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Philosophy of science: Interview with Brigitte Falkenburg

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Professor Dr. Brigitte Falkenburg is one of the leading philosophers of science, a representative of the German school of philosophy of science. She wrote or edited about twenty books, and published more than hundred articles on the most topical issues of philosophy of science, philosophy of physics and philosophy of consciousness. Her work is attractive for its clarity, precision and depth of scientific and philosophical analysis. Some of her prominent books include: "Particle metaphysics: A critical account of subatomic reality" (2007), "Kant's cosmology: From the Pre-Critical System to the Antinomy of Pure Reason" (2020) etc. In this interview, Prof. Falkenburg talks about her career path, main directions of her research, her books and new projects. Topics such as neo-Kantian philosophy of physics, scientific realism, interpretations of quantum mechanics, reality of virtual particles, the hard problem of consciousness, inductive metaphysics, the limits of scientific knowledge and others are discussed.

Keywords: neo-Kantianism, scientific realism, quantum mechanics, virtual particles, inductive metaphysics

Igor Pris: Good afternoon, Professor Falkenburg, I am very happy to see you. Thank you for accepting my invitation to give an interview and to tell about your research work.

Brigitte Falkenburg: Good afternoon.

IP: First of all, maybe a little bit personal question: you studied physics and philosophy at several German universities. You earned two PhD: a PhD in physics

and PhD in philosophy. How did you get started doing research in philosophy? Why did you finally choose philosophy?

BF: I had two areas of interest from the very beginning of my studies: (i) to understand nature, and (ii) to understand what is going on in society. The first interest was stronger. Therefore, I studied physics, but when it came to quantum mechanics, I wanted to understand the foundations and started to read books on the philosophical interpretation of quantum mechanics. I read the German translation of Blokhintsev's "*Foundation of Quantum Mechanics*", and a little bit later I found Peter Mittelstaedt's "*Philosophische Probleme der modernen Physik*" ("*Philosophical Problems of Modern Physics*"), which is a Kantian approach to the foundations of physics, and became interested in Kant's philosophy. In parallel to my physics studies at the Technische Universität Berlin, I attended philosophy seminars at the Freie Universität and started to read the works of the critical theory of the Frankfurt school, above all, the "*Dialektik der Aufklärung*" *(Dialectic of Enlightenment)*. After my physics diploma, I oscillated for a while between physics and philosophy and worked for several years in parallel on my philosophy thesis on Kant's and Hegel's philosophy of nature, and in a scattering experiment of high energy physics that investigated the quark structure of the nucleon. Finally, I switched definitely to philosophy and was working for several years with Erhard Scheibe at the University of Heidelberg.

IP: What are the main directions of your research work?

BF: My main directions of research are philosophy of science (with a primary focus on physics, and a second focus on neuroscience), traditional philosophy of nature (Kant, sometimes still Hegel), neo-Kantian philosophy of science (from the Marburg school to Bohr and the Heisenberg school, to which Erhard Scheibe and Peter Mittelstaedt belonged), philosophy of technology, and the methods of natural science vs. cultural and social science. The latter two fields of research added to the former as an offspring of my early interest in social philosophy, but also of a stay at the Institute of Advanced Studies (Wissenschaftskolleg) in Berlin, where I participated in an interdisciplinary project "*Models as Mediators: The Role of Models in Physics and Economics*", together with Margie Morrison from Toronto.

IP: What is your philosophical position? Is it scientific realism?

BF: This is hard to say. I think that the "isms" are simplifying too much the very complex access of the sciences to the world. As far as I know the structure of the sciences and the nature of experiments, our scientific theories combine constructivist and empiricist features with certain crucial realistic aspects. Perhaps I am closest to a version of Kant's empirical realism or Putnam's internal realism, maintaining however to a certain degree a correspondence theory of truth: our theories are either true or wrong, even though we perhaps will never know.

IP: How do you understand a scientific realism?

BF: A combination of entity realism and theory (or structural) realism (I think it is only reasonable to combine both): Belief in the existence of subatomic particles, atoms, molecules, neurons, cosmic rays, black holes, etc., and belief that the well-established theories of science correspond at least approximately to the structure of nature.

IP: Now there are so-called "new realisms" in continental and also in analytic philosophy. Does it have any impact on philosophy of science? Do you think that scientific realism should be corrected?

BF: This is old wine in new bottles. Why do philosophers keep trying to reinvent the wheel instead of building on the insights from earlier debates?

IP: There are different interpretations of quantum mechanics. Which do you prefer? Or maybe you have your own interpretation?

BF: My views are close to Niels Bohr's complementarity view, in a generalized version that takes more recent developments of quantum theory into account, including quantum field theory. It is a kind of pluralism and perspectivism: Quantum theory is universally valid in the sense that the laws of quantum theory hold everywhere in the universe, for a given set of observables that is restricted by the uncertainty relations. But it is not universal in the sense of being able to describe the whole universe as a quantum object. The theories of classical physics and general relativity are indispensable at a large scale, and a tremendous reduction problem remains concerning the relations between general relativity, classical mechanics, thermodynamics, and quantum theory.

IP: Do virtual particles exist? Are they real?

BF: They are mathematical constructs of an approximation procedure, but the sum of their virtual effects describes real physical phenomena such as the Lamb shift in the hydrogen atom.

IP: In your book "*Mythos Determinismus*" (*Myths of Determinism)* [Falkenburg, 2012] you criticize a neuroscientific determinism and reductionism about the free will, but also about consciousness in general and, in particular, about phenomenal consciousness. What is your position about the nature of consciousness? How do you understand the so-called "explanatory gap problem" and "hard problem" in philosophy of mind?

BF: I think there are substantial limitations of scientific knowledge in this area. In the matter constituent models of physics, there are sum rules for mass-energy, charge, spin/angular momentum, and other physical properties, which explain at least in principle how the whole, i.e. a macroscopic body, is built up from molecules, atoms, and subatomic particles as its parts. Hence, in physics the ontological reduction of bodies to subatomic particles is plausible. In contrast, there are no such rules for the properties of mind and body, there is no part-whole relation between consciousness and the brain. There are only correlations between neural activities and consciousness, but no mechanistic explanations.

IP: In your recent book "*Kant's cosmology*" [Falkenburg, 2020] you analyze Kant's pre-critical analytic method to metaphysics. There has been a return of metaphysics in philosophy. Do you think that in a sense this is a return to the pre-critical stage of thinking?

BF: There are analytic metaphysics and ontology, which in a certain sense indeed return to a pre-critical stage of thinking, but on the condition that the world *could* be like that. On the other hand, I am participating in a research group on inductive metaphysics, and this is a *very* critical approach. Inductive metaphysics investigates the relations between everyday experience, the sciences, and general metaphysical concepts such as cause, disposition, etc., as well as the inductive

methods of the sciences and philosophy, in particular: abduction, analogical reasoning, as well as the traditional analytic-synthetic method used in early modern science and philosophy from Galileo, Descartes and Newton to Kant.

IP: What is, in your view, the main task of philosophy? Is philosophy a science?

BF: Philosophy belongs to the humanities and it is a *cultural* science, with the main theoretical tasks of clarifying concepts and arguments and understanding the relations between the sciences and the world. To them, the practical tasks of clarifying the normative principles of human behavior add.

IP: What do you think, at present, are the most important problems of philosophy of science or philosophy of physics?

BF: There are so many… The most important problem is to find a balance between scientific knowledge and the insights into its limits, in times of fake news and Covid skeptics.

IP: How do you work? Do you have your own method? Does it take much time to write a book?

BF: If I am at all able to describe my method, it is perhaps best characterized as inductive and critical. I start by collecting and structuring a lot of scientific and historical material until a philosophical thesis emerges, together with the arguments to support it. And I criticize one-sided philosophical approaches in order to bring out the complexity of the issues. – The time to write my books substantially differed. "The Particle Metaphysics" [Falkenburg, 2007] and "Kant's Cosmology" [Falkenburg, 2020] was based on more than 20 years of work each, whereas I completed "Mythos Determinismus" [Falkenburg, 2012] in about two years.

IP: What are your philosophical projects?

BF: (i) The translation of Erhard Scheibe's *Reduktion physikalischer Theorien* (with Gregg Jaeger from Boston), (ii) a book on the Neo-Kantian philosophy of physics from the Marburg school to the Heisenberg school, (iii) a project on the role of machine learning in astroparticle physics.

IP: Professor Falkenburg, thank you very much for this interview. It was my pleasure talking to you. All the best for you and for your research!

BF: Thank you.

Философия науки. Интервью с Бригиттой Фалькенбург

Бригитта Фалькенбург – доктор философии, доктор физики, профессор философии науки и техники. Технический университет Дортмунда. Германия, г. Дортмунд, 44277, ул. Эмиля Фигге, д. 50; e-mail: brigitte.falkenburg@tu-dortmund.de

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Профессор философии науки и техники, доктор философии, доктор физики Бригитта Фалькенбург – одна из ведущих философов науки, представитель немецкой школы философии науки. Она автор или редактор около двадцати книг, а также автор более ста статей по самым актуальным проблемам философии науки, философии физики и философии сознания. Ее работы привлекают своей ясностью, точностью и глубиной

научного и философского анализа. Среди ее наиболее известных работ – «Метафизика частиц: Критический анализ субатомной реальности» (2007 гг.), «Космология Канта: От докритической системы к антиномии чистого разума» (2020 гг.) и др. В интервью профессор Фалькенбург рассказывает о своём творческом пути, об основных направлениях своих исследований, своих книгах и новых проектах. Поднимаются такие темы, как неокантианская философия физики, научный реализм, интерпретации квантовой механики, реальность виртуальных частиц, трудная проблема сознания, индуктивная метафизика, пределы научного знания и другие.

Ключевые слова: неокантизм, научный реализм, квантовая механика, виртуальные частицы, индуктивная метафизика

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