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Colorado State University's Information Science and Technology Center (ISTeC)

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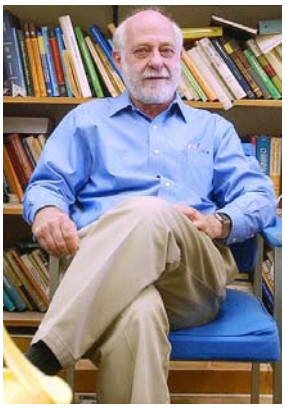

Dr. Herschel A. Rabitz

Professor, Department of Chemistry
Princeton University

ISTeC Distinguished Lecture

and Chemistry Department Seminar

"Controlling Quantum Phenomena: The Dream Is Alive"

Thursday, April 27, 2006
Reception: 3:30 pm, Chemistry B101A
Lecture: 4:10 to 5:00 pm, Chemistry B202

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Joint Electrical and Computer Engineering Department and Computer Science Department Seminar

sponsored by ISTeC

"An Open Forum on Controlling Quantum Phenomena: Why do the Experiments Appear "Easy" and What May Lie Ahead?"

Friday, April 28, 2006
Lecture: 4:10 to 5:00 pm
Guggenheim 107

ABSTRACTS

"Controlling Quantum Phenomena: The Dream Is Alive"

Since quantum phenomena were first discovered, a major effort has been to study its unusual character. The dream of controlling quantum phenomena emerged in tandem with the latter studies. Potentially controllable quantum phenomena span applications from electron transport in semiconductors out to analogous processes in biological molecules and generally manipulating atomic scale events of virtually any nature. The dream of carrying out these controlled processes was especially bolstered by the advent of lasers in the 1960's and ultimately the development of ultrafast lasers operating at femtoseconds or even shorter times in keeping with the inherent timescales of quantum phenomena. The additional ability to shape laser pulses rather arbitrarily now provides the means to create tailored *photonic reagents*, which can interact with matter in a fashion analogous to that of ordinary reagents. Finally, drawing in appropriate theoretical principles and special high-speed algorithms has enabled the execution of an increasing number of experiments demonstrating the control of quantum phenomena. Although the dreams in this area are as old as quantum mechanics itself, the subject is perhaps best viewed as only a few years young. Only recently have all of the appropriate concepts and technologies been folded together, providing the means to demonstrate that the dream of controlling quantum phenomena is in fact a reality. These developments will be discussed along with possible prospects for the future of the field.

"An Open Forum on Controlling Quantum Phenomena: Why do the Experiments Appear "Easy" and What May Lie Ahead?"

The forum will open with a brief introduction of several problems at the forefront of Control and System Inversion for Quantum Phenomenon. A discussion among attendees will follow regarding interesting prospects, challenging problems, open questions, and wild speculation about controlling quantum phenomenon.

The control of quantum phenomena with lasers is a quest going back many years with recent successes in the laboratory providing solid evidence for the ability to manipulate quantum dynamics. These successes across a broad spectrum of atomic and molecular scale applications, suggest that there is a generic foundation behind them. In particular, although the detailed nature of each quantum system will dictate the subtle structure of the shaped laser pulse acting as a *photonic reagent* control, the reason why the experiments succeed may be traced back to basic principles of quantum mechanics.

These findings bode well for the future of the field and open up potential new directions for consideration. The discussions will focus on questions such as the development of new algorithms and computational tools to extract information about the system under control, why these systems appear to exhibit universal controllability, and what properties might make a quantum system uncontrollable.

Dr. Herschel A. Rabitz graduated from Harvard University in 1970, with a Ph.D. degree in chemical physics. This was followed by post-doctoral work at the University of Wisconsin. In 1971, Professor Rabitz joined the faculty of the Department of Chemistry at Princeton University, and from July, 1993 to July, 1996 was Chairman of the Department. He is also an affiliated member of Princeton's Program in Applied and Computational Mathematics. Professor Rabitz's research interests lie at the interface of chemistry, physics, and engineering, with principal areas of focus including molecular dynamics, biophysical chemistry, chemical kinetics, and optical interactions with matter. An overriding theme throughout his research is the emphasis on molecular scale systems analysis. Professor Rabitz has over 650 publications in the general area of chemical physics.

To arrange a meeting with the speaker, please contact Dr. Randy Bartels at (970) 491-1464 or bartels@engr.colostate.edu

ISTeC (Information Science and Technology Center) is a university-wide organization for promoting, facilitating, and enhancing CSU's research, education, and outreach activities pertaining to the design and innovative application of computer, communication, and information systems. For more information please see ISTeC.ColoState.edu.