

## Workshop Hermann Weyl & the philosophy of the ‘new physics’

10 – 11 DÉCEMBRE / DECEMBER 10 – 11, 2014  
UNIVERSITÉ / UNIVERSITY PARIS DIDEROT



by courtesy of Lotte Meitner-Graf, London

**Organisateurs / Organizers**  
**Gabriel Catren, Silvia De Bianchi**

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(UMR 7219, CNRS et Universités Paris Diderot et Paris 1) / Workshop organised in the context of the ERC Project PhiloQuantumGravity  
at the Laboratoire SPHERE (UMR 7219, CNRS et Universités Paris Diderot et Paris 1)



AMPHITHEATER BUFFON, building Buffon, 15, rue Hélène Brion, 75013 Paris ([map](#))

9:30 Accueil / Welcome

**SESSION I**

**10:00 - 11:00 *Surface aspects and surrogative reasoning : dual descriptions in Weyl and Leibniz***

Norman SIEROKA (ETH Zurich)

During the 1920s Weyl sought for a kind of dual description of general relativity and (quantum) theories of subatomic matter. He worked on field physics as characterising "surface aspects" of something which is not itself in four-dimensional spacetime and took this to be an accomplishment of the programmatic framework of the then "new physics" outlined by Leibniz. I will sketch some of the striking parallels between Leibniz's "surrogative reasoning" and the central methodological characteristics of Weyl's approach. Afterwards, I will draw some tentative conclusions about the prospective limits of this general descriptive framework which, arguably, lives on (and even flourishes) today in so-called "holographic principles" (such as AdS/CFT). If time allows, I will conclude with some remarks on another philosopher who has been very influential on Weyl – namely Husserl – and on how his remarks about the relation between physics and mathematics relate to Leibniz's "surrogative reasoning".

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Pause café / Coffee – Break

**11:30 - 12:30 *In Weyl's Footsteps : Towards a Group-Theoretical Ontology for Quantum Systems***

Gabriel CATREN (CNRS, SPHERE and ERC project PhiloQuantumGravity)

We shall argue that Weyl's reflections on the notion of symmetry implicitly convey – beyond his explicit statements concerning the interpretation of quantum mechanics – a group-theoretical ontology for quantum systems. This ontology results from the interplay between two theses, namely 1) that thesis according to which quantum states can be interpreted in terms of what Weyl characterizes as "structure-endowed entities" equipped with a "group of automorphisms" (H. Weyl, *Symmetry*), and 2) the thesis according to which quantum numbers "are indices characterizing representations of groups." (H. Weyl, *Theory of Groups and Quantum Mechanics*). These theses can be naturally unified by claiming that the quantum numbers defining a given state are indices that fix a representation of the state's group of automorphisms. We shall argue that this statement, far from being trivial, entails a strong constraint on the set of invariant properties of a physical system, constraint that can be understood as the seed of Heisenberg indeterminacy principle.

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Déjeuner / Lunch – Break

ROOM 2-98, building Olympe de Gouges, 8, rue Albert Einstein, 75013 Paris ([map](#))

**SESSION II**

**14:30 - 15:30 *Hermann Weyl's Views on the Foundations of Mathematics and Physics as Informed by his Philosophical Outlook***

John L. BELL (Western University – Ontario)

Weyl's views on the foundations of mathematics and physics were strongly influenced by his philosophical orientation, which was fundamentally idealist, although certain "realist" touches seem also to be present in his account of physics. In my talk I shall, inter alia, attempt to describe Weyl's metaphysics and how from it emerged his differing accounts of the foundations of mathematics and physics, the former in principle directly accessible to intuition, the latter requiring the use of what Weyl termed symbolic construction – the representation of the real world by symbolic means.

**15:30 - 16:30 *Relativity and intersubjectivity in Weyl's philosophy***

Carlos LOBO (Collège International de Philosophie – Paris)

Against Becker, Weyl expresses strong reservations regarding the distribution of tasks between phenomenology and physics. Taking relativity theory merely as a positive scientific theory consisting, *formaliter*, in a hypothetico-deductive system and, *materialiter*, in a set of « empirical facts », Becker limits the task of his investigations into relativity theory, to extracting the explicit and implicit « material apriori propositions » and to grounding them. For Weyl, formal or analytical *a priori*s are at work in mathematics and physics. The so-called material *a priori* of space is thus successfully reduced to a formal construction — the building up of a Helmholtz-Lie group structure. Although empirical and positive, it is from relativity theory that we learned demonstrably : 1. that the relative and objective are co-dependent and co-extensive concepts and that subjectivity alone (taken in its pure monadic stance) is absolute ; 2. that there remains necessarily a double gap between the objective

construction and the real actual world, on the one hand, and between the absolute I (and Here) and the empirical and individuated subject, on the other. From that we can infer that intuitive space (definitely discarded as a sound basis for scientific construction), appears, from a metaphysical point of view, as « the necessary medium of intersubjective construction of the world », and thus, as Leibniz said rightly, as something ideal and subjective.

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Pause café / Coffee – Break

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**17:00 - 18:00 *Apriorism and holism in Weyl's works in mathematical physics***

Christophe ECKES (Université de Nancy)

In our presentation, we will determine the form of apriorism Weyl supports when he develops his purely infinitesimal geometry as a mathematical framework for his unified field theory. We will also recall the philosophical sources of this apriorism. To this end, we will refer to his founding papers namely *Reine Infinitesimalgeometrie and Gravitation und Elektrizität* (1918). We will also analyze some arguments contained in the third and the fourth edition of *Raum Zeit Materie*. In addition, we will compare Weyl's philosophical reflections to the viewpoints defended by Hilbert, Einstein, Reichenbach, Cassirer and Geiger during the short period 1919-1921. We will also identify some changes in Weyl's philosophical views, when he solves his so-called Raumproblem (1921-1923). Then we will underline the fact that Weyl remains attached to a kind of holism, inspired by Duhem and Hilbert, in all his contributions in mathematical physics, that is in general relativity as well as in quantum mechanics. Finally, we will try to determine the connections between Weyl's holism and the idea of a symbolic construction of reality, as it is already put forward in the first edition of *Philosophie der Mathematik und Naturwissenschaft* (1927).

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Conférence-Dîner / Conference – Dinner

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**JEUDI 11 DECEMBRE / THURSDAY DECEMBER 11**

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**ROOM 575F** (level 5, hall F), building Halle aux farines, 10, rue Françoise Dolto, 75013 Paris ([map](#))

**SESSION III**

**09:30 - 10:30 *Weyl's search for a difference between 'physical' and 'mathematical automorphisms' of physical theories***

Erhard SCHOLZ (Wuppertal University)

In his scale gauge geometry of 1918 Weyl extended the (localized) Poincaré group to the restricted conformal group of Minkowski space (in this context sometimes called the Weyl group). This extension played a crucial role in his geometrically unified field theory of 1918 and in his mathematical analysis of the space problem. Later in the 1920s, after his shift to the phase gauge approach in quantum mechanics, he re-analyzed this move in terms of a distinction between 'physical automorphisms' (generalized congruences) and 'mathematical automorphisms' (generalized similarities). In this talk I want to present Weyl's search for such a distinction in the automorphism structure of a physical theory and pose the question whether the indicated difference makes sense in the light of the later development of gauge theories.

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Pause café / Coffee – Break

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**11:00 - 12:00 *Weyl and the New Physics of Cosmological Speculation***

Thomas RYCKMAN (Stanford University)

From a contemporary standpoint, Weyl's contributions to the incipient science of cosmology in the 1920s appear both prescient and understandably premature, given the lack of observable data. I shall briefly review these contributions, which can be seen as extrapolations from existing physical theory, and then turn to consider the character and nature of his several cosmological speculations, beginning with his suggestion in 1919 concerning large numbers in physics that set in train other such efforts by Eddington and Dirac. However, I shall argue that for Weyl at least, the difference between extrapolation and speculation remained fundamental, and that he cannot be viewed as a precursor of current multiverse scenarios where observation and testability are subordinated to mathematical aesthetics.

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Déjeuner / Lunch

AMPHITHEATER 4C (level, hall C), building Halle aux farines, 16, rue Françoise Dolto, 75013 Paris ([map](#))

#### SESSION IV

##### 15:00 - 16:00 *Weyl in America*

Jeremy GRAY (Open University – London)

Much of Hermann Weyl's philosophical writing is in the form of high-level popularisations, including the series of invited lectures at Yale and Swarthmore, the English translation of his *Philosophy of Mathematics and Natural Science* (1949), and his book *Symmetry* (1952). They are profound, original, insightful, and alien to modern (Anglo-Saxon) philosophy of mathematics and science. This paper will offer a series of first impressions of how it is that they have become so difficult to read, and of what is valuable in Weyl's accounts, with particular reference to current philosophies of mathematical practice.

##### 16:00 - 17:00 *Weyl's "Levels of Infinity" (1930)*

Silvia DE BIANCHI (Autonomous University of Barcelona)

This contribution focuses on the paper delivered by Hermann Weyl on the 27th of October 1930 in Jena, entitled "Levels of Infinity" (*die Stufen des Unendlichen*) and published in German in 1931. In it, Weyl reconstructs the history of the notion of infinity from the Greeks and concludes by expounding the main features of the modern conception of infinity in mathematics and physics. The relevance of this short essay consists not only in the fact that Weyl clearly expounds what in his view are the characters of mathematics as the science of the infinite, but also in the fact that the epistemological considerations developed therein are related to natural science. This essay represents a synthesis of Weyl's notion of objectivity as drawn in his *Theory of Groups and Quantum Mechanics* and in the first edition of *Philosophy of Mathematics and Natural Science*. This contribution aims at throwing light on Weyl's philosophy and epistemology, by linking the notion of objectivity as it appears in *Levels of Infinity* to these two works. This approach offers a systematic view of Weyl's search for a suitable theory of knowledge in mathematics and physics.

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Pause café / Coffee – Break

##### 17:30 - 18:30 *Weyl's Interpretations on Riemann and Helmholtz-Lie's Problems of Space*

Julien BERNARD (Zukunftskolleg – Konstanz)

Hermann Weyl built the so called "problem of space" anew in 1921-1923, in a relativistic context. Einstein's space-time is a Riemannian manifold. Therefore, the problem becomes : how can we justify that the metric is given by a quadratic differential form ? In order to develop his own position, Weyl made a deep analysis of 1) Riemann's and 2) Helmholtz-Lie's positions. Weyl's aim was not only historical. Indeed, the relativity theories help us to show what was right or wrong in the respective philosophical positions on which Riemann's and Helmholtz-Lie's constructions were based. According to Weyl, Helmholtz' position was not satisfying because of its fundamental use of isotropy. Isotropy is questionable in relativistic context, because of the fundamental distinction between space-like and time-like directions. Despite Weyl's emphasis on isotropy, we think that Helmholtz' position was problematic for him at a deeper level. Indeed, Helmholtz tried to erase the epistemological gap between the infinitesimal realm and the finite one, which was so fundamental for Riemann. By confusing these two realms, Helmholtz wanted to minimize the role of synthetic *a priori* considerations, in favor of empiricism or conventionalism. A coherent idealistic position can be defended only by refuting this Helmholtz' confusion.

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Rafraîchissements / Wine and Cheese

#### INFORMATIONS PRATIQUES / PRACTICAL INFORMATION

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##### University Paris Diderot:

Wednesday 10, morning: amphitheater Buffon (15, rue Hélène Brion, 75013 Paris)

Wednesday 10, afternoon: building Olympe de Gouges (8, rue Albert Einstein, 75013 Paris), amphi 2 (level 1)

Jeudi 11, morning: building Halle aux Farines (10 rue Françoise Dolto), hall F, room 575F (level 5)

Jeudi 11, afternoon: building Halle aux Farines (16 rue Françoise Dolto), hall C, amphi 4C (1er étage)

Map of the campus with metro and buses.

Metro: line 14 and RER C / Station : Bibliothèque François Mitterrand ; line 6 / Station : Quai de la Gare  
Bus 64 / Stop: Tolbiac-Bibliothèque François Mitterrand ; bus 62 & 89 / Stop: Avenue de France or  
Bibliothèque François Mitterrand (terminus) ; Bus 325 / Stop: Watt