobel system until 1966, relying on new material from the Nobel Archive in Stockholm. This work is still in progress.

GRR: What are the areas worth investigating in the history of the physical sciences that you think is yet not well (or less) researched?

Helge Kragh: One area, which I have thought of for a long time, is a sociologically oriented analysis of the origin and development of modern cosmology. How did cosmology become a scientific discipline? When and why did people begin to identify themselves as "cosmologists"? When and

why did textbooks and specialized journals appear? Can one speak, even today, of a community of cosmologists? There exists this kind of social history for particle and solid-state physics, for example, but not for cosmology or even for astrophysics. I would not myself be able to write such a history, but in collaboration with a sociologist or social historian I probably would. I also think that there are interesting areas of a cross-disciplinary nature, especially modern geophysics, medical physics and astrophysics that deserve to be more and better cultivated. And within the chemical sciences there is not, to my knowledge, any good historical work on so-called computational chemistry. Finally, it would be of value to have a comprehensive study of the relationship between philosophy and the physical sciences in the period after about 1970. My guess is that the impact of professional philosophers upon physics in this period has been minimal, but I am not sure.

GRR: What would be your best advice for a historian of science (and especially a historian of physical sciences) in his or her early career today?

Helge Kragh: I find it difficult to come up with a good advice. In some sense he (or she) should work in established areas of history of science, on the other he should also try to come up with something original. From my own experience I would say that it is important to learn the craft of history as well as the content of one or preferably more sciences. One should not be too specialized but have the broader perspectives in mind.

GRR: Thank you so much!

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