All or Nothing at All: An Ontology for Quantum Mechanics

Martín Narvaja

CONICET – Universidad de Buenos Aires

In the usual interpretations of Quantum Mechanics, the main interpretative problems are treated independently, and this has two consequences: on the one hand, each interpretation focuses primarily (and usually only) on one of the problems; on the other hand, the interpretative task is conceived as a succession of answers to separate problems that will supposedly agree at the end of the day. Although those answers have contributed to the deeper understanding of quantum problems, I think that the idea of recover unity at the end is misguided. Metaphysics and ontology will never be the result of a sum of independent answers: unity either comes at the beginning or does not come at all. From my viewpoint, the leading ideas in the constitution of quantum ontology are (1) the possible-actual distinction (common to all the modal interpretations) and (2) the holistic character of quantum systems. On this basis, and in general agreement with the Modal-Hamiltonian Interpretation, I will sketch a set of consistent answers to quantum contextuality and indistinguishability, EPR non-locality, and the measurement problem. Although the detailed treatment of all these issues is not possible, I hope that the general viewpoint will be clear enough to serve as a basis for discussion.

Martin Narvaja has obtained his degree in philosophy with honors in 2009, at the Facultad de Filosofía y Letras, Universidad de Buenos Aires, under the supervision of Olimpia Lombardi. Nowadays he is pursuing his Ph.D. in philosophy at the same faculty and under the same supervision, in the areas of philosophy of physics and metaphysics of quantum mechanics. He is teaching Logics at the Universidad Nacional de Tres de Febrero, and Philosophy of Science at the Universidad de Buenos Aires. He has also been granted with a Ph.D. fellowship from CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas). He has published articles and reviews in journals and chapters in different books, and participated in several national and international academic events.

Emergence & Top-Down Causation Regarding the Chemistry–Physics Interface

Eric Scerri

Department of Chemistry & Biochemistry, UCLA, Los Angeles, CA 90095

Several philosophers of science have made claims concerning the possibility of emergence and downward causation. In the present article I examine two such claims

concerning the emergence or otherwise of chemistry from physics. Whereas McLaughlin (1992) has claimed that the development of quantum mechanics renders any emergentist claims implausible, Hendry (2010) claims precisely the opposite. I will argue that McLaughlin fails to rule out emergence, while Hendry[i] fails to provide convincing arguments in its favor. I conclude that one must remain agnostic about the possible existence of emergence and downward causation, at least on the basis of quantum mechanics and the kinds of arguments that have been suggested by analytical philosophers. In the cases that I examine I conclude that the authors have not paid sufficient attention to the scientific details in question. McLaughlin fails to comprehend the nature of the quantum mechanical account of chemical bonding while Hendry falsely claims the existence of configurational Hamiltonians on the basis of calculations of molecular structure based on the Born-Oppenheimer approximation.

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Eric R. Scerri is a historian and philosopher of science who investigates the extent to which chemical concepts can be explained through fundamental theories in physics, especially quantum mechanics. He also has considered the implications of such interpretations for chemical education, in particular the manner in which chemistry is presented in textbooks and introductory chemistry courses, as well as writing about other pedagogical issues in science. A lecturer in chemistry and biochemistry at the University of California, Los Angeles (UCLA), Dr. Scerri received a B.S. with honors in chemistry from Westfield College, University of London, a master's degree in physical chemistry from the University of Southampton, and a Ph.D. in the history and philosophy of science from King's College London in 1992. In 1993. He became a research fellow in the history and philosophy of science at the California Institute of Technology two years later and, after teaching chemistry at Bradley University in Illinois and at Purdue University, he was named to his present position as chemistry lecturer in 2000. At UCLA, he teaches classes for general chemistry students as well as courses in the history and philosophy of science. Dr. Scerri is the recipient of four UCLA faculty development awards. The founding editor-in-chief of Foundations of Chemistry, he is the author of some ninety-five papers published in academic journals or as chapters in volumes of collected works, a co-editor (with David Baird and Lee McIntyre) of The Philosophy of Chemistry: The Synthesis of a New Discipline (2005), and editor of the forthcoming Oxford Handbook on the Philosophy of Chemistry. He is also the author of four books, including The Story of the Periodic System: Its Development and Its Significance (2007), which was selected as an outstanding academic title of the year by Choice and earned its author UCLA's Herbert Newby

McCoy Award for outstanding contributions to the science of chemistry, two collections of papers—Collected Papers on Philosophy and Chemistry (2008) and Collected Papers on the Periodic Table (2009), and A Tale of Seven Elements: The Last to be Discovered among the I-92, which will be published by Oxford University Press (OUP) later this year. Dr. Scerri is presently writing A Very Short Introduction to the Periodic Table for OUP.

Quantum Mechanics Interpretation and Backward-in-time Causation in Phil Dowe Theory

Rolando Núñez Pradenas

Agencia Nacional de Promoción Científica y Tecnológica
nunez.rolando@gmail.com

In his book Physical Causation, Dowe takes in consideration to explain the Bell phenomena three interpretations of quantum mechanics: The Copenhague interpretation, which would represent one of the positions most widely accepted by the physicists in the present but nevertheless could be considered a rather instrumentalistic position with respect to quantum mechanics; The "telepathic" interpretation, which conflicts with the Special Theory of Relativity by postulating influence faster than the speed of light; and finally the proposal he gives, which is the backwards-in-time causation, which is based on the transactional interpretation of quantum mechanics.

I will try to show that the telepathic interpretation and the backwards-in-time interpretation ultimately have similar consequences, to such an extent that the reasons for rejecting the first one could be wielded largely to reject the second one. One of the Dowe´s reasons for accepting backwards-in-time causation is to save the physical causality, but while it seems that backwards-in-time causation achieve this goal, the concept of causality will be as affected as in the case of the telepathic interpretation.

Rolando Núñez Pradenas is Licenciate in Philosophy Education and Master in Philosophy of Sciences. Fellowship in the Project "Counterfactuals, explanation and causality". Early Teaching positions at Universidad Andrés Bello and Universidad de Santiago de Chile.

Modal Hamiltonian Interpretation: Unveiling the Secrets of Quantum Mechanics

Juan Sebastián Ardenghi – Olimpia Lombardi

CONICET – Universidad de Buenos Aires

The Modal-Hamiltonian interpretation of quantum mechanics is a new realist, non-collapse interpretation which moves away from the prevailing trend in the subject by paying special attention to the physical relevance of the Hamiltonian. The proposal endows the Hamiltonian of the system, systematically ignored in the traditional interpretations, with a central role: the Hamiltonian distinguishes between systems and subsystems and is the main ingredient in the selection of the definite-valued observables. We show how this interpretation solves the measurement problem, both in the ideal and in the non-ideal versions, and we argue for the physical relevance of the rule that selects the definite-valued observables of the system.

Juan Sebastián Ardenghi obtained his degree in physics in 2007 at the University of Bahia Blanca and, at present, he is a Ph.D. student of physics at the University of Buenos Aires. He has been granted a PhD fellowship from CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas). The subject of his Ph.D. research is the development of the modal-Hamiltonian interpretation of quantum mechanics, under the supervision of Mario Castagnino and Olimpia Lombardi.

Olimpia Lombardi obtained degrees in electronic engineering and in philosophy at the Universidad de Buenos Aires, and her Ph.D. in philosophy at the same university. At present, she is an Independent Researcher of the CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas), and Professor at the Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires (UBA). She has been director and codirector of several research projects, and has been the supervisor of two finished Ph.D. theses, and several Ph.D. theses still in development. Her main interests are the interpretation of quantum mechanics, the philosophy of chemistry, the problems of irreversibility and of the arrow of time, and the problems of realism and of intertheoretic relations in sciences.

What is Quantum Mechanics Talking About?

Mariano Lastiri

CONICET – Universidad de Buenos Aires

In this work I will develop a preliminary discussion about a reconstruction of quantum mechanics from a structuralist point of view. Here I will try to answer the question

about QM- non theoretical terms, i.e., the magnitudes that can be measured independently of the *Schrödinger equation* and of *Born's rule*. Once this question is answered, one of the relevant features that can be analyzed the measurement problem. Since the measurement problem is directly related to the linear and unitary character of the time evolution of the quentum state, given by the Schrödinger equation, the measurement of the values of those concepts that do not presuppose the law would be not affected by that problem. Though this does not answer all the questions about quantum measurement, it constitutes a first step towards a more thorough understanding of this problem.

Mariano Lastiri obtained his Ph.D. in Epistemology and History of Science in 2011, at Universidad Nacional de Tres de Febrero, with a dissertation on a structuralist reconstruction of quantum mechanics supervised by Olimpia Lombardi and Pablo Lorenzano. At present he is a postdoctoral researcher at the CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas). Currently he is working on the measurement problem and the classical limit of quantum mechanics.

The Philosophy of Physics: Its Dynamics Today

Victor Rodriguez
Universidad Nacional de Córdoba

Some current lines of research on philosophy of physics will be exposed, trying to present a brief account of the field of philosophical reflections closely related to contemporary physics. The approach is too general and rather superficial, but it is considered relevant for appreciating the shifts that have suffered several technical notions and methodologies around physics in the last decades. The dynamics of the theories and the activity of the laboratories are producing new frameworks for analyzing old topics. It is argued that the small community of philosophers of physics cannot follow the intensity of these trends in an adequate way. It is esteemed that this asymmetry of practices produces considerable gaps in the treatment of philosophical topics, leaving many of them only in the hands of scientists.
Some topics will be analyzed in detail, in order to illustrate this comparative dynamics of researches. Examples coming from general relativity and quantum frameworks will be considered, extending these scenarios to some styles of work in cosmology and computation with a dose of sensibility for the art of measurement.

Victor Rodriguez es Profesor Titular Dedicación Exclusiva de Epistemología de las Ciencias Naturales, Escuela de Filosofía, Facultad de Filosofía y Humanidades, Universidad Nacional de Córdoba. Dirige un equipo de investigación en esa institución. Ha sido director de tesis doctorales en varias universidades nacionales. Ha dictado numerosos cursos de posgrado en universidades nacionales. Ha desempeñado funciones de gestión en instituciones académicas, y asociaciones nacionales e internacionales de la especialidad.

Causation, Pseudocausation and Physics

Wilfredo Quezada[1] – Luis Pavez[1]

[1]Universidad de Santiago de Chile

A part of the contemporary discussions on special relativity (SR) has been focused on the problem, pointed many years ago by H. Reichenbach ((Reichenbach 1927), of making a adequate distinction between a genuinely causal process and a non-causal one. Non-causal processes are called (according to Salmon 1984 and Dowe 2000) pseudo-processes (PSP). As Reichenbach points, PSPs can, at first sight, be well defined as processes which seem to violate the constancy of the light velocity (c). Typical examples of them are a spot of light (created for instance by laser ray) moving along a surface, a moving shadow, and the point of intersection of two superluminical rulers.

In work previously presented in other places we have suggested a working program for PSPs in physics by showing, against the received view (defended in particular in Dowe 2000), they have historically played and in the present day continue to play a key role in measurement procedures in different areas of physics and, hence, seem more intertwined with the practice in physics than imagined before. In such a work we have applied the program to physical movement processes which happen under, equal to or over the light speed.

In this occasion we want to make a general exposition of the program introducing new results for movement physics and examining preliminary extensions to quantum physics. Regarding the latter, we discuss and clarify the connections between the conserved quantity properties of quantum entities and pseudo-processes occurring at the non-quantum level of the measurement.

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Wilfredo Quezada is Associate Professor at the Philosophy Department, Universidad de Santiago de Chile (Usach). He studied his first degree in philosophy at U. de Chile. Then he gained a Master degree in Logic and Philosophy of Science by the U. de Valparaíso, Chile, and his PhD (Philosophy) by King's College London, U. K. At present he is the Head of the Master Program in Philosophy of Science at Usach. His main research interests are focused on philosophy of science, philosophical logic and philosophy of physics.

Luis Pavez is a Secondary School Teacher in physics (U. Metropolitana de la Educación, Chile). Recently, he gained a Master degree in Philosophy of Science by the Universidad de Santiago de Chile (Usach). At present, he teaches at the secondary school level and at several universities in Santiago. He has published some important stuff on the methodology of physics for the Chilean Education Ministry.

Philosophers and Physicists

Jorge Paruelo

Universidad de Buenos Aires – ANPCyT

The relationship between philosophy and physics takes different ways. In this work I analyze several of these ways. In particular, I will focus my talk on how philosophers use physical concepts to manage some philosophical issues, and how physicists could use philosophical concepts to deal with some problems related with their work.

Jorge Paruelo

Lic. in Pedagogy in Math.
Professor of Introducción al Pensamiento Científico at Ciclo Básico Común, Universidad de Buenos Aires, and Joint Professor of Calculus at Universidad

Tecnológica Nacional. He is Director in the Project "Philosophy of science and teaching sciences: representation and articulation". He is a research member in the project "Counterfactuals, explanation and causality". He has given many posgraduate seminars at national universities and directed several magister thesis. He is the present Treasurer of AFHIC (Asociación de Filosofía e Historia de la Ciencia del Cono Sur).

On the Identification of Chemical Substances

Mariana Córdoba[1] – Martín Labarca[1] – Alfio Zambón[2]

[1] CONICET – Universidad de Buenos Aires

[1] Universidad Nacional de la Patagonia

The characterization of the notion of chemical substance is a problem that does not find solution in the philosophical tradition. In this work we will analyze the issue of the identification of each chemical substance, i. e., what makes a substance distinguishable from any other. We will consider the different answers that have been given to this problem: the idea that a chemical substance has to be identified at the macro-level (the level of the phenomenological properties), and the idea that substance identification has to be found at the micro-level (the level of the molecular structure). We will also consider Paneth's proposal, according to which the identification of each substance relies on the atomic number. The problem that arises after considering these ideas is that there is no clear connection between both levels. This problem gets worse when we analyze the microlevel, where we do not find just one level, but two: it is necessary to distinguish between the quantum mechanics level and the molecular chemistry level.

Mariana Córdoba obtained his degree in philosophy in 2006 at the Facultad de Filosofía y Letras, Universidad de Buenos Aires, and she is currently pursuing her Ph.D. in philosophy, in the area of philosophy of science, at the same faculty, under the supervision of Olimpia Lombardi. At presente she is teaching philosophy of science at the Universidad de Buenos Aires. She has been granted a Ph.D. fellowship from CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas). She has published articles in journals and chapters in different books, and has participated in several national and international academic events.

Martín Labarca has a degree in chemistry (Universidad Nacional de La Pampa) and as a teacher in chemistry (Instituto Superior de Formacion Docente Nro.45). He obtained his Ph.D. in social and human sciences at the Universidad Nacional de Quilmes. At present he is a researcher at CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas) and professor of philosophy of science at Universidad Nacional de Quilmes. He has been a visiting professor at the Universidad de la República, Uruguay. He has published articles in international journals on topics of philosophy of chemistry and physics, and about education in chemistry.

Alfo Zambón has degrees both in pharmacy (Universidad Nacional de la Patagonia) and in chemistry (Universidad Nacional del Sur). Nowadays, he is professor of chemistry and epistemology at the Universidad Nacional de la Patagonia "San Juan Bosco", and he is a Ph.D. student in history and philosophy of science at the Universidad Nacional de Tres de Febrero, under the supervision of Martín Labarca. He has been a member of several research groups in fields like chemistry of natural products, medicinal chemistry and philosophy of science. He has presented works at national and international academis events, and has published three specialized publications as a co-author.

Fusion Emergence Reconsidered

Paul Humphreys

University of Virginia

In 'How Properties Emerge' I suggested a way of considering ontological emergence that avoids some of the major objections that have been raised against what is often called strong emergence. In this talk I will address some of the objections that have been raised against fusion emergence, generalize it, and show how it fits into a broader set of approaches to emergence. Some further physical examples of fusion emergence will be discussed, as well as general criteria for what counts as a satisfactory theory of emergence.

Paul Humphreys is Professor of Philosophy at the University of Virginia. He is the author of *The Chances of Explanation* (Princeton 1989) and *Extending Ourselves* (Oxford 2004), as well as co-editor,with Mark Bedau, of *Emergence*. He has published numerous papers on causation, explanation, probability, metaphysics, and epistemology. His recent research concerns computational science, emergence, and related topics.

Complexity and Emergence

Miguel Angel Fuentes

Santa Fe Institute – CONICET – Universidad Católica de Chile

There is a strong connection, at least in a huge part of the community discussing emergent phenomena, between complex systems and emergence. This entanglement can be understood if we think of a complex system as a collection of elements, each one interacting with the others via simple local rules or nonlinear dynamics. The properties that this collection of elements exhibits are sometimes completely unexpected and these

cases have received, at times, the label of emergent properties or emergent phenomena. In this talk I will discuss, using complexity theory, the characteristics that a given system should have in order to produce some emergent phenomena. I will argue that this property is ubiquitous in any physical system showing emergence.

Miguel Angel Fuentes is Ph. D. in Physics, Institut Non Lineaire de Nice, France, and Instituto Balseiro, Argentina. Co-directed, Ph. D. in Physics, Institut Non Lineaire de Nice, France, and Instituto Balseiro, Argentina. Co-directed.
PostDoc Appointment at Los Alamos National Laboratory, New Mexico, USA: Center for Non Linear Studies. Santa Fe Institute, Omidyar Fellow. He is Researcher at CONICET, Argentina.

Causal Closure Principle and its Requirements Over Causation Theories

Hernán Miguel

Universidad de Buenos Aires

In analyzing whether the mental can cause some effects on the physical, the strategy for denying it is grounded on the assumption that every physical effect has always a physical cause. This principle combined with a second assumption on the futility of the acceptance of entities that only have an overdetermined role as causes complete the picture of such a denial. In this presentation I will show that the assumption of the causal closure of the physical has some success only if we assume certain type of theories for causation relation so that the principle not only rules about what is causing what, but also how we have to understand causation itself.

Hernán Miguel
Lic. en Física – Dr. en Filosofía.
Profesor Titular Regular de Introducción al Pensamiento Científico, Ciclo Básico Común, Universidad de Buenos Aires. Es Director del Proyecto "Contrafácticos, explicación y causalidad" y Codirector del Proyecto "Filosofía de la ciencia y enseñanza de las ciencias: representación y articulación." Es miembro de equipos de investigación del exterior. Ha dictado cursos de posgrado y doctorado en universidades nacionales y del exterior y dirigido tesis de maestría y doctorado. Fue presidente de AFHIC (2007-2008) y forma parte de la Comisión Directiva de SADAF.