

THE LEGACY OF HANS PRIMAS

Symposium

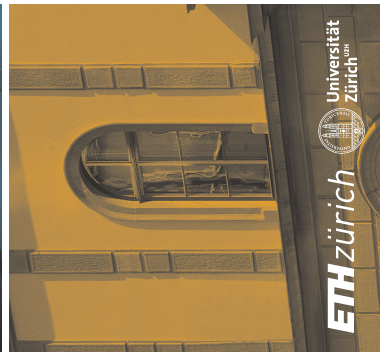
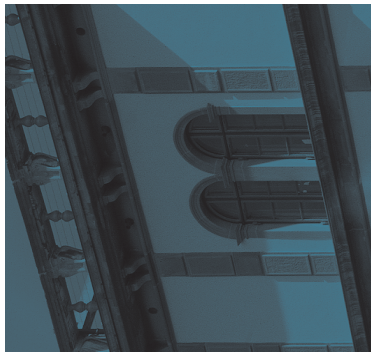
Friday, November 27, 2015

Collegium Helveticum, Schmelzbergstrasse 25, 8006 Zurich

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Universität
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Organized by H. Atmanspacher and U. Müller-Herold

Hans Primas was a Professor in the Chemistry Department at ETH Zurich from 1962 to 1995, and maintained his research activities until his death in 2014. In these more than 50 years, he worked on the foundations of nuclear magnetic resonance spectroscopy, contributed to a number of significant issues in theoretical chemistry, helped to clarify central topics in quantum theory and the philosophy of physics, suggested innovative ways of addressing interlevel relations in the philosophy of science, and introduced cutting-edge approaches in the flourishing young field of scientific studies of consciousness.

His work in these five areas of research and its present impact will be appreciated in presentations by noted experts, colleagues, and collaborators of Primas. All speakers will contextualize their presentation to facilitate the mutual dialog between their topics.

Speakers

Prof. Dr. Richard Ernst (Department of Chemistry and Applied Biosciences, ETH Zurich)

Prof. Dr. Geoffrey Bodenhausen (Laboratory of Biomolecular Magnetic Resonance, EPF Lausanne)

Prof. Dr. Ulrich Müller-Herold (Department of Environmental Systems Science, ETH Zurich)

Prof. Dr. Domenico Giulini (Institute of Theoretical Physics, Gottfried Wilhelm Leibniz Universität Hannover)

Prof. Dr. William Seager (Department of Philosophy, University of Toronto at Scarborough)

PD Dr. Harald Atmanspacher (Collegium Helveticum)

Program Schedule

Friday, November 27, 2015

10:00	Welcome and Introduction
10:15	Richard Ernst and Geoffrey Bodenhausen Hans Primas and Nuclear Magnetic Resonance Spectroscopy: Fundamental Contributions and His Legacy
11:15	Ulrich Müller-Herold Theoretical Chemistry and More: Personal Reflections on Hans Primas and His Work
12:15	Lunch Break
14:00	Domenico Giulini On the Notion of Superselection Rules
15:00	William Seager Relations across Levels of Description in Science
16:00	Coffee Break
16:30	Harald Atmanspacher Non-Commutative Structures from Quantum Physics to Consciousness Studies
17:30	Closing

Abstracts

Harald Atmanspacher

Non-Commutative Structures from Quantum Physics to Consciousness Studies

It has been an old idea by Niels Bohr, one of the architects of quantum physics, that central features of quantum theory, such as complementarity, are also of pivotal significance beyond the domain of physics. But Bohr – and others, such as Wolfgang Pauli – never elaborated this idea in concrete detail, and for a long time no one else did so either. This situation has changed: there are now a number of research programs applying key notions of quantum theory in areas of knowledge outside physics. In his typical way, both insurgent and conservative, Hans Primas has critically supported and contributed to these developments.

There are essentially two extraphysical directions in which non-commuting operations, the basis of complementarity, have been applied in the past 20 years. One of them refers to fertile new insights in psychology and cognitive science, due to which non-commutativity is a core feature of various kinds of decision-making processes. Meanwhile, there is a number of research groups worldwide who study these and other cognitive processes using quantum concepts. The other direction is closely related to a topic that interested Primas since his student days: the philosophical conjecture, developed by Pauli and C.G. Jung, that the mental and the physical are complementary aspects of one underlying reality that itself is psychophysically neutral. In his most recent work, Primas exploited this framework to explore the relation between mental and physical time.

Richard Ernst and Geoffrey Bodenhausen

Hans Primas and Nuclear Magnetic Resonance Spectroscopy: Fundamental Contributions and His Legacy

Based on astonishingly detailed documents written by Hans Primas himself that were collected by his son Urs Primas, it is evident that, already at an early age, Hans Primas prepared himself very carefully for a career as a scientist. He performed experiments at home in various fields of physics, electronics, and chemistry. This gave him a comprehensive view of disciplines that would become important in his later experimental research. In addition Hans Primas read a wide variety of advanced scientific textbooks. The original contributions of Hans Primas to theoretical and experimental nuclear magnetic resonance are described

in 23 publications, and he contributed to various aspects of practical analytical chemistry and infrared spectroscopy in 9 early papers. These publications will be summarized.

Domenico Giulini

On the Notion of Superselection Rules

In the early 1990s Hans Primas and Anton Amann visited Heidelberg to discuss physical and mathematical aspects of quantum theory with six other colleagues, in particular the notions of decoherence and superselection. This memorable meeting evolved from a mere clash of cultures into a heated but fruitful debate on fundamental issues concerning the role of “abstract representations” and the meaning of “understanding” in physics (and mathematical sciences in general). I will recall our debate on superselection rules which, though driven by technical issues, serves well to illustrate the different attitudes.

Ulrich Müller-Herold

Theoretical Chemistry and More: Personal Reflections on Hans Primas and His Work

In 1967, Primas decided to concentrate on research into the enigmatic relation between chemistry and quantum mechanics: How can it be that a molecule exhibits purely classical features in stereochemical ball-and-stick models alongside purely quantal properties in chemical spectroscopy? Due to the discovery of superselection rules in the 1950s Primas was able to propose a solution in terms of classical observables. In this vein he contributed to the theory of chirality and to measurement in quantum mechanics, and he initiated research on elementary systems and the construction of observables in general.

At the end of the 1970s, a permanent discussion topic in the Primas group was reductionism: How can a given theoretical description be related to more fundamental lower-level theories? The magnum opus by Primas, *Chemistry, Quantum Mechanics and Reductionism* (1981) addresses this question, which is difficult and provocative at the same time. Accordingly, the reception of this monograph in the scientific community covered the full range between enthusiasm and harsh criticism.

By the mid 1980s, environmental problems emerged as a new and important theme. At ETH, Primas worked on the establishment of a diploma curriculum in environ-

mental sciences. After his retirement, he restarted earlier work on time and irreversibility. This culminated in a seminal paper “Time-entanglement between mind and matter” (2003) which explores Pauli’s idea that mind and matter are complementary aspects of the same reality.

William Seager

Relations across Levels of Descriptions in Science

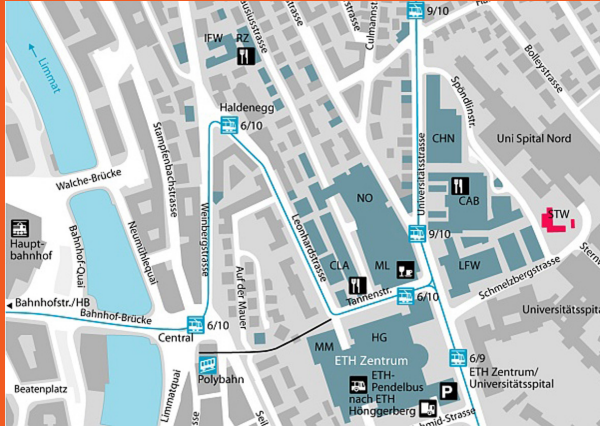
Hans Primas was distinguished amongst scientists by his abiding interest in and contributions to the philosophy of chemistry and general philosophy of science. Three fundamental concepts link Primas’s thought to recent work in the philosophy of science: classicality, patterns and emergence. Primas was prescient in applying the concept of “pattern” to the problem of emergence, anticipating the work of Daniel Dennett (which has been adapted to a quantum context by David Wallace). He was a pioneer in the attempt to understand how classical systems could emerge from a quantum reality.

It is striking that these three themes have played a central role in the remarkable growth of interest in the many-worlds interpretation of quantum mechanics in recent philosophy of science. Although Primas came to regard the many-worlds interpretation of quantum mechanics as “nonviable” he at one time (in his opus magnum of 1981) held it in some regard.

The issue of the emergence of classical systems is also considered as critical for a viable many-worlds interpretation of quantum mechanics. Much work toward this end has been done within the decoherence paradigm which has interesting connections to Primas’s emphasis on Boolean substructures. It is tempting to equate these metaphysically with Everett’s “worlds”. Nevertheless, the problem of probability seems to remain as a significant stumbling block to the acceptance of that interpretation. This difficulty (and others) might lead back to Primas’s dual aspect view of reality which, though hard to articulate clearly, was a perennial aspect of his thought.

Venue

Collegium Helveticum, Semper-Sternwarte, Schmelzbergstr. 25, 8006 Zurich



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Registration

Since the number of participants is limited, registration is necessary and will be processed in the order of arrival. Please register at info@collegium.ethz.ch. Deadline is November 20, 2015.

COLLEGIUM HELVETICUM
LABORATORIUM FÜR TRANSDISZIPLINARITÄT

IN GEMEINSAMER TRÄGERSCHAFT
VON UNIVERSITÄT ZÜRICH UND ETH ZÜRICH

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