

武汉物数所理论交叉学术交流系列报告

(第一二七——一二八期)

Quantum Mechanics from the Top Down: Understanding and controlling quantum systems by studying their classical counterparts

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频标楼4楼报告厅

I. Chaotic Transport and Escape (10月20日)

Chaotic transport, and the escape of trajectories from defined regions of phase space, has been an important topic in dynamics for many years, because it describes phenomena that occur in many branches of physics. For example, some meteorites that fell on Antarctica are believed to have come from Mars; how they escaped from Mars' gravitational field is a problem in the theory of chaotic transport. At a smaller scale, one of the important topics in nanophysics is ballistic transport of electrons through a small junction: electrons enter a junction from one lead, bounce around within the junction following either regular or chaotic paths, and eventually find their way to an exit lead. Ultracold atoms can be pumped from one reservoir to another through a lead having oscillating potential-energy barriers. At the molecular level, we may think about the breakup of a temporarily bound complex, such as a He atom weakly bound to an I₂ molecule. At the atomic level, the ionization of an excited hydrogen atom in applied electric and magnetic fields is an excellent candidate for the laboratory study of chaotic transport. One general theory describes all of these phenomena.

II. Topological Changes of State in Classical and Quantum Systems (10月21日)

One of the topological changes of state exhibited by some systems is called "monodromy". This can be found in quasi-linear molecules, atoms in a trap, a "swing-spring", or a hydrogen atom in crossed fields. A quantum manifestation of monodromy is a defect in the lattice of eigenvalues. A dynamical manifestation of monodromy, which will be visible in both classical and quantum systems, will be described in this talk. Especially we discuss how this phenomenon could be observed using a classical pendulum system or ultracold atoms.

About Speaker

John B. Delos is professor of physics at William and Mary, where he joined the faculty in 1971. He is author of about 130 papers, mostly published in Physical Review or Journal of Chemical Physics. He has held research grants from National Science Foundation continuously for about 30 years, and he received grants from Office of Naval Research for about ten years. He is fellow of the American Physical Society (APS), Outstanding Scientist of Virginia (1990), and a few years ago was elected as Chair of the Division of Atomic, Molecular and Optical Physics of APS (2600 members). Now he has a new project applying nonlinear dynamics to the study of heart rates and respiration of infants in neonatal intensive care units. For seven years he taught a Freshman Seminar titled "Ethical Issues in Men's Lives". Readings and discussions included Aristotle's *Ethics*, moral development of children, family structures, and biological perspectives on human ethics.

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