



清华大学
Tsinghua University



清华大学高等研究院 – 冷原子物理系列讲座

Fundamentals of Cold Atomic and Molecular Collisions

地点: 高等研究院, 科学馆三楼报告厅

报告人: **Professor Paul S. Julienne**
Joint Quantum Institute, University of Maryland and NIST

Lecture 1 - Cold Collision Basics

April 19 (Tuesday) 2016 10:00 a.m.

This lecture describes how to describe cold collisions quantum mechanically, with emphasis on scattering and bound state properties near a collision threshold that are relevant to cold atom studies, emphasizing especially the role of the long range potential between two interacting atoms. The 7 isotopes of the Yb atom make a good test case of threshold scattering and bound state properties, and help to illustrate the powerful "quantum defect" concept.

Lecture 2 - Feshbach Resonances I

April 19 (Tuesday) 2016 2:30 p.m.

Magnetically tunable scattering resonances known as Feshbach resonances permit the control of the interactions of cold bosonic or fermionic atoms and have been essential to the multidisciplinary fruitfulness of cold atom studies. This lecture shows how to understand such resonances, using examples of magnetically tunable Feshbach resonances that have been successfully used in experimental work.

Lecture 3 - Feshbach Resonances II

April 21 (Thursday) 2016 10:00 a.m.

This lecture continues a discussion of Feshbach resonances, introducing two topics relevant to ongoing research. One is overlapping or interfering resonances, which can be important in practical cases. The other is optically tunable resonances, which serve as an example of a class of resonances that exhibit loss due to spontaneous irreversible decay. This lecture will explain how to compare magnetically and optically tunable resonances.

Lecture 4 - Universality in Atomic and Molecular Collisions

April 21(Thursday) 2016 2:30 p.m.

This lecture explores the concept of "universality," that is, the existence of scattering properties that are independent of the details of complex short-range chemical interactions. The power of this idea based on the "quantum defect" concept will be illustrated with examples involving two- and few-body physics, and the reactive and inelastic collisions of cold molecules.

Lecture 5 - Other Topics in Cold Collisions

April 22 (Friday) 2016 10:00 a.m.

The lecture series concludes by exploring some additional topics that are relevant to current research areas. These include chaotic dynamics with complex atoms or molecules, which have dense sets of overlapping resonances but may also have some universal properties. The effect of reduced dimension, or tight quantum confinement, on cold collisions will be examined for some aspects of atomic and molecular collisions.



Professor Paul S. Julienne

Paul S. Julienne obtained his Ph. D. in Chemical Physics in 1969 from the University of North Carolina at Chapel Hill. After postdoctoral work at the National Bureau of Standards (NBS), he worked with the Plasma Physics Division at the Naval Research Laboratory before returning to NBS (now called NIST) in 1974, where he has remained ever since. He served as a group leader for the Quantum Processes Group, as a NIST Fellow, and as a founding Fellow of the Joint Quantum Institute (JQI) of NIST and the University of Maryland. After retiring in 2013, he serves as a NIST Scientist Emeritus and an Emeritus Fellow and Adjunct Professor of Physics at the JQI. He is a Fellow of the American Physical Society (APS) and was awarded the 2004 Davison-Germer Prize of the American Physical Society and the 2015 William F. Meggers Award of the Optical Society of America. Since the mid 1980s, his research has concentrated on the collisions and spectroscopy of cold and ultracold atoms and molecules and their applications in quantum gases and optical lattices.