Module: Elective Advanced Lectures: Theoretical Physics

Module No.: physics70c

Course: Surprises in Quantum Mechanics (T)

Course No.: physics7519

Category	Type	Language	Teaching hours	CP	Semester
Elective	Mixed lecture and seminar	English	2	4	WT/ST

Requirements for Participation:

Preparation:
Advanced Quantum Theory (physics606)

Form of Testing and Examination:
Presentation of an independently completed project

Length of Course:
1 semester

Aims of the Course:
Gaining a deeper understanding of quantum mechanics, including several so-called paradoxa, covering both theoretical and experimental aspects

Contents of the Course:
Basic formalism of quantum mechanics, followed by a selection of:
Pitfalls in infinitely dimensional Hilbert spaces
Classical vs quantum mechanical correlations
When does interference occur, when is it destroyed?
The "quantum eraser"
Quantum mechanical description of measurement devices
A quantum measurement yielding S_z = 42 for a spin-1/2 particle
How to ascertain all spin components of a spin-1/2 particle ("quantum card trick")
Quantum mechanics without "collapse of the wave function"?
Generalizations of the Aharonov-Bohm effect
Hanbury-Brown-Twiss correlations

Recommended Literature:
Mostly research and review articles will be used. Some of the topics are discussed in
Y. Aharonov, D. Rohrlich, "Quantum paradoxes: quantum theory for the perplexed", Wiley, 2005