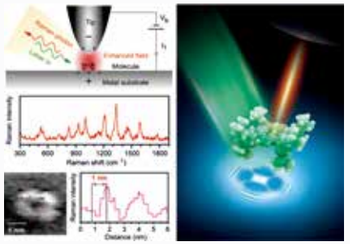
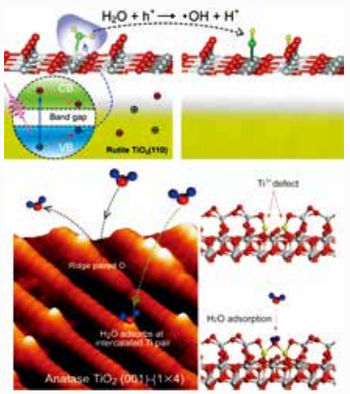
Research group for Quantum control on the single-molecular scale, University of Science and Technology of China



光学成像技术的重大突破：前所未有的最高分辨单分子光学成像与化学识别，分辨率高达 0.5nm

Breakthrough in optical microscopy-Realization of unprecedented high-resolution single-molecule Raman microscopy, the spatial resolution reaches 0.5 nm.

Matters on the single-molecular scale have rich structures, functions and unique quantum properties. They are promising building blocks for future quantum information technologies and may play significant roles in novel materials for new energy. Aiming to solve fundamental issues and problems in this field, since 1997, the research group has been devoted to the study of the single-molecular systems and has made a series of important scientific discoveries and innovative contributions. Especially in the last 5 years, the group has further developed important techniques and theoretical methods for detection, manipulation and control of quantum states on single-molecular scale. The major achievements include: realization of single-molecule Raman spectro-microscopy with subnanometer resolution which is a breakthrough in optical microscopic techniques; realization of novel single-molecule devices with designed functions through single-molecule chemistry; identification and verification of microscopic mechanisms for surface catalytic reactions on the single-molecular level; proposal of a novel mechanism for photo-catalytic water splitting using infrared light. The innovative achievements were highly reviewed and valued by the science community and have been elected top 10 breakthroughs in science and technology of China for 3 times. The research group has become an international well-known group with high prestige at the leading edge of single-molecule sciences.



在单分子尺度上原位研究表面光催化机制

In-situ study of surface photocatalysis on the single-molecular level

Outstanding contributors of this research group

Hou Jianguo

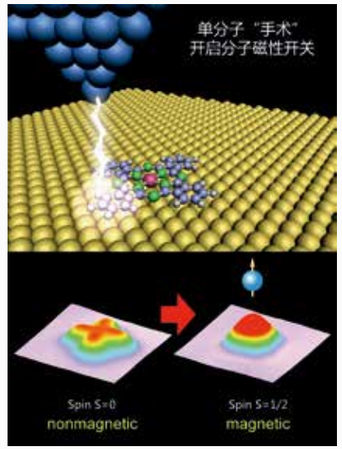
Leader and organizer of the group. He has made significant contributions to the fields of quantum control on the single-molecular scale, single-molecule manipulation and high-resolution single-molecule microscopy.

Yang Jinlong

Leader of the theoretical part of the group. He has made several important seminal achievements in theoretical design and computational simulation of quantum control of single molecules.

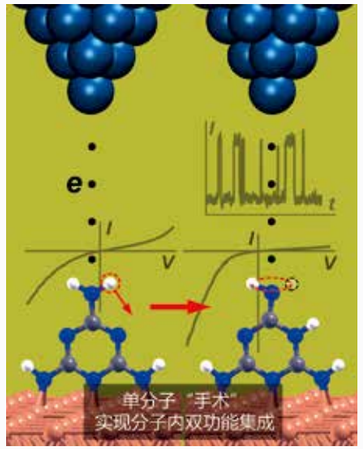
Other members

Wang Bing
Dong Zhenchao
Wang Xiaoping
Luo Yi
Zhao Jin
Li Zhenyu
Zhao Aidi
Li Bin



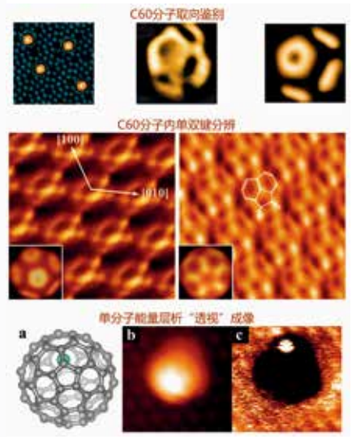
发展了基于 STM 的选键化学的单分子“手术”操纵，实现分子磁性自旋态调控

Control of single-molecule magnetism and spin state via single molecule bond-selective chemistry and manipulation.



利用单分子选键化学操纵，实现了对单分子电子输运性质的调控

Control of single-molecule transport properties and via single molecule bond-selective chemistry and manipulation.



发展了同时具有空间与能量高分辨的 STM 表征手段，实现分子内部高分辨成像

Development of scanning tunneling microscopy techniques with high spatial and energy resolution for intramolecular characterization.

单分子尺度的量子调控研究集体

研究集体推荐单位：中国科学技术大学

研究集体主要科技贡献：

单分子尺度体系具有丰富的功能结构和独特的量子性质，是未来量子信息技术的最佳物质载体之一，也在新能源材料中发挥着极其重要的作用。十余年来，该研究集体坚持对上述体系开展系统的探索，取得了一批重要的创新成果。近五年，他们进一步发展和提升了单分子尺度量子态的探测、操纵及调控技术，发展了一批具有重要学术价值的新方法和新理论，率先实现了国际上最高水平的亚纳米分辨的单分子拉曼成像，成功设计并实现具有多重功能集成的单分子器件，揭示出氧化物表面光催化分解水的微观机制，提出了红外光分解水的全新原理。该集体的创新成就受到国内外同行的高度赞誉，曾先后三次入选中国十大科技进展，奠定了该集体在相关科学领域的国际前沿地位。

侯建国 Hou Jianguo

杨金龙 Yang Jinlong

研究集体突出贡献者

侯建国

集体的组织者和领导者，在单分子尺度的量子调控、单分子操纵与高分辨成像等领域取得了多项开创性的重大研究成果

杨金龙

集体的理论研究学术带头人，在单分子尺度量子调控的理论设计和计算模拟方面取得了多项重要的创新性成果

研究集体主要完成者

王　兵　董振超　王晓平　罗　毅　赵　瑾　李震宇　赵爱迪　李　斌

实现最高分辨率单分子拉曼成像—2013 年中国十大科技进展新闻

Realization of highest-resolution single-molecule Raman microscopy-Top 10 breakthrough news in science and technology of China in 2013

成功实现首次单分子自旋态控制—2005 年中国十大科技进展新闻

Realization of first control of single-molecule magnetic state-Top 10 breakthrough news in science and technology of China in 2005

亚纳米分辨单分子拉曼成像—被国际顶级科学媒体作为物理和化学领域的重大突破广泛报道

Optical spectroscopy goes intramolecular-
The work was widely reported and reviewed by top scientific medias and magazines