

Geneva Summer School in the Philosophy of Physics 2009, July 5-11: Foundations of Quantum Mechanics

Topic: „Is Schrödinger's Cat Alive or Dead or Both?“

A summer school on the foundations of quantum physics.

Quantum physics is at the same time both arguably the most successful set of scientific theories of all times, as well as a severe competitor for the title of the least understood. This summer school on the foundations of quantum physics will introduce young minds to the fascination and paradoxes that have attracted and puzzled philosophers and physicists alike for almost a century now. The overarching questions that we will address is the following: Assuming that quantum mechanics is true, what does this imply for what the real world is like? Or, more succinctly, what is real according to quantum mechanics? Finding the answer to this question has turned out to be much harder, and much more controversial, than anyone could have anticipated.

Erwin Schrödinger captured most vividly the core of the problem in his famous thought experiment involving a cat imprisoned in a windowless box, in a clear violation of any animal welfare standards. Within the chamber with the cat is also a device that kills the cat with the exact probability of fifty percent during the first hour of imprisonment. Leaving the system box-cum-cat-cum-device alone for an hour, we would say that the cat is alive with a fifty-percent chance and dead with a fifty-percent chance. In quantum mechanical terms, the cat would be in a superposition of the states „alive“ and „dead“. We then open the box to determine whether the cat has indeed survived or not. If we do many experiments, we would expect that fifty percent of the runs would end with living cats and fifty percent with dead cats, assuming the device is not deterministic and can thus not be predicted, i.e. it is for instance coupled to radioactive decay. When, Schrödinger then asks, does the state of the cat stop existing as a superposition and unambiguously become one or the other?

Put here: paradox in above thought experiment; alternatively: a better way to illustrate the puzzling character of quantum mechanics? Or should this go into the text for the funding campaigns?

Targeted audience and objectives

This summer school is geared to doctoral students and postdoctoral researchers in philosophy of physics as well as philosophically minded physicists. We aim to bring this group together with leading experts on the foundations of quantum physics who will guide us through the current debates in the philosophical foundations and in the interpretation of quantum theory. Experts will give lectures on each of these topics. An effort will be made to presuppose little by way of prior exposure to the literature both in physics as well as in philosophy. The lectures should thus be accessible to the talented novice, although we expect the programme to be dense. Anyone successfully completing the summer school should thus be in a position to get started on some of the more advanced work in the foundation of quantum physics. In particular, the summer school will serve as an intense preparation for doing research in the area, both for the beginning

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doctoral student as well as for anyone further along the road with an interest to build up the foundations of quantum physics as a core competence. Last but not least, it will allow the participants to connect with leading experts in the field and thus lets them establish a network vital for their research careers.

Topics

Preliminary list of topics for lectures:

- Measurement problem
- Schrödinger's cat, Wigner's friend, and quantum entanglement
- Einstein-Podolsky-Rosen paradox
- Bohr-Einstein debate
- Bell inequality
- Non-locality, separability, and backward causation
- Quantum mechanics and reality
- Copenhagen interpretation of quantum mechanics
- Collapse interpretations
- Hidden-variable/Bohmian interpretation
- Everettian/Many-worlds interpretation
- Decoherence and consistent histories
- Uncertainty relations
- Mathematical foundations of quantum mechanics
- Kochen-Specker theorem
- Quantum field theory (QFT): fields or particles?
- Algebraic QFT
- QFT on curved spacetime, Rindler quanta, Unruh effect

Organizing Committee

The Geneva Summerschool in the Philosophy of Physics 2009 is organised by **eidos**, the Geneva Centre for Metaphysics, in close cooperation with the department of philosophy (Prof. Kevin Mulligan) and the Unit for History and Philosophy (Prof. Jan Lacki).

Direction: [Kevin Mulligan](#), Professor at the Department of Philosophy, University of Geneva, and Head of *eidos*, the Centre for Metaphysics at the University of Geneva

Organizing Committee:

- [Christian Wüthrich](#), Department of Philosophy, University of California, San Diego, and University of Geneva
- [Vincent Lam](#), Department of Philosophy, University of Lausanne and University of Geneva
- [Philipp Keller](#), Department of Philosophy, University of Geneva

Speakers

The following speakers have confirmed their presence at the summer school:

- David Albert (Columbia)
- Chris Isham (Imperial College London)
- Guido Bacciagaluppi (Sydney)
- David Wallace (Oxford)
- Nicholas Gisin (Genève)
- Christian Wüthrich (UC San Diego et Genève)
- Vincent Lam (Lausanne et Genève)

Location and dates

Date: July 5-11 2009

The summer school will take place at the beautifully located "Hôtel du Mont-Collon", in the middle of the Swiss Alps at Arolla.

Arolla (2000m) is a small mountain resort at the end of an alpine valley (the "Val d'Hérens") surrounded by the impressive Mont-Collon (3636m) and the Pigne d'Arolla (3790m).

The participants will be accommodated at the "Hôtel du Mont-Collon" in two- to four-bed rooms (depending on the number of participants) with shared bathroom.

Accommodation fee (full board): 103 CHF per night (2008 prices).

Hotel du Mont-Collon
Monica and Vincent Anzévui
CH-1986 Arolla VS
Tel +41 27 283 11 91
Email info@hotelmontcollon.ch
<http://www.hotelmontcollon.ch/>

Application

We ask PhD students and young researchers at the postdoctoral level to apply by sending us a short, one-page application letter stating the reason for their application and their level of technical expertise in the relevant physics together with a CV by 15 March 2009.

We will notify the applicants by 1 April 2009.

Tuition Fee

- for PhD students in philosophy or physics and young researchers (PhD not more than three years ago): 300 CHF (by 15 April) / 400 CHF (after 15 April)

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- for academic and non-academic professionals: 1000 CHF (by 15 April) / 1200 CHF (after 15 April)

Tuition fee includes all lectures, conference materials, reception on Sunday evening, coffee breaks, and the excursion. The fees do not include accommodation, meals, and travel to and from the location of the summer school.

Programme

Programme is TBD. Below is one proposal, taking into account the many suggestions for trying out different formats. Most importantly, it involves „Groups“, i.e. session when we split up into smaller groups (perhaps introductory sessions and more advanced discussions).

Sunday evening: Registration, welcome drink, dinner, Lecture 01

Mon	Tue	Wed	Thu	Fri	Sat 2 August
09:30-11:00 Lecture 02	09:30-11:00 Lecture 06	09:30-11:00 Lecture 08	09:30-11:00 Lecture 10	09:30-11:00 Lecture 14	09:30-11:00 Lecture 16
11:00-11:30 Coffee break	11:00-11:30 Coffee break	11:00-11:30 Coffee break	11:00-11:30 Coffee break	11:00-11:30 Coffee break	11:00-11:30 Coffee break
11:00-12:30 Lecture 03	11:30-13:00 Lecture 07	11:30-13:00 Lecture 09	11:30-13:00 Lecture 11	11:30-13:00 Lecture 15	11:30-13:00 Lecture 17
13:00-14:30 Lunch	13:00-14:30 Lunch	13:00-14:00 Lunch	13:00-14:30 Lunch	13:00-14:30 Lunch	13:00-14:30 Lunch
14:30-16:00 Lecture 04	14:30-16:00 Groups 1	14:00-18:30 Excursion	14:30-16:00 Lecture 12	14:30-16:00 Groups 3	14:30 End
16:00-16:30 Coffee break	16:00-16:30 Coffee break		16:00-16:30 Coffee break	16:00-16:30 Coffee break	
16:30-18:00 Lecture 05	16:30-18:00 Groups 2		16:30-18:00 Lecture 13	16:30-18:00 Groups 4	
19:00-20:30 Dinner	19:00-20:30 Dinner	19:00-20:30 Dinner	19:00-20:30 Dinner	19:00-20:30 Dinner	