2013 年度报告 ANNUAL REPORT

CONTENTS 目录

ABOUT CSRC 中心简介 01 - 06

PEOPLE 人员情况 07 - 16

RESEARCH HIGHLIGHTS 科研亮点 17 - 32

RESEARCH PROJECTS 科研项目 33 - 36

PUBLICATIONS 发表论文 37 - 46

EVENTS 学术活动 47 - 50

COLLABORATIONS 合作交流 51 - 52

VISITORS 学术访问 53 - 54

FUTURE DEVELOPMENT 发展规划 55 - 56

本册所列所有信息为2013年1月至12月期间

ABOUT CSRC 中心简介

PEOPLE	人员情况
RESEARCH HIGHLIGHTS	科研亮点
RESEARCH PROJECTS	科研项目
PUBLICATIONS	发表论文
EVENTS	学术活动
COLLABORATIONS	合作交流
VISITORS	学术访问
FUTURE DEVELOPMENT	发展规划

中心简介

北京计算科学研究中心（以下简称中心）是隶属于中国工程物理研究院的独立法人单位，是以计算科学为牵引的多学科基础研究机构。中心成立于2009年8月。中心的定位是开展计算科学研究，促进科技发展，打造一个国际一流的开展计算科学及相关学科交叉研究的综合平台。

中心目标：

◇ 以计算科学研究为手段，以重大科学技术工程的实施和发展需求为牵引，积极引进海内外高层次人才，促进人才培养，开展基础性、前沿性、关键性和交叉性的研究工作；

◇ 加强对外学术技术交流，促进与国际知名科研机构的合作，搭建开放式、综合性、国际化的科研平台；

◇ 探索适于科研创新的管理体系，落实机制改革创新，提升我国科技自主创新能力，增强我国科技综合实力。

中心积极引进高层次人才，努力开展计算科学相关学科的交叉和创新研究，目前已成立七个实验室：物理系统模拟实验室、量子光学与量子信息实验室、先进功能材料与绿色能源实验室、复杂系统实验室、应用数学实验室、力学实验室、计算方法实验室。截至2013年12月，中心的科研人才队伍包括11位讲座教授和14位特聘研究员、2位特聘副研究员、1位工程师；其中，中科院院士1名、国家“千人计划”教授9名、国家“青年千人计划”特聘研究员10名、杰青1名。另外，中心已有签约客座教授33位、在职博士后56位、在读博士/硕士研究生39位。他们的研究领域涵盖了数学、力学、物理学、化学、材料科学、计算机科学等多个基础、前沿领域。

2013年，中心公开发表国际学术论文183篇，主办合办学术会议12次，举办科技前沿讲座8期，邀请学术报告97期，博士后报告43期，接待来自10多个国家和地区的访问学者500余人次。中心积极与国际知名科研机构开展合作，年内与美国乔治亚大学（GUA）、日本理化学研究所（RIKEN）等签署了合作协议，努力推动学科交叉、加强学术交流。

作为一个基础性、跨学科、开放式的综合研究平台，中心将成为中物院在各个研究领域开展创新研究的重要支撑，开展对外科学技术交流合作的桥梁和纽带，高层次人才引进与培养的摇篮，同时填补我国计算科学相关学科交叉研究领域的空白。

ABOUT CSRC

Beijing Computational Science Research Center (CSRC) is a multidisciplinary research organization under the auspices of the China Academy of Engineering Physics (CAEP). Established in August 2009, CSRC positions itself as a center of excellence in computational science research addressing current and critical issues in multidisciplinary mixes of Mathematics, Mechanics, Physics, Chemistry, Materials Science, and Computational Science.

Mission of CSRC:

◎ carry out fundamental, frontier, critical , and multidisciplinary research with advanced computational approaches, thereby attract talents worldwide and train highly qualified research personnel, to support grand scientific development and technology innovation in China;

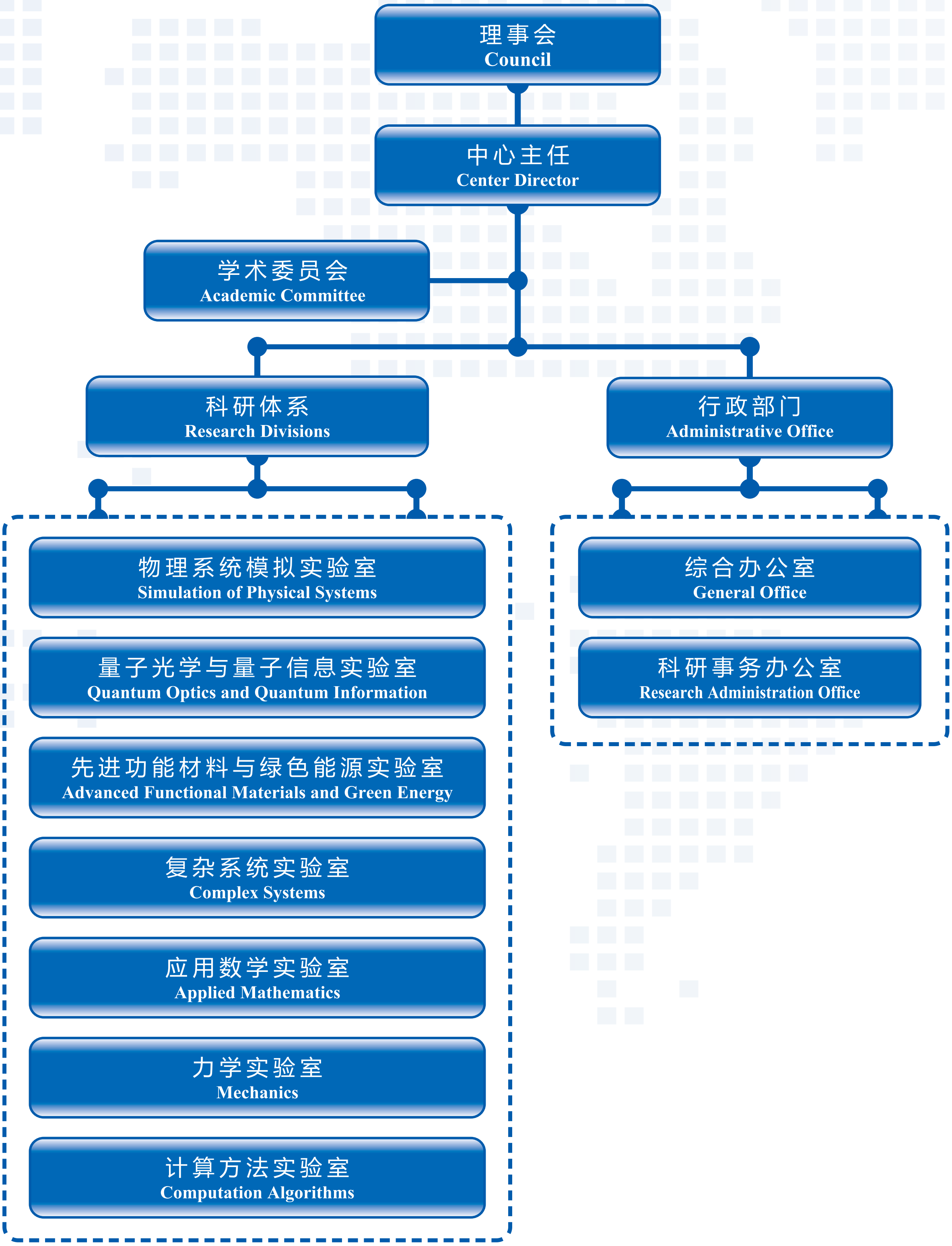
◎ develop and maintain collaboration with research institutes elsewhere by building a comprehensive and internationalized research platform, to support academic and technological exchange and advancement;

◎ innovate and reform organizational structures, management policies and methods for enabling creative and effective scientific research, to raise our national competence in technology innovation and enhance our comprehensive strength in science and technology.

Specifically, CSRC supports the development and implementation of grand challenging projects in natural science and engineering where computational modeling and simulation play a key role. CSRC also encourages its members to engage in the development of computational algorithms and software.

As of December 2013, CSRC has recruited 28 faculty members, 33 associate members, 95 postdoctoral fellows and students. With its talented research staff, CSRC has established the following seven divisions: Simulation of Physical Systems, Quantum Optics and Quantum Information, Advanced Functional Materials and Green Energy, Complex Systems, Applied Mathematics, Mechanics, and Computation Algorithms. In research performance, CSRC has published 183 papers, organized 12 academic conferences and workshops, 8 colloquiums on scientific frontiers, and 97 CSRC seminars and 43 postdoctoral seminars. CSRC has also forged partnerships with many prestigious universities and research institutions around the world.

中心组织构架
ORGANIZATION



学术委员会成员
MEMBERS OF ACADEMIC COMMITTEE

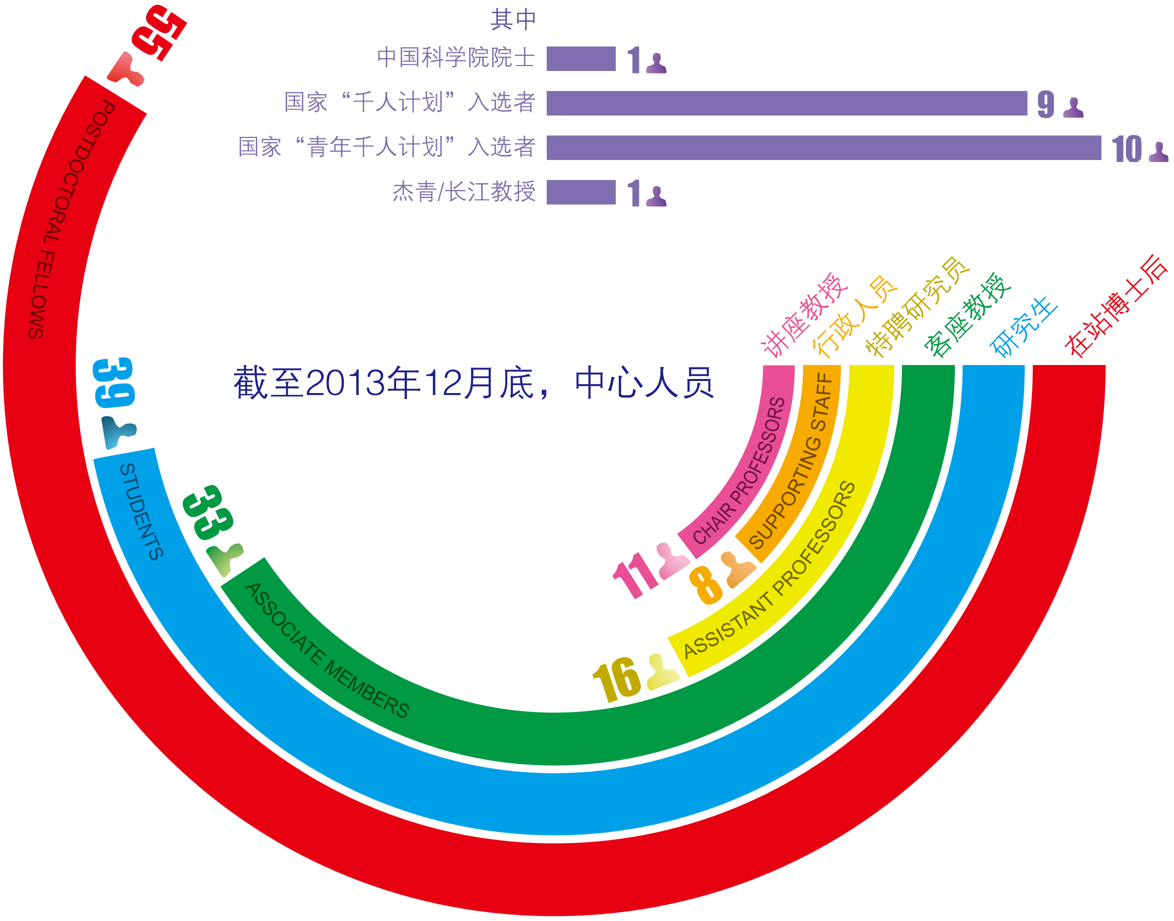
领域 Field	姓名 Name	单位 Institute
物理 Physics	贺贤土	北京应用物理与计算数学研究所
	Xian-Tu He	Institute of Applied Physics and Computational Mathematics, CAEP
	王鼎盛	中国科学院物理研究所
	Ding-Sheng Wang	Institute of Physics, CAS
	陶瑞宝	复旦大学
	Rui-Bao Tao	Fudan University
	张肇西	中国科学院理论物理研究所
	Zhao-Xi Zhang	Institute of Theoretical Physics, CAS
	朱邦芬	清华大学
	Bang-Fen Zhu	Tsinghua University
	赵宪庚	中国工程物理研究院
	Xian-Geng Zhao	China Academy of Engineering Physics
	赵光达	北京大学
	Guang-Da Zhao	Peking University
	邢定钰	南京大学
	Ding-Yu Xing	Nanjing University
	郑杭	上海交通大学
	Hang Zheng	Shanghai Jiao Tong University
	林海青	北京计算科学研究中心
	Hai-Qing Lin	Beijing Computational Science Research Center
	孙昌璞	北京计算科学研究中心
	Chang-Pu Sun	Beijing Computational Science Research Center
	游建强	北京计算科学研究中心
	Jian-Qiang You	Beijing Computational Science Research Center
	朱诗尧	北京计算科学研究中心
	Shi-Yao Zhu	Beijing Computational Science Research Center
力学 Mechanics	李家春	中国科学院力学研究所
	Jia-Chun Li	Institute of Mechanics, CAS
	白以龙	中国科学院力学研究所
	Yi-Long Bai	Institute of Mechanics, CAS
	符松	清华大学
	Song Fu	Tsinghua University
	罗礼诗	北京计算科学研究中心
	Li-Shi Luo	Beijing Computational Science Research Center

领域 Field	姓名 Name	单位 Institute
化学与生物物理 Chemistry & Biophysics	来鲁华	北京大学
	Lu-Hua Lai	Peking University
	李隽	清华大学
	Jun Li	Tsinghua University
	陈润生	中国科学院生物物理研究所
	Run-Sheng Chen	Institute of Biophysics, CAS
	刘焕明	北京计算科学研究中心
	Woon-Ming Lau	Beijing Computational Science Research Center
	汤雷翰	北京计算科学研究中心
	Lei-Han Tang	Beijing Computational Science Research Center
数学 Mathematics	崔俊芝	中国科学院数学与系统科学研究院
	Jun-Zhi Cui	Academy of Mathematics and Systems Science, CAS
	张平文	北京大学
	Ping-Wen Zhang	Peking University
	江松	北京应用物理与计算数学研究所
	Song Jiang	Institute of Applied Physics and Computational Mathematics, CAEP
	李大潜	复旦大学
	Da-Qian Li	Fudan University
	袁亚湘	中国科学院数学与系统科学研究院
	Ya-Xiang Yuan	Academy of Mathematics and Systems Science, CAS
	杜强	北京计算科学研究中心
	Qiang Du	Beijing Computational Science Research Center
	张智民	北京计算科学研究中心
	Zhi-Min Zhang	Beijing Computational Science Research Center
计算科学 Computational Science	钱德沛	北京航空航天大学
	De-Pei Qian	Beihang University

ABOUT CSRC 中心简介

PEOPLE 人员情况

RESEARCH HIGHLIGHTS 科研亮点
RESEARCH PROJECTS 科研项目
PUBLICATIONS 发表论文
EVENTS 学术活动
COLLABORATIONS 合作交流
VISITORS 学术访问
FUTURE DEVELOPMENT 发展规划


截至2013年12月底，中心人员

物理系统模拟实验室
SIMULATION OF PHYSICAL SYSTEMS DIVISION

实验室主任
DIVISION HEAD

林海青

（国家第二批"千人计划"入选者）

研究方向：凝聚态物理和计算物理

Hai-Qing Lin

Research Interests: Condensed Matter Physics, Computational Physics

特聘研究员
ASSISTANT PROFESSOR

杨　文

研究方向：凝聚态物理

Wen Yang

Research Interests: Condensed Matter Physics

张东波

（国家第五批"青年千人计划"入选者）

研究方向：凝聚态物理

Dong-Bo Zhang

Research Interests: Condensed Matter Physics

Stefano Chesi

（国家第五批"青年千人计划"入选者）

研究方向：凝聚态物理

Research Interests: Condensed Matter Physics

研究生
STUDENT

解亚明	王晓慧
Ya-Ming Xie	Xiao-Hui Wang
李一巍	屈晋先
Yi-Wei Li	Jin-Xian Qu
王　评	陈玉琴
Ping Wang	Yu-Qin Chen
李圣文	张艺浩
Sheng-Wen Li	Yi-Hao Zhang

特聘副研究员
RESEARCH ASSISTANT PROFESSOR

周崇斌

研究方向：凝聚态物理

Chung-Pin Chou

Research Interests: Condensed Matter Physics

博士后
POSTDOCTORAL FELLOW

Eric Barbagiovanni	
Dibya Prakash Rai	
刘晓洁	刘莉丽
Xiao-Jie Liu	Li-Li Liu
付振国	杨孝森
Zhen-Guo Fu	Xiao-Sen Yang
陈　亮	高峻峰
Liang Chen	Jun-Feng Gao
谭　为	闫循旺
Wei Tan	Xun-Wang Yan
刘卯鑫	刘　宝
Mao-Xin Liu	Bao Liu
赖文喜	张书辉
Wen-Xi Lai	Shu-Hui Zhang
赵荟艳	刘　钊
Hui-Yan Zhao	Zhao Liu
姜玉铸	徐金英
Yu-Zhu Jiang	Jing-Ying Xu

实验室助理
ASSISTANT

刘　薇	Tel: 86-10-82687089
Miss Wei Liu	Email: weiliu@csrc.ac.cn

量子光学与量子信息实验室
QUANTUM OPTICS AND QUANTUM INFORMATION DIVISION

实验室主任
DIVISION HEAD

朱诗尧
（国家第三批"千人计划"入选者）
研究方向：量子光学

Shi-Yao Zhu
Research Interests: Quantum Optics

讲座教授
CHAIR PROFESSOR

孙昌璞
（中国科学院 院士）
研究方向：量子物理

Chang-Pu Sun
Research Interests: Quantum Physics

游建强
（杰青/长江学者）
研究方向：量子信息与计算，凝聚态物理

Jian-Qiang You
Research Interests: Quantum Computation and Information, Condensed Matter Theory

特聘研究员
ASSISTANT PROFESSOR

李　勇
研究方向：量子光学

Yong Li
Research Interests: Quantum Information

赵　楠
（国家第四批"青年千人计划"入选者）
研究方向：量子信息与计算、凝聚态物理

Nan Zhao
Research Interests: Quantum Computation and Information, Condensed Matter Theory

李铁夫（兼职）
研究方向：量子信息与计算

Tie-Fu Li （Part-time）
Research Interests: Quantum Computation and Information

特聘副研究员
RESEARCH ASSISTANT PROFESSOR

高翔
研究方向：原子分子物理学

Xiang Gao
Research Interests: Atomic Physics

博士后
POSTDOCTORAL FELLOW

Faheel Hashmi	
Sandra Isabelle Schmid	
李军奇	曾小东
Jun-Qi Li	Xiao-Dong Zeng
李圣文	王治海
Sheng-Wen Li	Zhi-Hai Wang
胡文晖	姚尧
Wen-Hui Hu	Yao Yao
栗军	李增朝
Jun Li	Zeng-Zhao Li
徐勋卫	曾然
Xun-Wei Xu	Ran Zeng
郑强	葛力
Qiang Zheng	Li Ge
李睿	肖兴
Rui Li	Xing Xiao

研究生
STUDENT

聂文杰	郭玉杰
Wen-Jie Nie	Yu-Jie Guo
徐磊	罗晓清
Lei Xu	Xiao-Qing Luo
肖科文	李福
Ke-Wen Xiao	Fu Li
冯伟	王逸璞
Wei Feng	Yi-Pu Wang
李凯	陈亮
Kai Li	Liang Chen
陈臻	
Zhen Chen	

实验室助理
ASSISTANT

高媛	Tel: 86-10-82687001
Miss Yuan Gao	Email: gaoyuan@csrc.ac.cn

科研助理
RESEARCH ASSISTANT

王宇清	平婧
Yu-Qing Wang	Jing Ping

先进功能材料与绿色能源实验室
ADVANCED FUNCTIONAL MATERIALS AND GREEN ENERGY DIVISION

实验室主任
DIVISION HEAD

刘焕明

（国家第四批"千人计划"入选者）

研究方向：材料科学，绿色能源

Woo-Ming Lau

Research Interests: Materials Science, Green Energy

讲座教授
CHAIR PROFESSOR

姜晶

（国家第九批"千人计划"入选者）

研究方向：新能源与核能

Jing Jiang

Research Interests: New Energy and Nuclear

特聘研究员
ASSISTANT PROFESSOR

刘利民

（国家第二批"青年千人计划"入选者）

研究方向：材料科学

Li-Min Liu

Research Interests: Materials Science

管鹏飞

（国家第五批"青年千人计划"入选者）

研究方向：材料学

Peng-Fei Guan

Research Interests: Materials Science

张妍宁

（国家第五批"青年千人计划"入选者）

研究方向：表面科学

Yan-Ning Zhang

Research Interests: Surface Science

博士后
POSTDOCTORAL FELLOW

Jorge Botana Alcalde	
耿巍	唐振坤
Wei Geng	Zhen-Kun Tang
吕健	李晓凤
Jian Lu	Xiao-Feng Li
周盼盼	郎秀峰
Pan-Pan Zhou	Xiu-Feng Lang

研究生
STUDENT

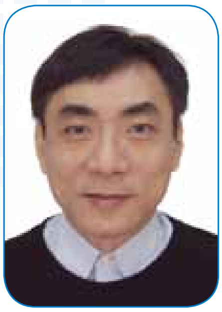
詹浩然	吴建
Hao-Ran Zhan	Jian Wu
殷文金	李希波
Wen-Jing Yin	Xi-Bo Li
童传佳	闻波
Chuan-Jia Tong	Bo Wen
郭盼	张乐
Pan Guo	Le Zhang

实验室助理
ASSISTANT

高媛	Tel: 86-10-82687001
Miss Yuan Gao	Email: gaoyuan@csrc.ac.cn

复杂系统实验室
COMPLEX SYSTEMS DIVISION

实验室主任
DIVISION HEAD



汤雷翰
（国家第四批"千人计划"入选者）
研究方向：统计物理，计算物理，生物物理

Lei-Han Tang
Research Interests: Statistical Physics, Computational Physics, Biophysics

讲座教授
CHAIR PROFESSOR

单一兵
（国家第九批"千人计划"入选者）
研究方向：计算生物物理

Yi-Bing Shan
Research Interests: Computational biophysics

特聘研究员
ASSISTANT PROFESSOR

喻　进
（国家第二批"青年千人计划"入选者）
研究方向：生物物理

Jin Yu
Research Interests: Computational Biophysics

研究生
STUDENT

王　洋	鄂　超
Yang Wang	Chao E
戴立强	王寿文
Li-Qiang Dai	Shou-Wen Wang

博士后
POSTDOCTORAL FELLOW

罗　亮	伍绍贵
Liang Luo	Shao-Gui Wu
柴　彦	段宝根
Yan Chai	Bao-Gen Duan
林　海	马　惠
Hai Lin	Hui Ma

实验室助理
ASSISTANT

徐晶晶	Tel: 86-10-82687089
Ms. Jing-Jing Xu	Email: xjj@csrc.ac.cn

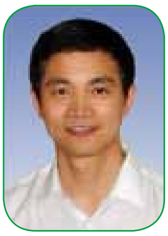
应用数学实验室
APPLIED MATHEMATICS DIVISION

实验室主任
DIVISION HEAD

杜 强
（国家第六批"千人计划"入选者）
研究方向：应用数学，计算数学

Qiang Du
Research Interests: Applied Mathematics, Scientific Computing

讲座教授
CHAIR PROFESSOR



张智民
（国家第七批"千人计划"入选者）
研究方向：计算数学

Zhi-Min Zhang
Research Interests: Computational Mathematics

特聘研究员
ASSISTANT PROFESSOR

明 炬
（国家第四批"青年千人计划"入选者）
研究方向：计算数学

Ju Ming
Research Interests: Computational Mathematics

博士后
POSTDOCTORAL FELLOW

许志国	寇继生
Zhi-Guo Xu	Ji-Sheng Kou
徐喜华	田 浩
Xi-Hua Xu	Hao Tian
张 晶	杜绍洪
Jing Zhang	Shao-Hong Du
袁永军	史晓冉
Yong-Jun Yuan	Xiao-Ran Shi
蒋 维	
Wei-Jiang	

研究生
STUDENT

徐术伟	孙 琪
Shu-Wei Xu	Qi Sun
梁 宏	刘建辉
Hong Liang	Jian-Hui Liu
王 雪	
Xue Wang	

实验室助理
ASSISTANT

徐晶晶	Tel: 86-10-82687089
Ms. Jing-Jing Xu	Email: xjj@csrc.ac.cn

力学实验室
MECHANICS DIVISION

实验室主任
DIVISION HEAD

罗礼诗

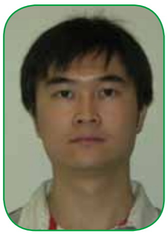
（国家第七批"千人计划"入选者）

研究方向：非平衡和复杂流体

Li-Shi Luo

Research Interests: Non-equilibrium and Complex Fluids

特聘研究员
ASSISTANT PROFESSOR



邓小龙

研究方向：流体力学，工程学

Xiao-Long Deng

Research Interests: Fluid Mechanics, Engineering

博士后
POSTDOCTORAL FELLOW

李茂军	
Mao-Jun Li	

研究生
STUDENT

白　晓	赵伟峰
Xiao Bai	Wei-Feng Zhao
陶　亮	
Liang Tao	

实验室助理
ASSISTANT

陈梦隆（实习生）	Tel: 86-10-82687001
Miss Meng-Long Chen	Email: menglong8802@csrc.ac.cn

计算方法实验室
COMPUTATION ALGORITHMS DIVISION

特聘研究员
ASSISTANT PROFESSOR

任志勇
（国家第四批"青年千人计划"入选者）
研究方向：计算方法

Chi-Yung Yam
Research Interests: Computation Algorithms

刘海广
（国家第五批"青年千人计划"入选者）
研究方向：计算生物学

Hai-Guang Liu
Research Interests: Computational Biology

工程师
ENGINEER

陈丽贞
研究方向：流体力学

Li-Zhen Chen
Research Interests: Fluid Mechanics

博士后
POSTDOCTORAL FELLOW

胡自玉
Zi-Yu Hu

实验室助理
ASSISTANT

杨　娟	Tel: 86-10-82687023
Miss Juan Yang	Email: yangjuan@csrc.ac.cn

客座教授
ASSOCIATE MEMBERS

包维柱	新加坡国立大学	常　凯	中国科学院半导体研究所
Wei-Zhu Bao	National University of Singapore	Kai Chang	Institute of Semiconductors, CAS
曹俊鹏	中国科学院物理研究所	丁　峰	香港理工大学
Jun-Peng Cao	Insititute of Physics, CAS	Feng Ding	The Hong Kong Polytechnic University
郭照立	华中科技大学	黄忠兵	湖北大学
Zhao-Li Guo	Huazhong University of Science and Technology	Zhong-Bing Huang	Hubei University
鞠立力	美国南卡罗莱纳大学	柯三黄	同济大学
Li-Li Ju	University of South California	San-Huang Ke	Tongji University

刘海广	美国亚利桑那州立大学
Hai-Guang Liu	Arizona State University
罗洪刚	兰州大学
Hong-Gang Luo	Lanzhou University
苗茂生	美国加州大学圣塔芭芭拉分校
Mao-Sheng Miao	University of California, Santa Barbara
王浩斌	美国新墨西哥州立大学
Hao-Bin Wang	New Mexico State University
邢建华	弗吉尼亚理工大学
Jian-Hua Xing	Virginia Polytechnic Institute and State University
张瑞勤	香港城市大学
Rui-Qin Zhang	City University of Hong Kong
张培鸿	纽约州立大学布法罗分校
Pei-Hong Zhang	University at Buffalo
Jonathan P. Dowling	美国路易斯安那州立大学
	Louisiana State University
Joerg Evers	德国马克斯-普朗克研究所
	Max-Planck-Institut für Kernphysik
Pedro Domingos Sacramento	葡萄牙里斯本技术大学
	Instituto Superior Tecnico, Technical University of Lisbon
Nuno Miguel Machado Reis Peres	葡萄牙米尼奥大学
	University of Minho
Jaime Eduardo Vieira da Silva Moutinho Santos	葡萄牙波尔图大学
	University of Porto
Henri Orland	法国新能源与原子能委员会
	French Alternative Energies and Atomic Energy Commission

刘智攀	复旦大学
Zhi-Pan Liu	Fudan University
马天星	北京师范大学
Tian-Xing Ma	Beijing Normal University
马琰铭	吉林大学超硬材料国家实验室
Yan-Ming Ma	State Key Lab of Superhard Materials, Jilin University
王　奇	美国南卡罗来纳大学
Qi Wang	University of South Carolina
雍稳安	清华大学
Wen-An Yong	Tsinghua University
周　涛	电子科技大学
Tao Zhou	University of Electronic Science and Technology of China
周昌松	香港浸会大学
Chang-Song Zhou	Hong Kong Baptist University
M. Suhail Zubairy	美国德克萨斯农工大学
	Texas A&M University
Jose Manuel Pereira Carmelo	葡萄牙米尼奥大学
	University of Minho
Eduardo Filipe Vieira de Castro	葡萄牙里斯本技术大学
	Instituto Superior Tecnico, Technical University of Lisbon
Miguel Antonio da Nova Araujo	葡萄牙埃武拉大学
	University of Evora
Alejandro Muramatsu	德国斯图加特大学
	University of Stuttgart

行政管理及辅助人员
ADMINISTRATIVE & SUPPORTTING STAFF

中心主任	林海青
Director	Hai-Qing Lin
中心副主任（兼任）	曲　彤
Deputy Director (part-time)	Tong Qu

综合办公室 General Office	办公室主任	陈蜀勇
	Head, General Office	Shu-Yong Chen
	办公室助理	郑　阳
	Assistant, General Office	Yang Zheng
	财务主管	郭长虹
	Financial Manager	Chang-Hong Guo
	财务助理	尧　欢
	Financial Assistant	Huan Yao
科研事务办公室 Research Administration Office	办公室主任	焦明晖
	Head, Research Administration Office	Ming-Hui Jiao
	办公室助理/助理工程师	阴　超
	Computer Technician	Chao Yin

北京计算科学研究中心把人才招聘视为第一要务。更多信息请浏览：http://www.csrc.ac.cn/zh/rczp/

For more position openings at CSRC, please visit：http://www.csrc.ac.cn/joinus/

ABOUT CSRC 中心简介
PEOPLE 人员情况

RESEARCH HIGHLIGHTS 科研亮点

RESEARCH PROJECTS 科研项目
PUBLICATIONS 发表论文
EVENTS 学术活动
COLLABORATIONS 合作交流
VISITORS 学术访问
FUTURE DEVELOPMENT 发展规划

WILSON RATIO OF FERMI GASES IN ONE DIMENSION

Wilson ratio, defined as the ratio of the magnetic susceptibility χ to specific heat *C*v divided by temperature T

$$R_W = \frac{4}{3}\left(\frac{\pi k_B}{\mu_B g}\right)^2 \frac{\chi}{c_v/T},$$

is a constant at the renormalization fixed point of these systems. For example, RW = 1 for noninteracting or weakly correlated electrons in metals [1], and RW = 2 in the Kondo regime for the impurity problem [2]. The dimensionless Wilson ratio quantifies the interaction effect and spin fluctuations and thus presents a characteristic of strongly correlated Fermi liquids [1]. RW > 1 in strongly correlated systems where the spin fluctuations are enhanced while charge fluctuations are suppressed.

Motivated by the experimental results for the spin ladder and some optical systems, several physicists, including Prof. H. Q. Lin at the Beijing Computational Science Research Center and Prof. X. W. Guan at Wuhan Institute of Physics and Mathematics, considered the Wilson ratio [3] in the context of the spin-1/2 delta-function interacting Fermi gas [4,5]. The quantum liquids exhibited by this model include the paradigm of a spin-charge separated Tomonaga-Luttinger liquid (TLL) in the repulsive regime and a two-component TLL of pairs and single fermions in the attractive regime. They addressed the issue that whether the Wilson ratio can capture a similar Fermi liquid nature of such a particular pairing phase, and found that

$$R_W = \frac{4}{(\upsilon_N^b + 4\upsilon_N^M)\left(\frac{1}{\upsilon_s^b} + \frac{1}{\upsilon_s^M}\right)}$$

which holds throughout the two-component TLL phase.

This result is in terms of the density stiffness vNb;u and sound velocity vNb;u for pairs b and excess single fermions u. These parameters can be calculated from the ground state energy. Figure 1 shows that at finite temperatures, the contour plot of RW can map out not only the two component TLL phase but also the quantum criticality of the attractive Fermi gas. The Wilson ratio thus gives a simple testable parameter to quantify interaction effects and the competing order between pairing and depairing.

The Wilson ratio of 1D Fermi gases can in principle be measured in experiments. The Wilson ratio of the 1D attractive Fermi gases which they have obtained thus provides a measurable parameter to quantify different phases of quantum liquids in 1D interacting fermions with polarization. At low temperatures, the Fermi liquid nature is retained in 1D many-body systems of interacting fermions. Their analysis can be adapted to different systems, such as interacting fermions, bosons, and mixtures composed of cold atoms with higher spin symmetry.

This research was also supported by MOST and NSFC.

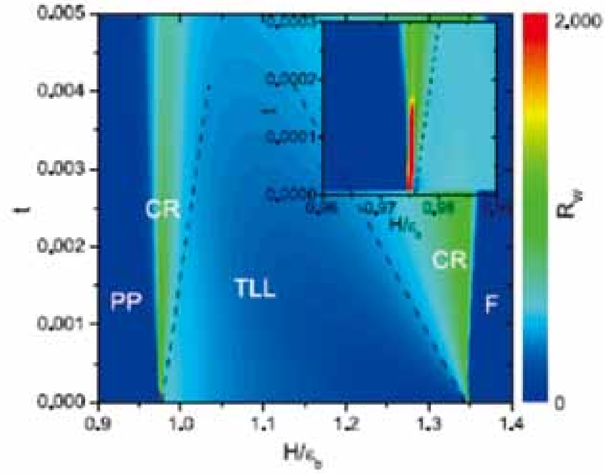


Fig.1: Contour plot of the Wilson ratio RW [Eq. (1)] of the attractive Fermi gas for dimensionless interaction | γ | = 10 as a function of the reduced temperature $t = T/\varepsilon_b$ and magnetic field. ε_b is the binding energy. The result [Eq. (2)] provides a criterion for the two-component TLL phase in the region below the dashed lines, where RW is temperature independent. The dashed lines indicate the crossover temperature $T^*H - H_c$ | separating the relativistic liquid from the nonrelativistic liquid. RW = 0 for both the TLL of pairs (PP) and the TLL of excess fermions (F). In the critical regimes (CR), RW gives a temperature-dependent scaling. However, near the two critical points, the ratio reveals anomalous enhancement, discussed further in the paper. The inset shows the enhancement at the lower critical point.

References
[1] A. C. Hewson, The Kondo Problem to Heavy Fermions (Cambridge University Press, Cambridge, England, 1997).
[2] K. G. Wilson, Rev. Mod. Phys. 47, 773 (1975).
[3] X.-W. Guan*, X.-G. Yin, A. Foerster, M. T. Batchelor, C.-H. Lee, and H.-Q. Lin*, Phys. Rev. Lett. 111, 130401 (2013).
[4] M. Gaudin, Phys. Lett. 24A, 55 (1967).
[5] C. N. Yang, Phys. Rev. Lett. 19, 1312 (1967).

QUANTUM CONFINEMENT INDUCED OSCILLATORY ELECTRIC FIELD ON A STEPPED PB(111) FILM AND ITS INFLUENCE ON SURFACE REACTIVITY

Manipulating and controlling the surface chemical reactivity on metal thin films is an interesting topic in physics and chemistry, since metal surfaces play an important role in catalysis, molecular self-organization, and corrosion processes. Recent experiments indicate that the quantum size effects (QSE) can cause selective adsorption and enhancement of chemical process on the terraces of wedge-shaped thin Pb(111) films formed on stepped Si(111) substrate. Nevertheless, the microscopic mechanisms that relate the QSE to the experimentally observed selective chemical reaction are still not well understood, although some correlations between the surface reactivity and electronic properties (e.g., work function, density of states at Fermi level) have been discussed.

Recently, a group of physicists including Xiaojie Liu and H. Q. Lin at CSRC, investigated how QSE can control the selective adsorption and chemical processes on stepped or wedge-shaped Pb(111) films [1]. Unlike all the previous theoretical studies which have focused on the properties of separate uniform height islands, they investigated the situation when several Pb thin strips with different thicknesses are brought into contact to form a stepped or wedge-shaped thin film. Using first-principles calculations, they showed that QSE will induce a modulated oscillatory electrostatic potential on the surface of stepped or wedge-shaped Pb(111) films. This modulated electrostatic potential will cause an alternating electric field across the strips of different thickness on the wedge and influence the growth morphology and reactivity on the flat top of the wedge-shaped Pb(111) films as observed experimentally. Such a QSE induced electric field modulation mechanism would be used to design metal film geometries for desirable controlling of nanostructure morphologies and selective chemical reactions.

Ref.: [1] Xiaojie Liu, C.Z Wang, M. Hupalo, H.-Q. Lin, K.M. Ho, "Quantum confinement induced oscillatory electric field on a stepped Pb(111) film and its influence on surface reactivity", Phys. Rev. B 89, 041401(R) (2014), (pub. 06 January 2014). DOI:10.1103/PhysRevB.89.041401

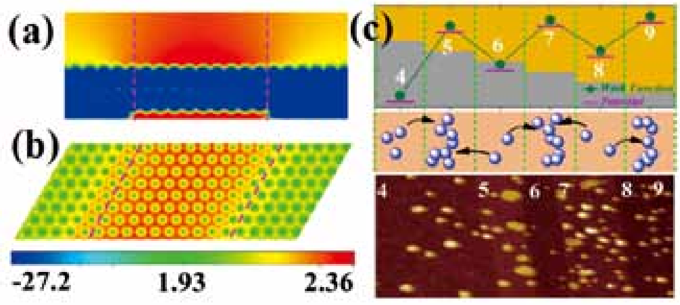


Fig. 5 Quantum size effects induce oscillatory electrostatic potential and thus alternating electric field on the surface of the wedge-shaped Pb(111) films, leading to selective even or odd layer adsorption preference depending on the charge state of the adatoms. The electrostatic potential are shown in Fig. 5(a) (side view) and (b) (side view).

THEORETICAL STUDIES ON THE NOVEL QUANTUM SCATTERING AND FRACTIONAL QUANTUM HALL EFFECT OF DIRAC FERMIONS ON THE SURFACE OF A TOPOLOGICAL INSULATOR

The recent theoretical prediction and experimental discovery of topological insulators (TI) has attracted considerable interest in the condensed matter physics community. One topic of fundamental importance in topological surface states is the defect- or impurity-induced strong modifications on the local electronic properties, which can be detected by scanning tunneling microscopy (STM). Because of the Dirac spectrum, the spin-orbit coupling (SOC) induced fermionic chirality, and the strong warping effect in topological surface states, the impurity scattering effect in TIs is naturally expected to display novel behavior that should be absent from the conventional semiconductor or metal-surface twodimensional electron gases. The characterizations of the fractional quantum Hall effect (FQHE) of Dirac fermions on the TI surface in the presence of a magnetic field is another interesting topic. Especially, owing to the unique spin chirality of Dirac fermions induced by intrinsic strong SOC in TI materials, the effect of tilted magnetic field, the Zeeman effect, and the warping effect on the FQHE on TI surface should remarkably differ from that in conventional 2DEG. However, the novel properties of the FQHE of Dirac fermions on TI surface is still missing in the literature,

Recently, a group of physicists including CSRC researchers, Zhen-Guo Fu and H. Q. Lin, and associate member P. Zhang, performed systematic theoretical studies on i) the quantum scattering effect of Dirac fermions induced by impurities and steps on TI surface[1-3], and ii) the FQHE of Dirac fermions on TI surface [4-6].

In order to study the quantum scattering effect of Dirac fermions, the topological surface states are described by a Dirac wave equation with an additional locking between momentum and spin of the surface Dirac electrons, and the strong warping effect is also taken into account. They theoretically developd a partial-wave method to study multiple scattering of massive/massless Dirac fermions on the surface of TI with strong warping effect, and demonstrated that with increasing the Fermi energy, the power-law decay of local density of states (LDOS) induced by impurities is modified due to the warping effect of the Fermi surface. In symmetric double-step barriers on TI surface, their results showed that the remarkable warping effect may result in anisotropic Fabry-Perot-like resonance states confined in the step-well running along Γ-M direction and Γ-K direction. Cooperating with the STM experimental group of Prof. Q. K. Xue in Tsinghua University, they also studied the quantum confinement of Dirac fermions in triangular quantum corrals on TI Bi2Te3 surface, and the theoretical simulations are consistent with the experimetal observations very well.

Furthermore, taken into account the electron-electron interactions and an external tilted magnetic field, they theoretically found that by increasing the in-plane component of the tilted magnetic field as well as the warping strength of the Fermi surface, the FQHE state at n=0 Landau level (LL) becomes more stable, while the stabilities of n=±1 LLs become weaker. Moreover, their results showed that the excitation gaps of the ν=1/m FQHE states increase with increasing the tilt angle. Taken into account the Zeeman effet, the effective pseudopotentials of the Coulomb interaction are reformed and are quite different from those in graphene. They showed that the ground state energies and the excitation gaps at ν=1/3 FQHE between the n=±1 LLs render asymmetry, and the FQHE state at the n=+1 LL is more robust than that at n=−1 LL since the excitation gap at n=+1 LL is larger than that at n=−1 LL. Their works are not only useful for understanding the novel properties of Dirac fermions in TIs, but also encouraging for the experimental research of STM and FQHE in TIs.

This research was also supported by NSFC and NBRPC.

Ref.: [1] Zhen-Guo Fu, Ping Zhang, Hai-Qing Lin, and Shu-Shen Li, “Multiple scattering theory for massive Dirac fermions on the topological insulator surface with a strong warping effect”, Phys. Rev. B 88, 085304 (2013), (pub. 5 August 2013). DOI: 10.1103/PhysRevB.88.085304.

[2] Zhen-Guo Fu, Ping Zhang, Mu Chen, Zhigang Wang, Fawei Zheng, and Hai-Qing Lin, “Anisotropic Fabry-Perot resonant states confined within nano-steps on the topological insulator surface”, Europhys. Lett. (under review).

[3] Mu Chen, Zhen-Guo Fu, Jun-Ping Peng, Fawei Zheng, Hui-Min Zhang, Xiao Feng, Cui-Zu Chang, Ke He, Lili Wang, Ping Zhang, Xucun Ma, Qi-Kun Xue, “Direct observation of quantum confinement of massless Dirac fermions in a topological insulator”, Nature Nanotechnology (under review).

[4] Zhen-Guo Fu, Fawei Zheng, Zhigang Wang, and Ping Zhang, “The effect of the warping term on the fractional quantum Hall states in topological insulators”,

Prog. Theor. Exp. Phys. 2013, 103I01, (pub. 1 October, 2013). DOI: 10.1093/ptep/ptt075.

[5] Fawei Zheng, Zhigang Wang, Zhen-Guo Fu, and Ping Zhang, “Fractional quantum Hall effect of topological surface states under a strong tilted magnetic field”, EuroPhys. Lett. 103, 27001 (2013). (pub. 9 August 2013). DOI: 10.1209/0295-5075/103/27001.

[6] Zhigang Wang, Fawei Zheng, Zhen-Guo Fu, and Ping Zhang, “Fractional quantum Hall effect in topological insulators: The role of Zeeman effect”, New J. Phys. (under review).

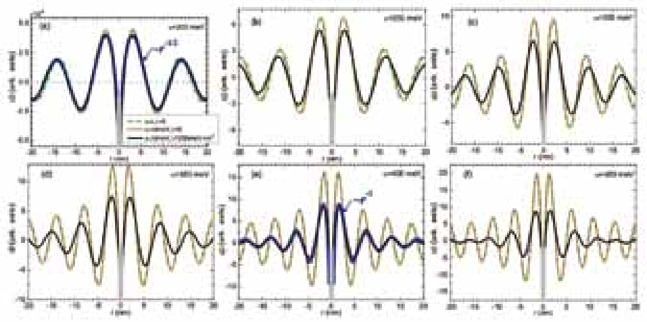


Fig.1: LDOS as a function of x (Γ-K direction) with y = 0 for a single magnetic impurity located at r=(0,0) with a radius of α = 0.5 nm.

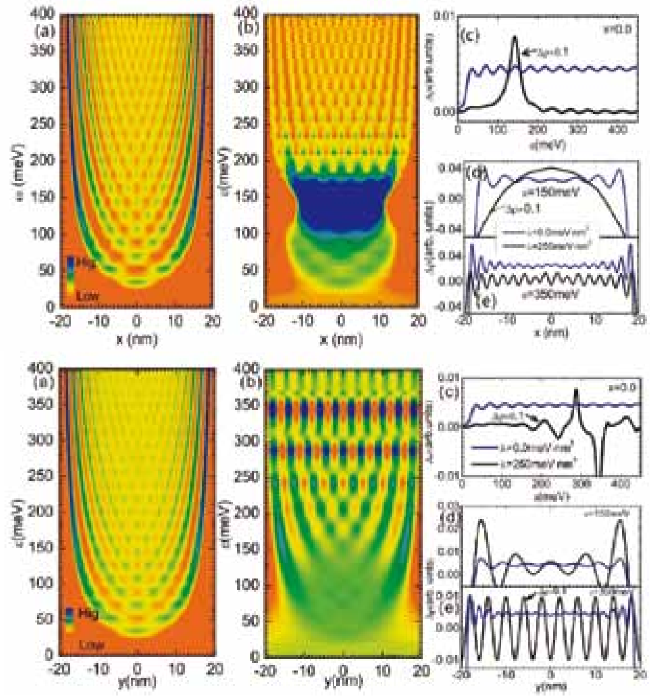


Fig.2: The change in the LDOS of Dirac electrons confined in the double symmetric barriers along Γ-M direction (Left)and Γ-K direction (right).

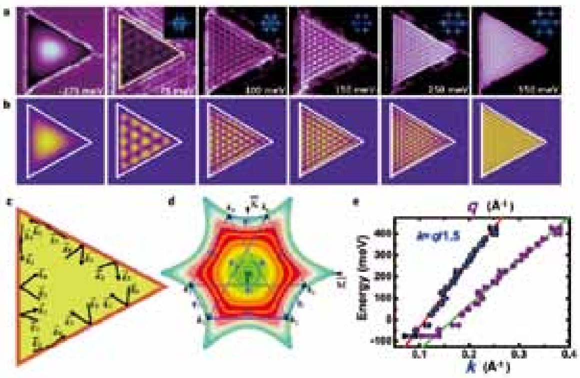


Fig.3: Quantum confinement of Dirac fermions on the surface of TI Bi2Te3.

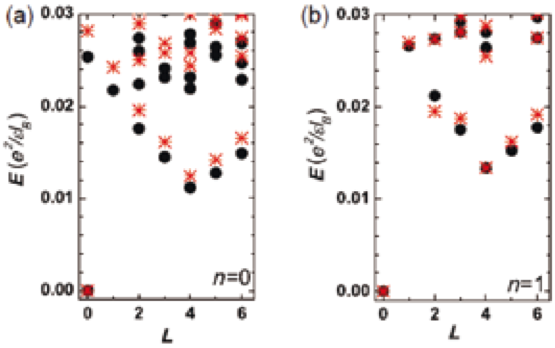


Fig.4: Exact energies versus the angular momentum L for N = 7 electrons at the 1/3 TIFQH state. The warping strength is chosen as 0 (circles) and 0.2 (stars).

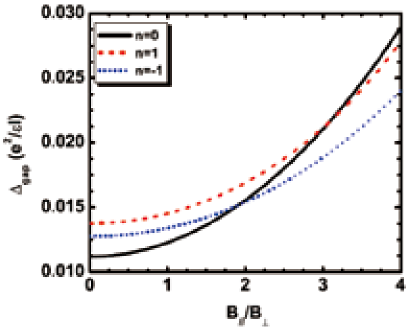


Fig.5: The gap width between the ground state and the first excited state at 1/3 FQHE states for LLs n=0 and ±1.

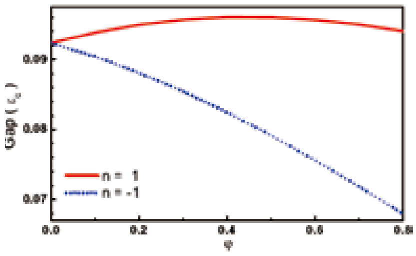


Fig.6: Excited energy gap versus Zeeman parameter for N=6 electrons at1/3 FQHE state.

NUMERICAL STUDIES ON FRACTIONAL CHERN INSULATORS

Fractional Chern insulator (FCI) is a new type of topological phase of matter that was first proposed in 2011. It is a collective phenomenon of strongly interacting particles occurring in nearly flat Bloch band with nonzero Chern number . Compared with usual fractional quantum Hall (FQH) states, FCIs do not need external magnetic fields and can potentially be realized in room temperature, therefore providing a more promising platform for the study of topological order and relevant physics.

Recently, Z. Liu in CSRC, with his collaborators in Europe and China, did several theoretical studies on fractional Chern insulators by numerical algorithms, such as exact diagonalzation and density matrix renormalization group (DMRG). They first established the adiabatic continuity between FCIs in Bloch bands and FQH states in Landau levels (LLs), thus confirmed these two different types of states are in the same topological phase [1]. Then they studied FCIs in Bloch bands on cylinders by DMRG, and found the excitation energy spectra on the edge and the space-cut entanglement spectra of the bulk ground states have the same counting structure, so the bulk-edge correspondence of FCIs was established [2]. They also discovered several FCIs beyond simple Laughlin-like states, such as the hierarchy states (the counterparts in LL are composite-fermion states) [3] and the non-Abelian states stabilized by long-range interactions [4]. Finally, they generalized the usual Hofstadter model by inducing long-range hopping and found much richer Bloch band topology, which can harbor various FCIs [5]. Because of these works, Z. Liu and one of his collaborators were invited to write a review paper on the progress of the field of fractional Chern insulators [6].

Z. Liu was also supported by China Postdoctoral Science Foundation Grant

References:

[1] From fractional Chern insulators to Abelian and non-Abelian fractional quantum Hall states: adiabatic continuity and orbital entanglement spectrum, Zhao Liu and Emil J. Bergholtz, Phys. Rev. B 87, 035306 (2013).

[2] Bulk-edge correspondence in fractional Chern insulators, Zhao Liu, D.L. Kovrizhin, Emil J. Bergholtz, Phys. Rev. B 88, 081106(R) (2013).

[3] Hierarchy of fractional Chern insulators and competing compressible states, A.M. Läuchli, Z. Liu, E.J. Bergholtz, R. Moessner, Phys. Rev. Lett. 111, 126802 (2013).

[4] Non-Abelian Fractional Chern Insulators from Long-Range Interactions, Zhao Liu, Emil J. Bergholtz, Eliot Kapit, Phys. Rev. B 88, 205101 (2013).

[5] Tunable Band Topology Reflected by Fractional Quantum Hall States in Two-Dimensional Lattices, Dong Wang, Zhao Liu, Junpeng Cao, Heng Fan, Phys. Rev. Lett. 111, 186804 (2013).

[6] Topological Flat Band Models and Fractional Chern Insulators, Emil J. Bergholtz, Zhao Liu, Int. J. Mod. Phys. B 27, 1330017 (2013).

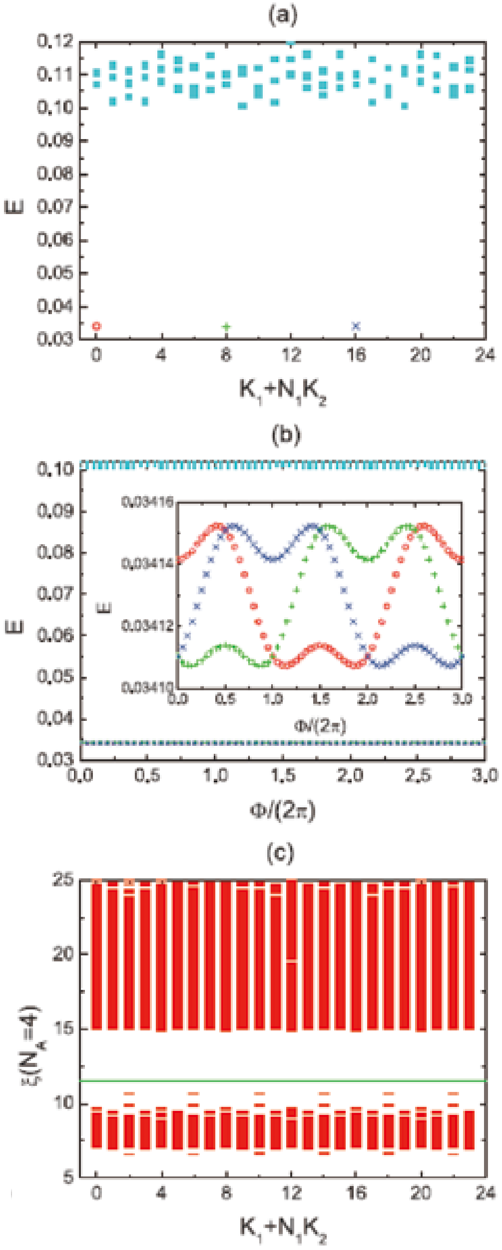
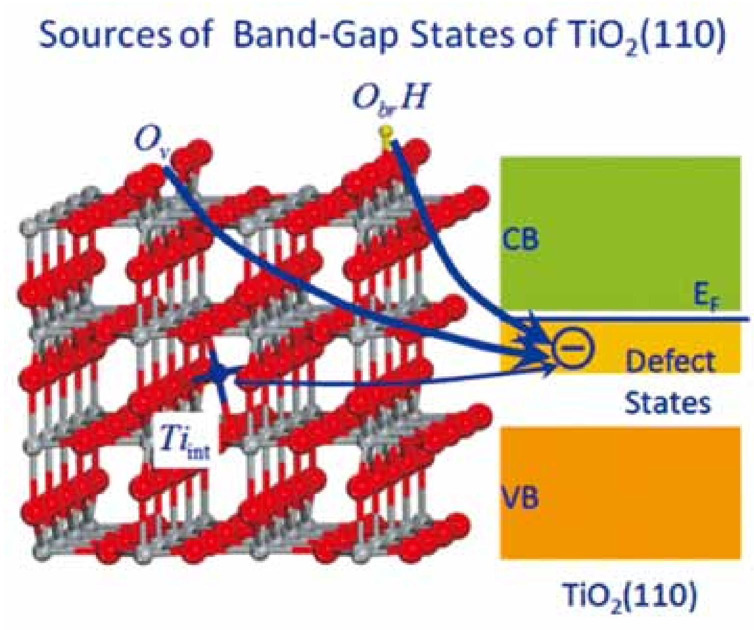


Fig.:Numerical observation of a FCI at $\nu = 1/3$ in a $|c| = 1$ band. (a) Shows the low lying energies with periodic boundary conditions in each (center-of-mass) momentum sector. There are three nearly degenerate ground states. (b) Shows the spectral flow under flux insertion. The three nearly degenerate ground states evolve into each other. (c) The ground-state particle-cut entanglement spectrum with a clear entanglement gap. The total number of levels below the gap is the same as the corresponding quasihole excitation counting of the $\nu = 1/3$ FQH Laughlin state.

BAND-GAP STATES OF TIO2(110): MAJOR CONTRIBUTION FROM SURFACE DEFECTS

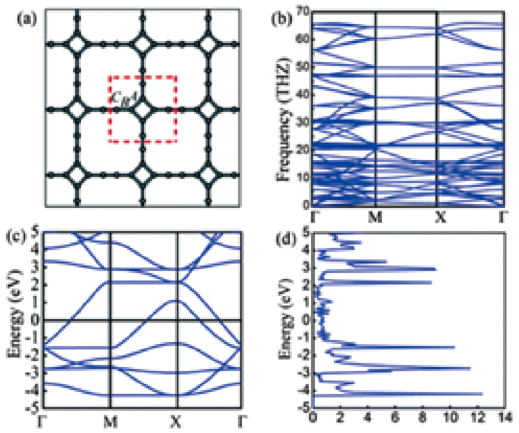
Titanium dioxide (TiO2) has attracted particular attention because of its wide range of applications in physics, chemistry and materials. Rutile (110), partly due to its stability, has become a prototypical system of metal oxide, and there are two kinds of typical point defects on rutile TiO2(110), i.e., surface Obr vacancies and subsurface Ti interstitials (Tiint). Once upon the existance of defect, the Fermi level (EF) is pinned to the bottom of conduction band (CBM), and defect states appear at about 0.8 eV below the EF. Many physical and chemical processes on TiO2 surface are linked to the excess electrons originated from band gap states. However, the sources (surface and/or subsurface defects) of these states are still rather controversial.

Recently, L.M Liu in CSRC with his collaborators performed density functional theory (DFT) calculations in combination of ultraviolet photoelectron spectroscopy (UPS) measurements on the band gap states of TiO2(110). Their results clearly suggest both surface and subsurface defects contribute to the band gap states, whereas the contribution of subsurface defects corresponds to that of only 1.9% monolayer ObrH at the current bulk reduction level. As the surface defect concentration is usually much larger than 1.9% monolayer in real studies and applications, such results clearly demonstrates the importance of surface defects in changing the electronic structure of TiO2, which dictates the surface chemistry.



See:
Xinchun Mao, Xiufeng Lang, Zhiqiang Wang, Qunqing Hao, Bo Wen, Zefeng Ren, Dongxu Dai, Chuanyao Zhou, Li-Min Liu, and Xueming Yang, “Band-Gap States of TiO2(110): Major Contribution from Surface Defects”, J. Phys. Chem. Lett., 2013, 4 (22), pp 3839–3844, DOI:10.1021/jz402053p

R-GRAPHYNE: A NEW TWO-DIMENSIONAL CARBON ALLOTROPE WITH VERSATILE DIRAC-LIKE POINT IN NANORIBBONS



Among the abundant allotropes, graphene is one of the most recently research hot topic due to the two-dimensional (2D) sp2 bond structure with unique electronic properties. The cause of the amazing electronic properties of graphene is attributed to its peculiar band structure featuring so-called Dirac points. In the vicinity of the Dirac point, the valence and conduction band meet at the Fermi level with zero band gap semiconductor forming a double cone, which appear in a linear relationship. Thereby, it considered as a revolutionary material for the future generation of high-speed nano-electronics. As a matter of fact, the potential application of graphene in future nano-electronic devices calls for controllable manipulation of its atomic and electronic properties. The general way is to introduce the defect or the functional groups.

Recently, L.M. Liu and L. Lau in CSRC with their collaborators proposed a novel two-dimensional carbon allotrope, rectangular graphyne (R-graphyne) with tetra-rings and acetylenic linkages, based on first-principles calculations. They found that although the bulk R-graphyne exhibits metallic property, the nanoribbons of R-graphyne show distinct electronic structures from the bulk. The most intriguing feature is that band gaps of R-graphyne nanoribbons oscillate between semiconductor and metallic states as a function of width. Particularly, the zigzag edge nanoribbons with half-integer repeating unit cell exhibit unexpected Dirac-like fermions in the band structures. The Dirac-like fermions of the R-graphyne nanoribbons originate from the central symmetry and two sub-lattices. The extraordinary properties of R-graphyne nanoribbons greatly expand our understanding of the origin of Dirac-like points. Such findings uncover a novel fascinating property of nanoribbons, which may have broad potential applications for carbon-based nanoscale electronic devices.

This work is highlighted in Nature China with the title of “Nanomaterials: A cute above”.

See:

Wen-Jin Yin, Yue-E. Xie, Li-Min Liu, Ru-Zhi Wang, Xiao-Lin Wei, Leo Lau, Jian-Xin Zhong and Yuan-Ping Chen, “R-graphyne: a new two-dimensional carbon allotrope with versatile Dirac-like point in nanoribbons”, Journal of Materials Chemistry A, 2013, 1(17): 5341-5346

STATISTICAL MECHANICAL STUDY OF ADAPTATION AND MOTOR SWITCHING KINETICS IN THE E. COLI CHEMOTAXIS SYSTEM

The chemotaxis pathway of the bacterium E. coli has been a model system for the study of active chemical sensing by a living cell. Its receptor domain exhibits very high signal sensitivity and can adapt to a broad range of ligand concentrations. Recently, Ganhui Lan et al. have shown that such a functional behavior can only exist in a nonequilibrium system supported by energy flow. Through an explicit but approximate model calculation, they obtained a quantitative relation between energy dissipation and adaptation accuracy, which they suggested to be general. We have analyzed a discrete-state model in detail and obtained exact solution for the adaptation accuracy, energy dissipation rate, and the frequency-resolved linear response of the circuit to a sinusoidal perturbation in the ligand concentration. A nonequilibrium “phase transition”-like behavior exists in this network when the number of methylation sites extends to infinity. The exact analysis clarifies the energy-speed-accuracy tradeoff relation proposed by Lan et al. This work was mostly done by a first year graduate student Wang Shouwen in the group.

Furthermore, Dr. Chai Yan in the group has continued his study on the kinetics of E. coli flagellar motor switching. The bacterial flagellar motor is a nanometer-scale machine whose rotational direction stochastically switches between clockwise and counterclockwise. Duration of the motor in each rotary state is regulated by the concentration of the chemotaxis signaling protein CheY-P which binds to the rotor ring. We have studied the kinetic properties of the motor switching in an equilibrium conformational spread model both analytically and numerically. Exact expression for the 2D free energy landscape of the model is obtained, as shown in Fig. 1. The dwell time distributions and transition time distribution are computed numerically. Characteristics of these distributions as a function of the kinetic rates for individual rotor switching and CheY-P binding are analyzed. The results are summarized in terms of the dynamic response of the motor switching under a varying CheY-P signal.

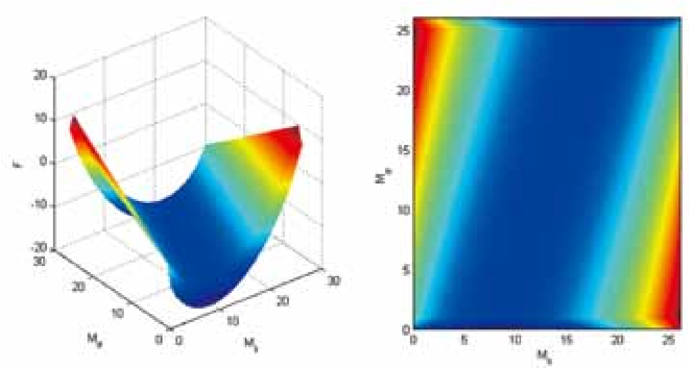
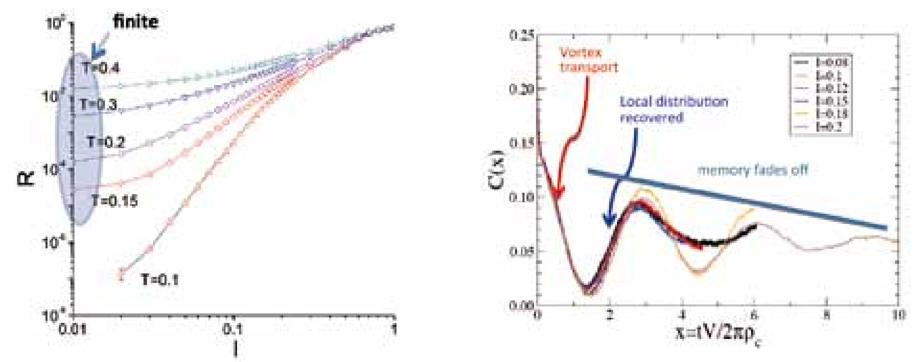


Fig. 1 Free energy landscape of the conformational spread model for flagellar motor that controls switching between two metastable states.

DRIVEN VORTEX MOTION AND ARRHENIUS RESISTIVITY IN 2D GAUGE GLASS

The two-dimensional gauge glass model has been proposed to study transport properties of granular superconducting films and disordered Josephson-junction (JJ) arrays in a magnetic field. Detailed analytical and numerical studies have shown that the low temperature equilibrium behavior of the system is controlled by a T=0 critical point with a finite density of states for gapless vortex excitations. However, due to the random potential created by the disorder and the ground state vortex configuration, vortex transport under a weak external current I is complex and has not been analyzed in detail. In fact, previous numerical work suggested a change of behavior from Ohmic to power-law I-V at around T/J~0.22, where J is the Josephson coupling constant between neighboring superconducting grains. We have carried out extensive simulations of the gauge glass model under the resistively-shunted-junction (RSJ) dynamics at weak applied currents and low temperatures. Ohmic behavior is observed down to T=0.1 for arrays of size up to 512x128. Simulations also indicate that the vortex configuration is insensitive to the temperature and a weak external current, suggesting that most of the dissipation is due to isolated vortices that traverse in a random potential. We investigated the auto-correlation of the spin chirality. A damped oscillatory auto-correlation is observed, from which information about the local transport and the birth and death of excess vortices can be extracted. The finite lifetime of the excess vortices results in the finite transport distance which does not depend sensitively on temperature and the driven current. Based on this observation, we relate the transport properties of the disordered JJ array to the individual vortex motion. Furthermore, the Arrhenius relation between voltage drop and temperature is explained by an exactly solvable single vortex model.



Josephson-Junction array with disorder. Its zero-current value decreases with temperature following the Arrhenius law. (b) The auto-correlation of a chirality parameter showing the finite lifetime of excited vortices as indicated by the scaled variable x.

CONTROLLING A NANOWIRE SPIN-ORBIT QUBIT VIA ELECTRIC-DIPOLE SPIN RESONANCE

How to achieve a simple and efficient way to manipulate a qubit is of basic importance in quantum information processing. For the conventional spin qubit, its manipulation can be accomplished by using the electron spin resonance technique. The spin-orbit qubit, unlike the conventional spin qubit, contains both the orbital and the spin degrees of freedom of an electron, owing to the spin-orbit coupling (SOC). The spin-orbit qubit has an additional advantage of being manipulable via an external a.c. electric field, an interesting phenomenon called the electric-dipole spin resonance (EDSR). With respect to generating a local a.c. magnetic field for manipulating a spin qubit, it is much easier to produce a local a.c. electric field with current experimental techniques.

Semiconductor quantum wires with strong SOC, e.g., InSb nanowires, are of current interest. These have been suggested as a potential platform for demonstrating Majorana quasiparticles, and these can also be used to produce a quantum dot for achieving a spin-orbit qubit. The coherent electric manipulation and the spectroscopy of a nanowire spin-orbit qubit were investigated, and a strong Rabi frequency of 100 MHz was also reported recently. Interestingly, the frequency of the driving a.c. electric field depends on the direction of the applied static magnetic field. As shown in a recent PRL paper by J.Q. You's group, this dependence is actually a signature of the strong SOC in the nanowire.

In this PRL paper, J.Q. You and his collaborators provided an explicit theoretical explanation for the EDSR effect in a nanowire quantum dot with strong SOC. In comparison with previous theories, where the SOC was regarded as a perturbation, they considered a strong SOC in this work. With their theory applicable in the strong SOC regime, it reveals that the Rabi frequency induced by an external a.c. electric field has a maximum value at an optimal SOC strength, instead of the Rabi frequency that is linearly proportional to the SOC strength. As their theory shows, this linear dependence is only valid in the weak SOC regime. Also, their theory shows that the SOC can be probed by monitoring both the spectrum and the EDSR responses of the spin-orbit qubit to the direction of the external static magnetic field. Therefore, it can provide a useful method to determine both Rashba and Dresselhaus SOCs in the nanowire.

This research was supported by the National Natural Science Foundation of China and the National Basic Research Program of China (973 Program).

Ref: Rui Li, J. Q. You, C. P. Sun, and Franco Nori, "Controlling a nanowire spin-orbit qubit via electric-dipole spin resonance", Phys. Rev. Lett. 111, 086805 (2013). (published 23 August 2013; DOI: 10.1103/PhysRevLett.111.086805).

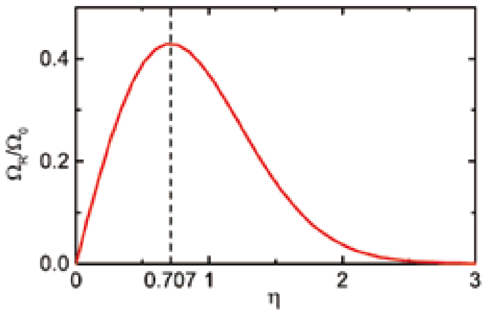


Figure 1: Electric-field-induced Rabi frequency of the nanowire spin-orbit qubit versus the strength of the spin-orbit coupling.

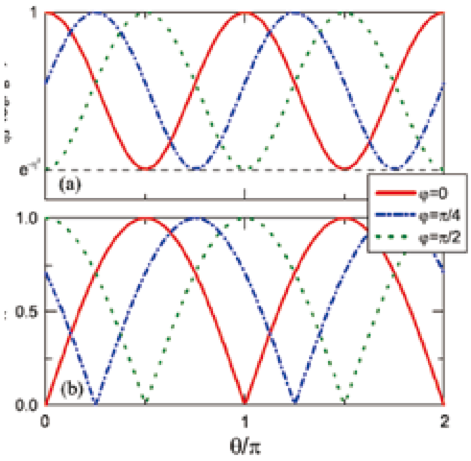


Figure 2: Periodic response of (a) the level spacing and (b) the Rabi frequency of the nanowire spin-orbit qubit on the direction of the external static magnetic field.

QUANTUM ROUTING OF SINGLE PHOTONS WITH A CYCLIC THREE-LEVEL SYSTEM

Many theoretical proposals and experimental demonstrations of a quantum router have been carried out in various systems, i.e., cavity QED system, circuit QED system, optomechanical system, and even a pure linear optical system. The essence lying at the core is the realization of the coupling between a two-(or few-) level system and quantum channels. Except for the experiment implemented with linear optical devices, the quantum router demonstrated in most experiments and theoretical proposals has only one output terminal. Thus the ideal quantum router with multi-access channels deserves more exploration.

Recently, Y. Li and C. P. Sun in CSRC, with their collaborators, theoretically proposed a scheme for quantum routing of single photons with two output channels, which are composed of two coupled-resonator waveguides (CRWs). The quantum node is realized by a three-level system with three transitions forming a cyclic (Δ-type) structure: Two different transitions of the Δ atom are coupled to the photonic modes of the two channels respectively and the other is used to connect the two channels with a classical field. It is shown that the quantum node indeed works as a multi-channel quantum router. Here, the Δ atom functions as a single-photon switch within the incident channel: When the classical field is applied to dress the atom, single photons can be routed from one channel to the other. Actually, there have been numerous theoretical studies focusing on the von Neumann–Wigner conjecture: whether or not there exist (quasi-) bound states when discrete energy levels are coupled to a continuum. Now, this hybrid system provides a platform to probe this kind of bound states.

The promising candidates for experimental implementations of the above quantum routing system are the following: The circuit QED system where two coplanar linear resonators are coupled to a cyclic Δ-atom using three Josephson junctions and microwaves serve as the classical controlling field; The defect cavities in photonic crystal coupled to a silicon-based quantum dot. It is hopeful that the quantum routing function predicted in this work can be observed in some experiments.

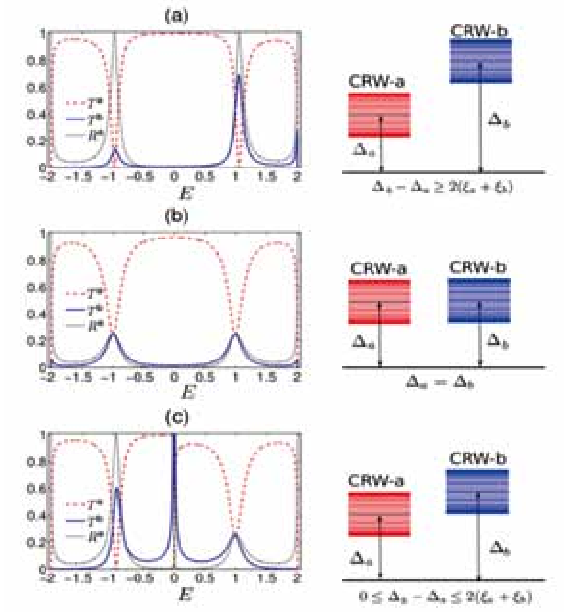


FIG.1 (color online). The scattering process described by transmittance $T^{\alpha}(E)$ (dashed red line), reflectance $R^{\alpha}(E)$ (dotted gray line), and transfer rate $T^{b}(E)$ (solid blue line) with different configurations of the two bands of the vacant CRWs, (a) $\Delta_b = 4.5$, thus $\Delta_b - \Delta_a > 2(\xi_\alpha + \xi_b)$. For convenience, all the parameters are in umits of ξ_α and we always set $\xi_b = \xi_\alpha = 1$, $\Delta_a = 0$, $\Omega = 1$, and $g_a = g_b = 0.5$.

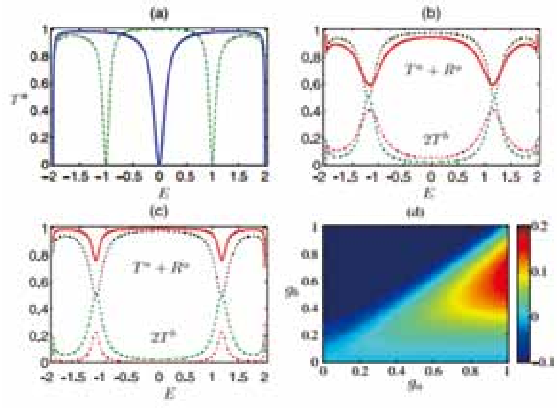


FIG.2 (color online). (a) The transmission T^{α} as a function of the incident cenergy E with $g_\alpha = 0.5$ and $\Omega = 0$ (solid blue line), or with $g_\alpha = 0.5$, $g_b = 0$ and $\Omega = 0$ (dotted-dashed green line); (b),(c) The coefficients $T^{\alpha} + R^{\alpha}$ (solid ren lines and dotted black lines), $2T^{b}$ (dshed green lines and sotted-dashed pink lines) as functions of the incident energy E with $g_\alpha = 0.5$ and $\Omega = 1.2$, $g_b = 0.5$ for the dotted black and dashed green lines, or $g_b = 0.8[0.2]$ for the solid red and dotted-dashed pink lines. (d) Transmittance difference ($T^{b} - T^{\alpha}$) at the condition $|E| = \Omega$ vs g_α and g_b. Here, we take $\Delta_\alpha = \Delta_b = 0$, and $\xi_\alpha = \xi_b = 1$.

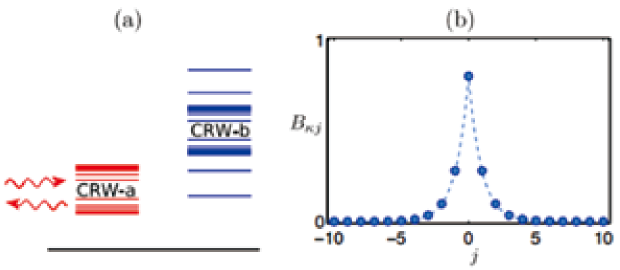


FIG.3 (color online). (a) The CRW-*b* plus the Δ atom have two bound states both above and blow the continuum band. The incident photon gets perfectly reflected when its energy matches the bound states within CRW-*b*; (b) Wave function of the bound state within CRW-*b* with $n_b = 0$.

See:
"Quantum Routing of Single Photons with a Cyclic Three-Level System"
Zhou, Lan; Yang, Li-Ping; Li, Yong; Sun, C. P. Phys. Rev. Lett. 111, 103604 (2013).

QUANTUM ZENO AND ANTI-ZENO EFFECT WITHOUT INTRODUCING WAVE-PACKET COLLAPSE: THEORY AND EXPERIMENT

The explanation for quantum Zeno effect evoked many arguments on whether the postulate "wave-packet collapse (WPC)" is necessary. To illustrate this problem, CP Sun's group presented a dispersive-coupling-based interpretation for the quantum Zeno effect (QZE) where measurements are dynamically treated as dispersive couplings of the measured system to the apparatus rather than the von Neumann's projections [1]. It is found that the explicit dependence of the survival probability on the decoherence time quantitatively distinguishes this dynamic QZE from the usual one based on projection measurements. By revisiting the cavity-QED experiment of the QZE [J. Bernu et al., Phys. Rev. Lett. 101, 180402 (2008)], CP Sun's group suggests an alternative scheme [1] to verify their theoretical consideration that frequent measurements slow down the increase of photon number inside a microcavity due to the non-demolition couplings with the atoms in large detuning.

CP Sun's group also cooperated with an NMR experiment group to experimentally demonstrate a dynamic fashion of quantum Zeno

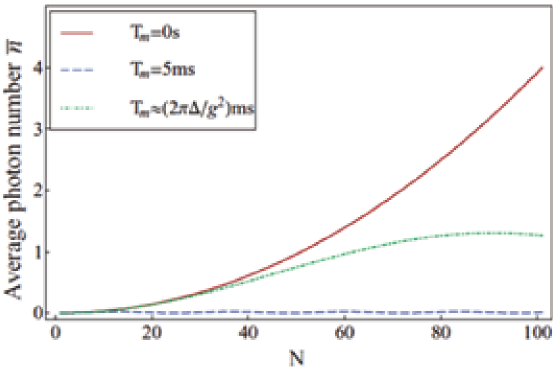


Fig. 1. Average photon number as a function of the pulse number N. Without the QND probe, the average photon number grows quadratically with N (red solid line). The QZE emerges as the average photon number is frozen at zero with τm = 5 ms (blue dashed line). If the measurement time is chosen specifically at τm, the average photon number increases obviously (green dash-dotted line) which is not explained in terms of the WPC interpretation. See Ref. [1].

effect [2]. The frequent measurements are implemented through quantum entanglement between the target qubit(s) and the measuring qubit, which dynamically results from the unitary evolution of duration τ_m due to dispersive coupling. Experimental results testify to the presence of "the critical measurement time effect", that is, the quantum Zeno effect does not occur when τ_m takes some critical values, even if the measurements are frequent enough. Moreover, they provide an experimental demonstration of an entanglement preservation mechanism based on such a dynamic quantum Zeno effect.

CP Sun's group also studied the quantum anti-Zeno effect without evoking the projection measurements [3]. They investigated the measurement-induced enhancement of the spontaneous decay for a two-level subsystem, where measurements are treated as couplings between the excited state and an auxiliary state rather than the von Neumann's wave function reduction. The photon radiated in a fast decay of the atom, from the auxiliary state to the excited state, triggers a quasi-measurement, as opposed to a projection measurement. Such frequent quasi-measurements result in an exponential decay of the survival probability of atomic initial state with a photon emission following each quasi-measurement. Their calculations show that the effective decay rate is of the same form as the one based on projection measurements. The survival probability of the atomic initial state obtained by tracing over all the photon states is equivalent to that of the atomic initial state with a photon emission following each quasi-measurement.

References:
[1] Dispersive-coupling-based quantum Zeno effect in a cavity-QED system
D. Z. Xu, Qing Ai, and C. P. Sun, Phys. Rev. A 83, 022107 (2011).
[2] Experimental demonstration of the quantum Zeno effect in NMR with
entanglement-based measurements,
Wenqiang Zheng, D. Z. Xu, Xinhua Peng, Xianyi Zhou, Jiangfeng Du, and C. P. Sun,
Phys. Rev. A 87, 032112 (2013).
[3] Quantum anti-Zeno effect without wave function reduction
Qing Ai, D. Z. Xu, Su Yi, A. G. Kofman, C. P. Sun and Franco Nori,
Scientific Reports 3, 1752 (2013).

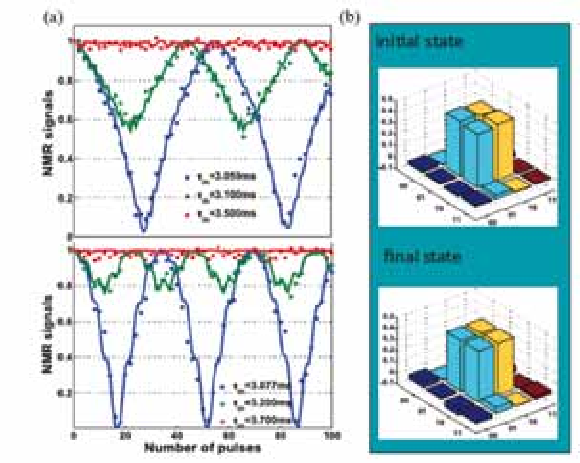


Fig. 2. (a) Experimental QZE with entanglement based measurement on two-qubit system for a product state (top plots) and an entangled state (bottom plots). (b) Real part of the reconstructed density matrix of the initial and final states for preserving the entangled state via QZE. See Ref. [2].

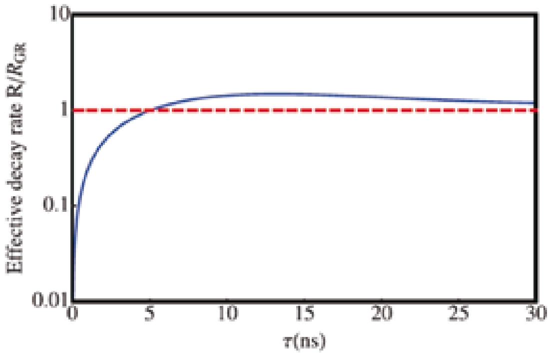


Fig.3 The effective decay rate R(t) versus the quasi-measurement interval for a Lorentzian interacting spectrum. The red dashed line displays the golden-rule decay rate. See Ref. [3].

OPTICAL DIODE MADE FROM A MOVING PHOTONIC CRYSTAL

Optical diodes controlling the flow of light are of principal significance for optical information processing. They transmit light from an input to an output, but not in the reverse direction. This breaking of time reversal symmetry is conventionally achieved via Faraday or nonlinear effects. For applications in a quantum network, features such as the abilities of all-optical control, on-chip integration, and single-photon operation are important. Here we propose an all-optical optical diode which requires neither magnetic field nor strong input field. It is based on a ‘‘moving’’ photonic crystal generated, see Fig. 1, in a three-level electromagnetically induced transparency medium in which the refractive index of a weak probe is modulated by the moving periodic intensity of a strong standing coupling field with two detuned counter-propagating components. Because of the Doppler effect, the frequency range of the crystal’s band gap for the probe copropagating with the moving crystal is shifted from that for the counter-propagating probe (see Fig. 1). This mechanism is experimentally demonstrated in a room temperature Cs vapor cell, see Fig. 2.

This work was supported by National Basic Research Program of China (Grants No. 2012CB921603, No. 2011CB922203, and No. 2010CB923102), National Natural Science Foundation of China (Grants No. 11174026 and No. 11274210), and CUHK Focused Investments Scheme.

See:
“Optical Diode Made from a Moving Photonic Crystal”, Wang, Da-Wei; Zhou, Hai-Tao; Guo, Miao-Jun; Zhang, Jun-Xiang; Evers, Joerg; Zhu,Shi-Yao, Phys. Rev. Lett. 110.093901(2013)

Flying photonic crystal (Doppler Effect)

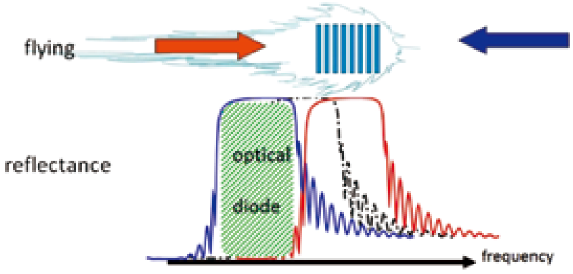


Fig. 1, Working principle of the optical diodes

Experimental Result of the optical diodes

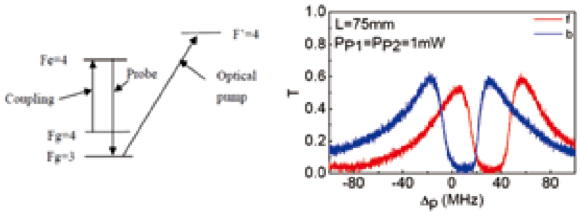


Fig. 2, Experimental result of the optical diodes. With coupling: 40mW, probe: 80 W, T =28^{o}C

GOOS-HÄNCHEN SHIFTS OF PARTIALLY COHERENT LIGHT FIELDS

The Goos-Hänchen (GH) shift refers to a lateral displacement (from the path expected from geometrical optics) along an interface in totally internal reflection. This phenomenon results from a coherence effect. In previous works, the first order Taylor expansion was used, which is not accurate for partial coherent beams. In order to bring to light the role of coherence, the reflection of partially coherent light fields was investigated within the framework of the coherence-theory. A formal expression for the GH shifts of partially coherent light fields is obtained in terms of eigenfunction expansion of the Mercer’s method, which is much more accurate than the traditional first order Taylar expansion, see Fig. 1. It is shown that both the spatial coherence and the beam width have an important effect on the GH shift, especially near the critical angles (such as totally reflection angle), see Fig. 2. For incident angle smaller than the critical angle, the GH shift is still finite. These results are important to observe the GH shifts of the beams with imperfect coherence, like x-ray and matter-wave beams.

This research is supported by NPRP Grant No. 4-346-1-061 by the Qatar National Research Fund (QNRF) and a grant from King Abdulaziz City for Science and Technology (KACST). This work is also supported by NSFC Grants (No. 61078021, No. 11174026, and No. 11274275), and by the National Basic Research Program of China (Grants No. 2012CB921602, 3 and No. 2011CB922203).

See:
“Goos-Ha¨nchen Shifts of Partially Coherent Light Fields”, Li-Gang Wang, Shi-Yao Zhu, and M. Suhail Zubairy, Phys. Rev. Lett. 111.223901(2013)

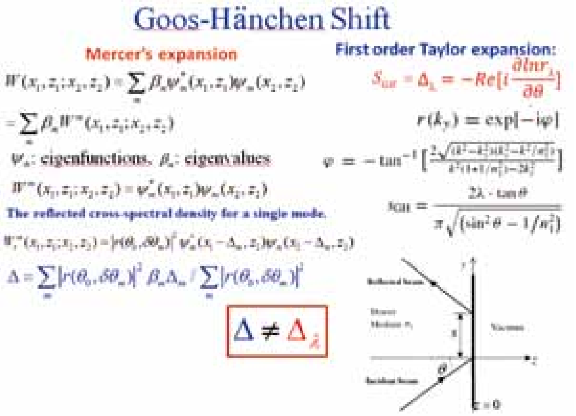


Fig. 1, The difference of this work with previous works

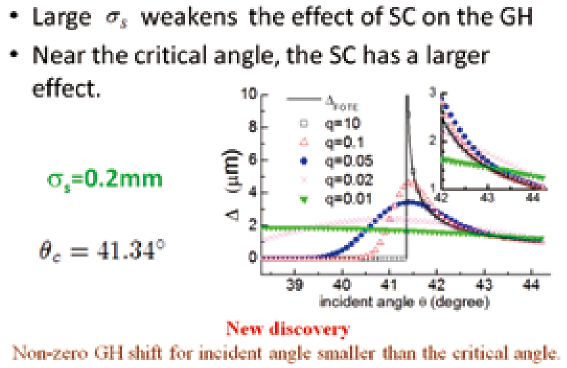


Fig. 2, The main result

ABOUT CSRC 中心简介
PEOPLE 人员情况
RESEARCH HIGHLIGHTS 科研亮点

RESEARCH PROJECTS 科研项目

PUBLICATIONS 发表论文
EVENTS 学术活动
COLLABORATIONS 合作交流
VISITORS 学术访问
FUTURE DEVELOPMENT 发展规划

序号	项目负责人	职称	经费来源	项目类别	项目名称	项目经费	起止时间
1	林海青	教授	科学技术部	重大科学研究计划	固态微结构中光诱导集体激发、光电耦合效应及其原型器件研究	2400	2011 - 2015
2	朱诗尧	教授	国家自然科学基金委员会	面上项目	反旋波项在光和原子相互作用中的影响	65	2012 - 2015
3	汤雷翰	教授	国家自然科学基金委员会	面上项目	全耦合及有限维空间 Kuramoto 模型同步相变的统计物理研究	66	2012 - 2015
4	林海青	教授	国家自然科学基金委员会	联合基金项目	氧化镁晶体微观结构、力学性质及超高压物性的研究	300	2013 - 2016
5	林海青	教授	国家自然科学基金委员会	重大研究计划	复杂结构及其相变的多尺度模型与算法	320	2013 - 2016
6	张培鸿	教授	国家自然科学基金委员会	海外及港澳学者合作研究基金	功能材料的电子激发态性质：理论方法发展与实际应用	20	2014 - 2015
7	游建强	教授	国家自然科学基金委员会	联合基金项目	超导量子比特的优化与混合量子器件的研究	320	2014 - 2017
8	朱诗尧	教授	国家自然科学基金委员会	联合基金项目	人工微结构中宏观量子效应的研究	340	2014 - 2017
9	孙昌璞	教授	中央组织部	重点领域创新团队	量子信息及其物理基础		2014
10	孙昌璞	教授	科学技术部	重大科学研究计划	固体量子计算的器件物理基础	120	2014 - 2018
11	李　勇	特聘研究员	国家自然科学基金委员会	科学部主任基金	首届全国原子分子光学物理青年科学家论坛	6	2011 - 2012
12	李　勇	特聘研究员	国家自然科学基金委员会	面上项目	光力系统中微纳机械振子的冷却原理研究	60	2012 - 2015
13	刘利民	特聘研究员	国家自然科学基金委员会	科学部主任基金	水与有缺陷二氧化钛表面相互作用的理论研究	12	2012 - 2012
14	刘利民	特聘研究员	中物院科学技术发展基金	一般项目	功能化石墨烯对光催化材料电子性质的调制	18	2012 - 2014
15	邓小龙	特聘研究员	国家自然科学基金委员会	青年科学基金项目	多相流自由界面不稳定性的计算流体力学研究	26	2013 - 2015
16	杨　文	特聘研究员	国家自然科学基金委员会	面上项目	半导体量子点中的电子自旋退相干及其抑制的理论研究	75	2013 - 2016
17	喻　进	特聘研究员	国家自然科学基金委员会	面上项目	单分子基因转录复制的非平衡态物理机制解析	70	2013 - 2016
18	刘利民	特聘研究员	国家自然科学基金委员会	优秀青年科学基金项目	材料的界面物理与化学	100	2013 - 2015
19	杨　文	特聘研究员	国家自然科学基金委员会	优秀青年科学基金项目	固态量子信息	100	2014 - 2016

续表

序号	项目负责人	职称	经费来源	项目类别	项目名称	项目经费	起止时间
20	赵楠	特聘研究员	国家自然科学基金委员会	面上项目	基于金刚石“氮-空位”中心的腔量子电动力学研究	76	2014 - 2017
21	任志勇	特聘研究员	国家自然科学基金委员会	优秀青年科学基金项目	复杂体系的多尺度模拟	100	2014 - 2016
22	明炬	特聘研究员	国家自然科学基金委员会	重大研究计划	实际复杂系统不确定量化中的降阶建模理论	70	2014 - 2016
23	赵楠	特聘研究员	科学技术部	青年科学家专题项目	自旋及其复合系统的量子操纵与相干集成研究	500	2014 - 2018
24	高翔	特聘副研究员	国家自然科学基金委员会	面上项目	原子体系散射及其相关精密谱学的理论研究	78	2013 - 2016
25	赵旭鹰	博士后	中国博士后科学基金	面上二等资助	自适应有限元方法及其在Peridynamic模型中的应用	3	2011 - 2013
26	李彦超	博士后	中国博士后科学基金	面上二等资助	准一维系统中的量子相变相关问题研究	3	2011 - 2013
27	陈彦军	博士后	中物院科学技术发展基金	一般项目	利用谐波辐射在超快时间尺度内探测分子结构的理论研究	20	2011 - 2013
28	李彦超	博士后	国家自然科学基金委员会	青年科学基金项目	低维体系中的量子相变及其研究方法探索	26	2012 - 2014
29	曹军	博士后	中国博士后科学基金	面上二等资助	非绝热动力学模拟方法的一些改进及其应用	5	2012 - 2014
30	李彦超	博士后	中国博士后科学基金	特别资助	准一维体系中的量子相变及其相关问题研究	15	2012 - 2014
31	李增朝	博士后	中国博士后科学基金	面上二等资助	Majorana费米子与量子信息处理的理论研究	5	2012 - 2014
32	杨孝森	博士后	中国博士后科学基金	面上二等资助	自旋轨道耦合超冷费米气体的研究	5	2012 - 2014
33	付振国	博士后	中国博士后科学基金	面上二等资助	拓扑绝缘体中新奇量子散射效应的理论研究	5	2012 - 2014
34	刘钊	博士后	中国博士后科学基金	面上二等资助	拓扑平带中分数陈绝缘体的研究	5	2012 - 2014
35	徐金英	博士后	中国博士后科学基金	面上二等资助	光子晶体及零折射率超材料中电子能量损失的研究	5	2012 - 2014
36	柴彦	博士后	中国博士后科学基金	面上二等资助	生物分子马达工作机理和动力学性质的理论研究	5	2012 - 2014
37	刘晓洁	博士后	国家自然科学基金委员会	青年科学基金项目	石墨烯表面金属纳米材料生长形貌以及生长机制的探索	25	2013 - 2015

序号	项目负责人	职称	经费来源	项目类别	项目名称	项目经费	起止时间
38	高峻峰	博士后	中国博士后科学基金	面上一等资助	二维单原子层薄膜在金属表面的生长机理	8	2013 - 2015
39	李圣文	博士后	中国博士后科学基金	面上二等资助	相互作用复合系统中的关联噪声	5	2013 - 2015
40	伍绍贵	博士后	中国博士后科学基金	面上二等资助	生物膜相态及膜溶机理的耗散粒子动力学研究	5	2013 - 2015
41	谭　为	博士后	中国博士后科学基金	面上二等资助	人工微结构中驻波场下的类量子干涉行为研究	5	2013 - 2015
42	高峻峰	博士后	中物院发展基金	中物院发展基金	金属衬底对石墨烯成核生长的影响的理论模拟	17	2013 - 2015
43	刘晓洁	博士后	中国博士后科学基金	特别资助	金属纳米材料在石墨烯表面生长的理论研究	15	2013 - 2015
44	陈　亮	博士后	中国博士后科学基金	面上二等资助	量子反常霍尔体系中的磁性无序	5	2013 - 2015
45	高峻峰	博士后	国家自然科学基金委员会	青年科学基金项目	从碳团簇到石墨烯：金属表面石墨烯成核生长的多尺度模拟	25	2014 - 2016
46	付振国	博士后	国家自然科学基金委员会	青年科学基金项目	拓扑绝缘体中新奇的量子散射效应	25	2014 - 2016
47	郎秀峰	博士后	国家自然科学基金委员会	青年科学基金项目	原子水平理解高能面覆盖贵金属纳米结构的表面增强拉曼光谱	25	2014 - 2016
48	聂文杰	博士生	国家自然科学基金委员会	青年科学基金项目	腔光机械系统中的Casimir效应及其若干量子特性研究	25	2014 - 2016

ABOUT CSRC 中心简介
PEOPLE 人员情况
RESEARCH HIGHLIGHTS 科研亮点
RESEARCH PROJECTS 科研项目

PUBLICATIONS 发表论文

EVENTS 学术活动
COLLABORATIONS 合作交流
VISITORS 学术访问
FUTURE DEVELOPMENT 发展规划

物理系统模拟实验室
SIMULATION OF PHYSICAL SYSTEMS DIVISION

“Low-lying quasiparticle excitations in strongly correlated superconductors: An ansatz from BCS quasiparticle excitations? ”,
Chou, Chung-Pin, *J. Phys. Chem. Solids*, 74.11.1589-1593(2013)

“Phase diagram of a spin-orbit coupled Fermi gas in a bilayer optical lattice”
Yang, Xiaosen; Huang, Beibing; **Lin, Hai-Qing**, *J. Phys. B-At. Mol. Opt. Phys*.46.205302(2013)

“Bulk-edge correspondence in fractional Chern insulators”
Liu, Zhao; Kovrizhin, D. L.; Bergholtz, Emil J. *Phys. Rev. B*, 88.081106(2013)

“Multiple scattering theory for massive Dirac fermions on the topological insulator surface with a strong warping effect”
Fu, Zhen-Guo; **Zhang, Ping**; **Lin, Hai-Qing**; Li, Shu-Shen,*Phys. Rev. B*, 88.085304(2013)

“Superconductivity in beta-Tin Germanium”
Zhang, Chao; Chen, Xiao-Jia; **Lin, Hai-Qing**, *J. Supercond. Nov. Magn*, 26.5. 2009-2011(2013)

“From fractional Chern insulators to Abelian and non-Abelian fractional quantum Hall states: Adiabatic continuity and orbital entanglement spectrum”
Liu, Zhao; Bergholtz, Emil J. *Phys. Rev. B*, 87.035306(2013)

“Van der Waals density functional study of the structural and electronic properties of La-doped phenanthrene”,*J. Chem. Phys*. 139. 204709
Yan, Xun-Wang; Huang, Zhongbing; Lin, Hai-Qing, (2013)

“Phonon-mediated superconductivity in quasi-1D Sc3CoC4”
Zhang, Chao; Tse, John S.; Tanaka, Kaori; **Lin, Hai-Qing**, *EPL*,100. 67003(2012)

“Topological flat band models and fractional chern insulators”
Bergholtz, Emil J.; **Liu, Zhao**, *Int. J. Mod. Phys. B* 27. 24. 1330017(2013)

“Tunable two types of Fano resonances in metal-dielectric core-shell nanoparticle clusters”
Yang, Zhong-Jian; Wang, Qu-Quan; **Lin, Hai-Qing**, *Appl. Phys. Lett*., 103. 111115(2013)

“Controlling edge state transport in a HgTe topological insulator by superlattice effect”
Lin, L. -Z.; Cheng, F.; Zhang, L. B.; Zhang, D.; **Yang, Wen**, *Phys. Rev. B*, 87.245311(2013)

“Electronic and spin transport properties of graphene nanoribbon mediated by metal adatoms: a study by the QUAMBO-NEGF approach”
Zhang, G. P.; **Liu, Xiaojie**; Wang, C. Z.; Yao, Y. X.; Zhang, Jian; Ho, K. M. *J. Phys.-Condes. Matter*, 25. 105302(2013)

“Wilson Ratio of Fermi Gases in One Dimension”
Guan, X. -W.; Yin, X. -G.; Foerster, A.; Batchelor, M. T.; Lee, C. -H.; **Lin, H. -Q.**, *Phys. Rev. Lett*. 111.130401(2013)

“Quantum Fisher information of entangled coherent states in the presence of photon loss”
Zhang, Y. M.; Li, X. W.; **Yang, W.**; Jin, G. R., *Phys. Rev. A*, 88.043832(2013)

“Tunable Band Topology Reflected by Fractional Quantum Hall States in Two-Dimensional Lattices”
Wang, Dong; **Liu, Zhao**; Cao, Junpeng; Fan, Heng, *Phys. Rev. Lett*.111.186804(2013)

“Electronic band gaps and transport properties in aperiodic bilayer graphene superlattices of Thue-Morse sequence”
Li, Changan; Cheng, Hemeng; **Chen, Ruofan**; **Ma, Tianxing**; Wang, Li-Gang; Song, Yun; **Lin, Hai-Qing**, *Appl. Phys. Lett*. 103. 172106(2013)

“Fractional quantum Hall effect of topological surface states under a strong tilted magnetic field”
Zheng, Fawei; **Wang, Zhigang**; **Fu, Zhen-Guo**; **Zhang, Ping**, *EPL*, 103. 27001(2013)

“Hidden (pi,0) instability as an itinerant origin of bicollinear antiferromagnetism in Fe1+x Te “
Ding, Ming-Cui; **Lin, Hai-Qing**; Zhang, Yu-Zhong, *Phys. Rev. B*, 87.125129

“Quantum Monte Carlo Study of a Dominant s-Wave Pairing Symmetry in Iron-Based Superconductors”
Ma, Tianxing; **Lin, Hai-Qing**; Hu, Jiangping, *Phys. Rev. Lett*. 110. 107002

续表

"Structures, mobilities, electronic and magnetic properties of point defects in silicone"
Gao, Junfeng; Zhang, Junfeng; Liu, Hongsheng; Zhang, Qinfang; Zhao, Jijun, *Nanoscale*, 5. 20. 9785- 9792(2013)

"Tunable Dirac cone in the rectangular symmetrical semiconductor quantum dots array"
Peng, Juan; **Fu, Zhen-Guo**; Li, Shu-Shen, *Appl. Phys. Lett.*, 101. 222108(2013)

"Hierarchy of Fractional Chern Insulators and Competing Compressible States"
Laeuchli, A. M.; **Liu, Zhao**; Bergholtz, E. J.; Moessner, R., *Phys. Rev. Lett*. 111.126802(2013)

"Construct order parameters from the reduced density matrix spectra"
Gu, Shi-Jian; Yu, Wing Chi; **Lin, Hai-Qing**, *Ann. Phys*. 336. 118-129(2013)

"Aspin chain with spiral orders: perspectives of quantum information and mechanical response"
Gu, Shi-Jian; Yu, Wing-Chi; **Lin, Hai-Qing**, *Int. J. Mod. Phys. B*, 27. 1350106(2013)

"Orbital selective phase transition"
Yao, Yao; Zhang, Yu-Zhong; Lee, Hunpyo; Jeschke, Harald O.; Valenti, Roser; **Lin, Hai-Qing**; Wu, Chang-Qin, Mod. *Phys. Lett*. B, 27. 1330015(2013)

"Surface spectral function of momentum-dependent pairing potentials in a topological insulator: application to CuxBi2Se3"
Chen, Liang; Wan, Shaolong, *J. Phys.-Condes. Matter*, 25. 215702 (2013)

"First-principles investigations on the magnetic property in tripotassium doped picene"
Zhong, Guo-Hua; **Zhang, Chao**; Wu, Guang-Fen; Huang, Zhong-Bing; Chen, Xiao-Jia; **Lin, Hai-Qing**, *J. Appl. Phys*. 113.17. 1.4795849(2013)

"Supersolid in Bose-Bose-Fermi mixtures subjected to a square lattice"
Yan, Zhongbo; **Yang, Xiaosen**; Wan, Shaolong, *J. Phys. B-At. Mol. Opt. Phys*. 46. 55302(2013)

"Electromechanical properties of zigzag-shaped carbon nanotubes"
Liu, Lizhao; **Gao, Junfeng**; Guo, Xu; Zhao, Jijun, *Phys. Chem. Chem. Phys*. 15. 40. 17134-17141(2013)

"Optical properties of impact diamonds from the Popigai astrobleme"
Yelisseyev, A.; Meng, G. S.; Afanasyev, V.; Pokhilenko, N.; Pustovarov, V.; Isakova, A.; Lin, Z. S.; **Lin, H. Q.** *Diam. Relat. Mat*. 37. 8-16(2013)

"Pressure-induced superconductivity in CaC2"
Li, Yan-Ling; Luo, Wei; Zeng, Zhi; **Lin, Hai-Qing**; Mao, Ho-Kwang; Ahuja, Rajeev *Proc. Natl. Acad. Sci. U. S. A*. 110. 23. 9289-9294(2013)

"Vibrational and structural properties of tetramethyltin under pressure"
Qin, Zhen-Xing; Chen, Xiao-Jia; Zhang, Chao; Tang, Ling-Yun; Zhong, Guo-Hua; **Lin, Hai-Qing**; Meng, Yue; Mao, Ho-Kwang32. Structural and vibrational properties of phenanthrene under pressure, *J. Chem. Phys*. 138. 24307(2013)

"Structural and vibrational properties of phenanthrene under pressure"
Huang, Qiao-Wei; Zhang, Jiang; Berlie, Adam; Qin, Zhen-Xing; Zhao, Xiao-Miao; Zhang, Jian-Bo; Tang, Ling-Yun; Liu, Jing; **Zhang, Chao**; Zhong, Guo-Hua; **Lin, Hai-Qing**; Chen, Xiao-Jia, *J. Chem. Phys*. 139. 104302(2013)

"Phase transformations and vibrational properties of coronene under pressure"
Zhao, Xiao-Miao; Zhang, Jiang; Berlie, Adam; Qin, Zhen-Xing; Huang, Qiao-Wei; Jiang, Shan; Zhang, Jian-Bo; Tang, Ling-Yun; Liu, Jing; **Zhang, Chao**; Zhong, Guo-Hua; **Lin, Hai-Qing**; Chen, Xiao-Jia, *J. Chem. Phys*. 139. 144308(2013)

"Design of a structure with low incident and viewing angle dependence inspired by Morpho butterflies"
Wang, Wanlin; Zhang, Wang; Gu, Jiajun; Liu, Qinglei; Deng, Tao; Zhang, Di; **Lin, Hai-Qing**, *Sci Rep*, 3. 03427(2013)

"Formation of Nanofoam carbon and re-emergence of Superconductivity in compressed CaC6"
Li, Yan-Ling; Luo, Wei; Chen, Xiao-Jia; Zeng, Zhi; **Lin, Hai-Qing**; Ahuja, Rajeev *Sci Rep*,3.3331(2013)

"From Boron Cluster to Two-Dimensional Boron Sheet on Cu(111) Surface: Growth Mechanism and Hole Formation"
Liu, Hongsheng; **Gao, Junfeng**; **Zhao, Jijun**, *Sci Rep*,3.3238(2013)

"Interface-Induced Topological Insulator Transition in GaAs/Ge/GaAs Quantum Wells"
Zhang, Dong; Lou, Wenkai; Miao, Maosheng; Zhang, Shou-cheng; **Chang, Kai**, *Phys. Rev. Lett*. 111.156402(2013)

“Numerical study of magnetic and pairing correlation in a bilayer triangular lattice”
Wu, Shuang; Li, Jinling; Gao, Pan; Liang, Ying; **Ma, Tianxing**, *J. Phys.-Condes. Matter*, 25. 375601(2013)

“Qtum monte carlo study of magnetic correlation in graphene nanoribbons and quantum dots”
Gao, Pan; Liu, Suhang; Tian, Lin; **Ma, Tianxing**, *Mod. Phys. Lett. B*, 27. 21. 1330016(2013)

“onductance of ferro- and antiferro-magnetic single-atom contacts: A first-principles study”
Tan, Zhi-Yun; Zheng, Xiao-long; Ye, Xiang; **Xie, Yi-qun**; **Ke, San-Huang**, *J. Appl. Phys*.114.63711(2013)

“Z(2) fractionalized Chern/topological insulators in an exactly soluble correlated model”
Zhong, Yin; Wang, Yu-Feng; **Luo, Hong-Gang**, *Phys. Rev. B*, 88.045109(2013)

“Helicity-dependent single-walled carbon nanotube alignment on graphite for helical angle and handedness recognition”
Chen, Yabin;Shen, Ziyong; Xu, Ziwei; Hu, Yue; Xu, Haitao; Wang, Sheng; Guo, Xiaolei; Zhang, Yanfeng; Peng, Lianmao; **Ding, Feng**; Liu, Zhongfan; Zhang, *Jin Nat. Commun*. 4.205(2013)

“malous decoherence in a dissipative two-level system”
Liu, Hai-Bin; An, Jun-Hong; Chen, Chong; Tong, Qing-Jun; **Luo, Hong-Gang**; Oh, C. H., *Phys. Rev. A*, 87.052139(2013)

“Generating many Majorana modes via periodic driving: A superconductor model Tong”
Qing-Jun; An, Jun-Hong; Gong, Jiangbin; **Luo, Hong-Gang**; Oh, C. H., *Phys. Rev. B*. 7.201109(2013)

“The Kondo effect of an adatom in graphene and its scanning tunneling spectroscopy”
Li, Lin; Ni, Yang-Yang; Zhong, Yin; Fang, Tie-Feng; **Luo, Hong-Gang**, *New J. Phys*. 15.3018(2013)

“Half-filled Kondo lattice on the honeycomb lattice”
Zhong, Yin; Liu, Ke; Wang, Yu-Feng; Wang, Yong-Qiang; **Luo, Hong-Gang**, *Eur. Phys. J. B*. 86.5(2013)

“Othogonal dirac semimetal on honeycomb lattice”
Zhong, Yin; **Luo, Hong-Gang**, *Int. J. Mod. Phys. B*, 27.7.361002(2013)

“Gap solitons of a super-Tonks-Girardeau gas in a one-dimensional periodic potential”
Xu, T. F.; Jing, X. L.; **Luo, H-G**; Wu, C.; Liu, C. S., *J. Phys. B-At. Mol. Opt. Phys*. 46. 35301(2013)

“Generation of Pure Bulk Valley Current in Graphene”
Jiang, Yongjin; Low, Tony; **Chang, Kai**; Katsnelson, Mikhail I.; Guinea, Francisco, *Phys. Rev. Lett*. 110. 46601(2013)

“Topological antiferromagnetic spin-density-wave phase in an extended Kondo lattice Model”
Yin; Wang, Yu-Feng; Wang, Yong-Qiang; **Luo, Hong-Gang**, *Phys. Rev. B*,uo, 87.035128(2013)

“Strong ferromagnetism in hydrogenated monolayer MoS2 tuned by strain”
Shi, Hongliang; Pan, Hui; Zhang, Yong-Wei; Yakobson, Boris I., *Phys. Rev. B*, 88.205305(2013)

“First-principles study of temperature-dependent diffusion coefficients for helium in alpha-Ti”
Lu, Yong; Zheng, Fawei; **Zhang, Ping**, *J. Appl. Phys*. 114.153507(2013)

“Ferromagnetic to antiferromagnetic transition of one-dimensional spinor Bose gases with spin-orbit coupling”
Chen, Xing; Hu, Haiping; **Jiang, Yuzhu**; Chen, Shu, *Eur. Phys. J. D*, 7.8.116(2013)

“Antiferromagnetic FeSe monolayer on SrTiO3: The charge doping and electric field effects”
Zheng, Fawei; **Wang, Zhigang**; Kang, Wei; **Zhang, Ping**, *Sci Rep*, 3,2213(2013)

“Comparing the effects of uniaxial and biaxial strains on the structural stability and electronic structure in wurtzite ZnS”
Lv, Dong; Duan, Yifeng; Zhao, Botao; Qin, Lixia; Shi, Liwei; Tang, Gang; **Shi, Hongliang**, *J. Appl. Phys*. 114,23514(2013)

“First-principles study of temperature-dependent diffusion coefficients: Hydrogen, deuterium, and tritium in alpha-Ti”
Lu, Yong; **Zhang, Ping**, *J. Appl. Phys*, 113,193502(2013)

“The new phase of HgF2 at high pressure”
Wang, Xiaoli; Li, Jianfu, *EPL Wang*, 102.36002(2013)

“Pseudomagnetoexcitons in strained graphene bilayers without external magnetic fields”
Wang, Zhigang; Fu, Zhen-Guo; Zheng, Fawei; **Zhang, Ping**, *Phys. Rev. B*, 87,125418(2013)

续表

"A Hybrid Density Functional Theory Study of Band Gap Tuning in ZnO through Pressure"
Zhao Bo-Tao; Duan Yi-Feng; **Shi Hong-Liang**; Qin Li-Xia; Shi Li-Wei; Tang Gang, *Chin Phys. Lett*. 29,117104(2013)

"Pressure-induced polymerization of nitrogen in potassium azides"
Li, Jianfu; **Wang, Xiaoli**; Xu, Ning; Li, Daoyong; Wang, Dongchao; Chen, Li, *EPL*, 104. 16005(2013)

"The distorted K-1 soft mode of hexagonal-BN sheet and effects of charge doping"
Yang, Wei; Yang, Yu; Zheng, Fawei; **Zhang, Ping**, *Appl. Phys. Lett.*, 103.83106(2013)

"Non-Abelian fractional Chern insulators from long-range interactions"
Liu, Zhao; Bergholtz, Emil J.; Kapit, Eliot, *Phys. Rev. B*, 88.205101(2013)

量子光学与量子信息实验室
QUANTUM OPTICS AND QUANTUM INFORMATION DIVISION

"Detector-induced backaction on the counting statistics of a double quantum dot"
Li, Zeng-Zhao; Lam, Chi-Hang; Yu, Ting; **You, J. Q.**, *Sci Rep*, 3. 3026(2013)

"Cooperative spontaneous emission of three identical atoms"
Feng, Wei; **Li, Yong**; **Zhu, Shi-Yao**, *Phys. Rev. A*, 88.033856(2013)

"Controlling a Nanowire Spin-Orbit Qubit via Electric-Dipole Spin Resonance"
Li, Rui; **You, J. Q.**; **Sun, C. P.**; Nori, Franco, *Phys. Rev. Lett*. 111.086805(2013)

"Casimir force between topological insulator slabs"
Nie, Wenjie; **Zeng, Ran**; Lan, Yueheng; **Zhu, Shiyao**, *Phys. Rev. B*, 88.085421(2013)

"Experimental test of the first- and second-order duality relations for the two-photon states "
Huang,Jie-Hui; Liu, Hong-Yu; Gao, Jiang-Rui; **Zubairy, M. Suhail**; **Zhu, Shi-Yao**, Phys. Rev. A, 88.013828(2013)

"Spectrum of collective spontaneous emission beyond the rotating-wave approximation"
Li, Yong; **Evers, Joerg**; **Feng, Wei**; **Zhu, Shi-Yao**, *Phys. Rev. A*, 87.053837(2013)

"Optimum valence bond scheme for its applications to the prediction of nano-structures and the study of matter properties"
Gao Xiang; Chen Xiao-Bo; Li Jun; Li Jia-Ming, *Acta Phys. Sin*. 62.093601(2013)

"Optical Diode Made from a Moving Photonic Crystal"
Wang, Da-Wei; Zhou, Hai-Tao; Guo, Miao-Jun; Zhang, Jun-Xiang; **Evers, Joerg**; **Zhu,Shi-Yao**, *Phys. Rev. Lett*. 110.093901(2013)

"Higher-order wave-particle duality"
Huang, Jie-Hui; Woelk, Sabine; **Zhu, Shi-Yao**; **Zubairy, M. Suhail**, *Phys. Rev. A*, 87.022107(2013)

"Quantum information best of both worlds"
Zhao, Nan; Wrachtrup, Joerg, *Nat. Mater*. 12. 2. 97-98(2013)

"Effect of the Casimir force on the entanglement between a levitated nanosphere and cavity modes"
Nie, Wenjie; Lan, Yueheng; **Li, Yong**; **Zhu, Shiyao**, *Phys. Rev. A*, 86.063809(2012)

"Quantum information transmission"
Wang, Lei; **Huang, Jie-Hui**; **Dowling, Jonathan P**; **Zhu, Shi-Yao**, *Phys. Lett. A*, 12.2. 899-906(2013)

"Analytical expressions of global quantum discord for two classes of multi-qubit states"
Xu, Jianwei, *Phys. Lett. A*, 377. 41337. 238-242(2013)

"Creating quantum discord through local generalized amplitude damping"
Xu, Jianwei, *Int. J. Quantum Inf., Int*. 10. 1250071(2012)

"Recoil effects of a motional scatterer on single-photon scattering in one dimension"
Li, Qiong; Xu, D. Z.; Cai, C. Y.; **Sun, C. P.**, *Sci Rep*, 03.3144(2013)

“Cooling a charged mechanical resonator with time-dependent bias gate voltages”
Zhang, Jian-Qi; **Li, Yong**; Feng, Mang, *J. Phys.-Condes. Matter*, 25.14.142201(2013)

“Non-Markovian quantum state diffusion for an open quantum system in fermionic environments”
Chen, Mi; **You, J. Q.**, *Phys. Rev. A*, 87.052108(2013)

“Quantum Routing of Single Photons with a Cyclic Three-Level System”
Zhou, Lan; Yang, Li-Ping; **Li, Yong**; **Sun, C. P.**, *Phys. Rev. Lett*.111.103604(2013)

“Goos-Ha¨nchen Shifts of Partially Coherent Light Fields”
Li-Gang Wang, **Shi-Yao Zhu**, and **M. Suhail Zubairy**, *Phys. Rev. Lett*. 111.223901(2013)

“riving a mechanical resonator into coherent states via random measurements”
Garcia, Ll; Chhajlany, R. W.; **Li, Y.**; Wu, L-A, *J. Phys. A-Math. Theor.* 46. 485305(2013)

“lectromagnetically-induced-transparency-like phenomenon with two atomic ensembles in a cavity”
Turek, Yusuf; **Li, Yong**; **Sun, C. P**, *Phys. Rev. A*, 88.053827(2013)

“ast optical cooling of nanomechanical cantilever with the dynamical Zeeman effect”
Zhang, Jian-Qi; Zhang, Shuo; Zou, Jin-Hua; Chen, Liang; **Yang, Wen**; **Li, Yong**; Feng, Mang, *Opt. Express*, 22. 21. 029695(2013)

“Nonequilibrium. Shot Noise Spectrum Through a Quantum Dot in the Kon.do Regime: A Master Equation Approach under Self-Consistent Born Approximation”
Liu Yu; Jin Jin-Shuang; **Li Jun**; Li Xin-Qi; Yan Yi-Jing, *Commun. Theor. Phys*.. 60. 4.503-509(2013)

“Quadripartite entanglement from a double three-level A-type-atom model”
Wang, Dan; Hu, Li-Yun; Pang, Xiu-Mei; Zhang, Jun-Xiang; **Zhu, Shi-Yao**, *Phys. Rev. A*, 88.042314(2013)

“Number-resolved master equation approach to quantum transport under the self-consistent Born approximation”
Liu Yu; Jin JinShuang; **Li Jun**; Li XinQi; Yan YiJing, *Sci. China-Phys. Mech. Astron*., 56. 10. 1866-1873(2013)

“Collective effects of multiscattering on the coherent propagation of photons in a two-dimensional network”
Xu, D. Z.; **Li, Yong**; **Sun, C. P.**; Zhang, Peng, *Phys. Rev. A*, 88.013832(2013)

“Control excitation and coherent transfer in a dimer”
Li, Hong-rong; Zhang, Pei; Liu, Yingjun; Li, Fu-li; **Zhu, Shi-yao**, *Phys. Rev. A*, 87.053831(2013)

“Coherent control of single photons in the cross resonator arrays via the dark state mechanism”
Tian, Tian; Xu, Dazhi; Zheng, Tai-Yu; **Sun, Chang-Pu**, *Eur. Phys. J. D*, 67. 3. (2013)

“Many-body quantum trajectories of non-Markovian open systems”
Jun Jing, Xinyu Zhao, **J. Q. You**, Walter T. Strunz, and Ting Yu, *Phys. Rev. A*, 88.052122(2013)

“Weak-value amplification of light deflection by a dark atomic ensemble”
Zhou, Lan; Turek, Yusuf; **Sun, C. P.**; Nori, Franco, *Phys. Rev. A*, 88.053815(2013)

“Quantum anti-Zeno effect without wave function reduction”
Ai, Qing; Xu, Dazhi; Yi, Su; Kofman, A. G.; **Sun, C. P.**; Nori, Franco, *Sci Rep*, 01752(2013)

“Experimental demonstration of the quantum Zeno effect in NMR with entanglement-based measurements”
Zheng, Wenqiang; Xu, D. Z.; Peng, Xinhua; Zhou, Xianyi; Du, Jiangfeng; **Sun, C. P.** *Phys. Rev. A*, 87.032112(2013)

“Effect of counter-rotating terms on the spontaneous emission in an anisotropic photonic crystal”
Yang, Shuai; **Al-Amri, M.**; **Zhu, Shi-Yao**; Zubairy, M. Suhail, *Phys. Rev. A*, 87.033818(2013)

“Master equation and dispersive probing of a non-Markovian process”
Yang, Li-Ping; Cai, C. Y.; Xu, D. Z.; Zhang, Wei-Min; **Sun, C. P.** *Phys. Rev. A*, 87.012110(2013)

“Controlling single-photon transport in waveguides with finite cross section”
Huang, Jin-Feng; Shi, Tao; **Sun, C. P.**; Nori, Franco, *Phys. Rev. A*, 88.013836(2013)

“Hybrid quantum circuits: Superconducting circuits interacting with other quantum systems”
Xiang, Ze-Liang; Ashhab, Sahel; **You, J. Q.**; Nori, Franco, *Rev. Mod. Phys*. 85.623(2013)

续表

"Photon blockade induced by atoms with Rydberg coupling"
Huang, Jin-Feng; Liao, Jie-Qiao; **Sun, C. P.**, *Phys. Rev. A*, 87.023822(2013)

"Hybrid quantum circuit consisting of a superconducting flux qubit coupled to a spin ensemble and a transmission-line resonator"
Xiang, Ze-Liang; Lu, Xin-You; **Li, Tie-Fu**; **You, J. Q.**; Nori, Franco, *Phys. Rev. B*, 87.144516(2013)

"Quantum Zeno and anti-Zeno effects measured by transition probabilities"
Zhang, Wenxian; Kofman, A. G.; Zhuang, Jun; **You, J. Q.**; Nori, Franco *Phys. Lett. A*, 377. 1837-1843(2013)

"Ultracold Fermi Gases with Resonant Dipole-Dipole Interaction"
T. Shi; S.-H. Zou; H. Hu; **C.-P. Sun**; S. Yi, *Phys. Rev. Lett*. 110, 045301(2013)

"Single-photon scattering on a strongly dressed atom"
Z. H. Wang; Yong Li; D. L. Zhou; **C. P. Sun**, and Peng Zhang, *Phys. Rev. A*, 86, 023824(2012)

"dentifying the interference effect in different harmonic-emission channels from oriented"
Zhang, Bing; **Chen, Yanjun**; Jiang, Xiangqian; Sun, Xiudong, *Phys. Rev. A*, 88.053428(2013)

"omment on "Past of a quantum particle"
Li, Zheng-Hong; Al-Amri, M.; **Zubairy, M. Suhail**, *Phys. Rev. A*. 88.046102

"hase estimation at the quantum Cramer-Rao bound via parity detection"
Seshadreesan, Kaushik P.; Kim, Sejong; **Dowling, Jonathan P.**; Lee, Hwang, *Phys. Rev. A*, 87.043833(2013)

"tatistical properties of coherent photon-added two-mode squeezed vacuum and its inseparability"
Hu, Li-Yun; Zhang, Zhi-Ming, *J. Opt. Soc. Am. B-Opt. Phys*. 30. 3. 518- 529(2013)

"Quantum memory using a hybrid circuit with flux qubits and nitrogen-vacancy centers"
Lu, Xin-You; Xiang, Ze-Liang; Cui, Wei; **You, J. Q.**; Nori, Franco, *Phys. Rev. A*, 88.012329

"Casimir force between anisotropic single-negative metamaterials"
Zeng, Ran; **Yang, Yaping**; **Zhu, Shiyao**, *Phys. Rev. A*, 87.063823(2013)

"Franck-Condon effect in central spin system"
Yang, L. P.; **Li, Y.**; **Sun, C. P.**, *Eur. Phys. J. D*, 66. 11. 300(2012)

先进功能材料与绿色能源实验室
ADVANCED FUNCTIONAL MATERIALS AND GREEN ENERGY DIVISION

"Umerically exact, time-dependent study of correlated electron transport in model molecular junctions"
Wang, Haobin; Thoss, Michael, *J. Chem. Phys*. 138. 134704(2013)

"Tunable electronic and magnetic properties of WS2 nanoribbons"
Zhang, Hui; **Li, Xi-Bo**; **Liu, Li-Min**, *J. Appl. Phys*. 114. 93710(2013)

"Atomic structure and electronic properties of folded graphene nanoribbons: A first-principles study"
Yin, Wen-Jin; Xie, Yue-E; **Liu, Li-Min**; Chen, Yuan-Ping; **Wang, Ru-Zhi**; **Wei, Xiao-Lin**; Zhong, Jian-Xin; **Lau, Leo**, *J. Appl. Phys*. 113. 173506(2013)

"Effects of intrinsic defects on methanthiol monolayers on Cu(111): A density functional theory study"
Fan, Xiao-Li; Yang, Yong-Liang; Liu, Yan; **Lau, Woon-Ming**, *J. Chem. Phys*. 117. 13. 6587-6593(2013)

"Dimethyl Disulfide on Cu(111): From Nondissociative to Dissociative Adsorption"
Fan, Xiao-Li; Liu, Yan; Ran, Run-Xin; **Lau, Woon-Ming**, *J. Phys. Chem. C*, 117. 13. 6587-6593(2013)

"Ab initio molecular dynamics simulation on the formation process of He@C-60 synthesized by explosion"
Li, Jian-Ying; **Liu, Li-Min**; Jin, Bo; Liang, Hua; Yu, Hai-Jun; Zhang, Hong-Chang; Chu, Shi-Jin; Peng, Ru-Fang, *J. Mol. Model*. 19. 4. 1705-1710(2013)

"Dimension-dependent phase transition and magnetic properties of VS2"
Lang, Xiufeng; You, Tingting; Yin, Penggang; Tan, Enzhong; Zhang, Yan; Huang, Yifan; Zhu, Hongping; Ren, Bin; Guo, Lin; **Zhang, Hui**; **Liu, Li-Min**; **Lau, Woon-Ming**, *J. Mater. Chem. A*, 1. 36.(2013)

"beta-MnO2 as a cathode material for lithium ion batteries from first principles calculations"
Wang, Da; **Liu, Li-Min**; Zhao, Shi-Jin; Li, Bai-Hai; Liu, Hao; **Lang, Xiu-Feng**, *Phys. Chem. Chem. Phys*. 15. 23. 9075-9083.(2013)

"R-graphyne: a new two-dimensional carbon allotrope with versatile Dirac-like point in nanoribbons"
Yin, Wen-Jin; Xie, Yue-E.; **Liu, Li-Min**; **Wang, Ru-Zhi**; **Wei, Xiao-Lin**; **Lau, Leo**; Zhong, Jian-Xin; Chen, Yuan-Ping, *J. Mater. Chem. A*, 1. 17. 5341- 5346(2013)

"Band-Gap States of TiO2(110): Major Contribution from Surface Defects"
Xinchun Mao, **Xiufeng Lang**, Zhiqiang Wang, Qunqing Hao, **Bo Wen**, Zefeng Ren, Dongxu Dai, Chuanyao Zhou, **Li-Min Liu**, and Xueming Yang, *J. Phys. Chem. Lett*. 4. 22. 3839-3844(2013)

"Why Clorine Is an Inefficient n-Type Dopant in CuInSe2? "
Xu, Li-Chun; **Wang, Ru-Zhi**; **Liu, Li-Min**; Song, Rong-Hui; Wei, Xiao-Lin; Chen, Yuan-Ping; Yan, Hui; **Lau, Woon-Ming**, Jpn. *J. Appl. Phys*. 52.100208(2013)

"Bioinspired synthesis and gas-sensing performance of porous hierarchical alpha-Fe2O3/C nanocomposites"
Yang, Fan; Su, Huilan; Zhu, Yaqi; Chen, Jianjun; **Lau, Woon Ming**; Zhang, Di, *Scr. Mater*. 68. 873-876(2013)

"Catalytically active single-atom niobium in graphitic layers"
Zhang, Xuefeng; Guo, Junjie; **Guan, Pengfei**; Liu, Chunjing; Huang, Hao; Xue, Fanghong; Dong, Xinglong; Pennycook, Stephen J.; Chisholm, Matthew F., *Nat. Commun*. 4. 1924(2013)

"Coupling and noise induced spiking-bursting transition in a parabolic bursting model."
Ji, Lin; Zhang, Jia; **Lang, Xiufeng**; Zhang, Xiuhui, *Chaos*, 23. 13141(2013)

"Structural and electronic properties of BaCrO4 at high-pressures"
Wei, Xiao-Lin; **Xu, Li-Chun**; Chen, Yuan-Ping; **Liu, Li-Min**, *Solid State Commun*. 155. 45-48(2013)

"The predominant role of Zn6Y9 cluster in the long period stacking order structures of Mg-Zn-Y alloys: a first-principles study"
Ma, Shang-Yi; **Liu, Li-Min**; Wang, Shao-Qing, *J. Mater. Sci*. 48. 4. 1407-1412(2013)

"In situ identification of crystal facet-mediated chemical reactions on tetrahexahedral gold nanocrystals using surface-enhanced Raman spectroscopy"
Lang, Xiufeng; You, Tingting; Yin, Penggang; Tan, Enzhong; Zhang, Yan; Huang, Yifan; Zhu, Hongping; Ren, Bin; Guo, Lin, *Phys. Chem. Chem. Phys*. 15. 44. (2013)

"Observing reduction of 4-nitrobenzenthiol on gold nanoparticles in situ using surface-enhanced Raman spectroscopy"
Ren, Xiaoqian; Tan, Enzhong; **Lang, Xiufeng**; You, Tingting; Jiang, Li; Zhang, Hongyan; Yin, Penggang; Guo, Lin, *Phys. Chem. Chem. Phys*. 15. 34(2013)

"Controlled fabrication of Si nanoparticles on graphene sheets for Li-ion batteries"
Zhu, Shenmin; Zhu, Chengling; Ma, Jun; Meng, Qing; Guo, Zaiping; Yu, Ziyong; Lu, Tao; Li, Yao; Zhang, Di; **Lau, Woon Ming**, *RSC Adv*. 3. 17. 6141-6146(2013)

"Two-Dimensional Superlattice: Modulation of Band Gaps in Graphene-Based Monolayer Carbon Superlattices"
Luo, Xiaoguang; **Liu, Li-Min**; Hu, Zhenpeng; Wang, Wei-Hua; **Song, Wen-Xiong**; Li, Feifei; Zhao, Shi-Jin; Liu, Hui; Wang, Hui-Tian; Tian, Yongjun, *J. Phys. Chem. Lett*. 3. 22. 3373-3378(2013)

"Efficient photochemical hydrogen production under visible-light over artificial photosynthetic systems"
Chen, Jianjun; Su, Huilan; Liu, Yujia; Zeng, Yiwei; Zhang, Wang; Gu, Jiajun; **Lau, Woon Ming**; Zhang, Di, *Int. J. Hydrog. Energy*, 38. 21. 8639-8647(2013)

续表

“First Principles Investigations on Structural, Elastic, Electronic, and Optical Properties of Li2CdGeS4” Weimin Peng, **Xiaofeng Li**, Junyi Du, *Mater. Trans*. 54. 12. 2167-2172(2013)
“Enhanced Thermal Decomposition of Nitromethane on Functionalized Graphene Sheets: Ab Initio Molecular Dynamics Simulations” **Liu, Li-Min**; Car, Roberto; Selloni, Annabella; Dabbs, Daniel M.; Aksay, Ilhan A.; Yetter, *Richard A*. 3058277 (2012)
“Basis set effect on defect induced spin polarization of a carbon nanotube in density functional theory calculations” Xin, Minsi; Dai, Xing; Huang, Bolong; **Meng, Yan**; Feng, Wei; Jin, Mingxing; Wang, Zhigang; **Zhang, Rui-Qin**, *Chem. Phys. Lett*. 585. 107-111(2013)
“Polymerization of nitrogen in lithium azide” **Wang, Xiaoli**; Li, Jianfu; **Botana, Jorge**; Zhang, Meiguang; Zhu, Hongyang; Chen, Li; Liu, Hongmei; Cui, Tian; **Miao, Maosheng**, *J. Chem. Phys*. 139.164710(2013)
“Caesium in high oxidation states and as a p-block element” **Miao, Mao-sheng**, *Nat. Chem*. 5. 10. 846-852(2013)
“Multilayer Multiconfiguration Time-Dependent Hartree Study of Vibrationally Coupled Electron Transport Using the Scattering-State Representation” **Wang, Haobin**; Thoss, Michael, *J. Phys. Chem*. A,117.32.431-7441(2013)
“Size-dependent structural characteristics and phonon thermal transport in silicon nanoclusters” Li, Hai-Peng; **Zhang, Rui-Qin**, *AIP Adv*. 382114(2013)
“Hole-lattice coupling and photoinduced insulator-metal transition in VO2” Yuan, Xun; Zhang, Wenqing; **Zhang, Peihong**, *Phys. Rev. B*, 88.35119(2013)
“.On the Stereochemical Inertness of the Auride Lone Pair: Ab Initio Studies of AAu (A = K, Rb, Cs) ” **Miao, Maosheng**; Brgoch, Jakoah; Krishnapriyan, Aditi; Goldman, Abby; Kurzman, Joshua A.; Seshadri, Ram, *Inorg. Chem*. 52.14.8183-8189(2013)
“Chemical Mechanism and Tunability of Surface-Enhanced Raman Scattering of Pyridine on Heteronuclear Coinage Metal Diatomic Clusters: A Density Functional Study” Chen, Lei; Li, Zhengqiang; **Meng, Yan**; Lu, Ming; **Wang, Zhigang**; **Zhang, Rui-Qin**, *J. Phys. Chem. C*,117.4.12544-12551(2013)
“Defect Induced Electronic Structure of Uranofullerene” Dai, Xing; Cheng, Cheng; Zhang, Wei; **Xin, Minsi**; Huai, Ping; **Zhang, Ruiqin**; Wang, Zhigang; *Sci Rep*, 3.1341(2013)
“Anomalous stability of graphene containing defects covered by a water layer” Song, Ruixia; Wangmo, Sonam; **Xin, Minsi**; Meng, Yan; Huai, Ping; **Wang, Zhigang**; **Zhang, Ruiqin**, *Nanoscale*, 5.15.6767-6772(2013)
“Graphene-ferromagnet interfaces: hybridization, magnetization and charge transfer” Abtew, Tesfaye; Shih, Bi-Ching; Banerjee, Sarbajit; **Zhang, Peihong**, *Nanoscale*, 5.5.1902-1909(2013)
“Dynamics of a two-level system coupled to a bath of spins” **Wang, Haobin**; Shao, Jiushu, *J. Chem. Phys*. 137.22A504(2012)
“An effective structure prediction method for layered materials based on 2D particle swarm optimization algorithm” Wang, Yanchao; **Miao, Maosheng**; Lv, Jian; Zhu, Li; Yin, Ketao; Liu, Hanyu; Ma, Yanming, *J. Chem. Phys*. 137.224108(2012)
“VO2: Orbital competition, magnetism, and phase stability” Yuan, Xun; Zhang, Yubo; Abtew, Tesfaye A.; **Zhang, Peihong**; Zhang, Wenqing, *Phys. Rev. B*. 86.235103(2013)
“Near-edge band structures and band gaps of Cu-based semiconductors predicted by the modified Becke-Johnson potential plus an on-site Coulomb U” Zhang, Yubo; Zhang, Jiawei; Gao, Weiwei; Abtew, Tesfaye A.; Wang, Youwei; **Zhang, Peihong**; Zhang, Wenqing, *J. Chem. Phys*. 139. 184706(2013)
“Signatures in vibrational and UV-visible absorption spectra for identifying cyclic hydrocarbons by graphene fragments” Meng, Yan; **Wu, Qi**; Chen, Lei; Wangmo, Sonam; Gao, Yang; **Wang, Zhigang**; **Zhang, Rui-Qin**; Ding, Dajun; Niehaus, Thomas A.; Frauenheim, Thomas, *Nanoscale*, 5. 24. 12184(2013)
“Theoretical investigations on the elastic, electronic and thermal properties of orthorhombic Li2CdGeS4 under pressure” **Li, Xiaofeng**; Peng, Weimin; Fu, Hongzhi, *J. Alloy. Compd*. 581. 867-872(2013)

复杂系统实验室
COMPLEX SYSTEMS DIVISION

“ Phase transitions of the q-state Potts model on multiply-laced Sierpinski gaskets”
Tian, Liang; **Ma, Hui**; Guo, Wenan; **Tang, Lei-Han**, *Eur. Phys. J. B*, 86. 197(2013)

“Trade-off between Multiple Constraints Enables Simultaneous Formation of Modules and Hubs in Neural Systems”
Chen, Yuhan; Wang, Shengjun; Hilgetag, Claus C.; **Zhou, Changsong**, *PLoS Comput. Biol*. 9.3(2013)

“Network Evolution Induced by Asynchronous Stimuli through Spike-Timing-Dependent Plasticity
Wu-Jie Yuan1; Jian-Fang Zhou1; **Changsong Zhou**, *PLoS ONE*, 0084644(2013)

“Information Filtering via a Scaling-Based Function”
Qiu, Tian; **Zhang, Zi-Ke**; Chen, Guang, *PLoS One*.8. 5.e63531(2013)

“Deviation of Zipf's and Heaps' Laws in Human Languages with Limited Dictionary S izes”
Lu, Linyuan; **Zhang, Zi-Ke**; Zhou, Tao, *Sci Rep*, 3.1082(2013)

应用数学实验室
APPLIED MATHEMATICS DIVISION

“A numerical study of the ground state and dynamics of atomic-molecular Bose-Einstein condensates”
Jiang, Wei; Wang, Hanquan; Li, Xianggui, *Comput. Phys. Commun*. 184. 11. 2396-2407(2013)

“Analysis and computation for ground state solutions of bose-fermi mixtures at zero temperature”
Cai, Yongyong; Wang, Hanquan, *SIAM J. Appl. Math*. 73.2.757-779(2013)

“Numerical methods and comparison for computing dark and bright solitons in the nonlinear Schrodinger equation”
Bao, Weizhu; Tang, Qinglin; **Xu, Zhiguo**, *J. Comput. Phys*. 235. 423-445(2013)

“Error reduction of the adaptive conforming and nonconforming finite element methods with red-green refinement”
Shi, Zhongci; **Zhao, Xuying**, *Numer. Math*. 123.3.553-584(2013)

“The spectral collocation method for stochastic differential equations”
Huang, Can; **Zhang, Zhimin**, *Discrete Contin. Dyn. Syst.-Ser. B*, 18. 3. 667-679(2013)

“The long time behavior of a spectral collocation method for delay differential equations of pantograph type”
Tang, Jie; Xie, Ziqing; **Zhang, Zhimin**, *Discrete Contin. Dyn. Syst.-Ser. B*, 18. 3. 797-819(2013)

“A spectral collocation method for eigenvalue problems of compact integral operators”
Huang, Can; Guo, Hailong; **Zhang, Zhimin**, 25. 1. 79-101(2013)

“Finite volume superconvergence approximation for one-dimesional singularly perturbed problems”
Cao, Waixiang; **Zhang, Zhimin**; Zou, Qingsong, *J. Comput. Math*. 31. 5. 488-508(2013)

“Local error estimates of the ldg method for 1-d singularly perturbed problems”
Zhu, Huiqing; **Zhang, Zhimin**, *Int. J. Numer. Anal. Model*.10. 2. 350-373(2013)

“Manufactured solutions and the verification of three-dimensional Stokes ice-sheet models”
Leng, W.; **Ju, L.**; Gunzburger, M.; Price, S., *Cryosphere*, 7.1.19-29(2013)

“Superconvergence points of polynomial spectral interpolation”
Zhang, Zhimin, *SIAM J. Numer. Anal*. 50. 6. 2966-2985(2012)

“Pointwise Error Estimates for the LDG Method Applied to 1-d Singularly Perturbed Reaction-Diffusion Problems”
Huiqing Zhu, **Zhimin Zhang**, *Computational Methods in Applied Mathematis*, 13. 1. 79-94(2013)

续表

"Abstract principal component analysis"
LI TianJiangm, **DU Qiang**, *SCIENCE CHINA Mathematics*, 56. 12. 2783-2798(2013)

"Mass and Volume Conservation in Phase Field Models for Binary Fluids"
Shen, Jie; Yang, Xiaofeng; **Wang, Qi**, *Commun. Comput. Phys*. 13.4.1045-1065(2013)

"Multilinear estimates and well-posedness for the vortex filament fourth-order Schrodingerequations"
Zhang, Junyong; Zheng, Jiqiang, *Math. Meth. Appl. Sci*, 36.11.1321-1333(2013)

"Interior penalty discontinuous Galerkin methods with implicit time-integration techniques for nonlinear parabolic equations"
Song, Lunji; Gie, Gung-Min; Shiue, Ming-Cheng, *Numer. Meth. Part Differ. Equ.* 29.4.1341-1366(2013)

"Mathematical theory and numerical methods for bose-einstein condensation"
Bao, Weizhu; **Cai, Yongyong**, *Kinet. Relat. Mod*, 6.1.1.135(2013)

"Global well-posedness and scattering for a nonlinear Klein-Gordon system in low dimensions"
Xia, Suxia; **Zhang, Junyong**, *Appl. Anal*. 92.2.351-378(2013)

"A convergent adaptive finite element algorithm for nonlocal diffusion and peridynamic models"
Du, qiang; Tian, Li; **Zhao, Xuying**, *SIAM J. Numer. Anal*. 51.2.1211-234(2013)

"Numerical study of quantized vortex interaction in complex Ginzburg-Landau equation on bounded domains"
Jiang, Wei; Tang, Qinglin, *Appl. Math. Comput*. 222. 210-230(2013)

"Using a bihomogeneous resultant to find the singularities of rational space curves"
Shi, Xiaoran; Jia, Xiaohong; Goldman, Ron, *J. Symb. Comput*. 53. 1-25(2013)

力学实验室

MECHANICS DIVISION

"Lattice Boltzmann simulations of thermal convective flows in two dimensions"
Wang, Jia; Wang, Donghai; **Lallemand, Pierre**; **Luo, Li-Shi**, *Comput. Math. Appl*. 65. 2. 262-286(2013)

多学科交叉实验室

CSRC

"Change of an insulator's topological properties by a Hubbard interaction",
Araujo, Miguel A. N.; **Castro, Eduardo V.**; **Sacramento, Pedro D.**, *Phys. Rev. B*, 87.085109(2013)

"Charge and spin fractionalization beyond the Luttinger-liquid paradigm",
Moreno, A.; **Muramatsu, A.; Carmelo, J. M. P.**, *Phys. Rev. B*, 87.075101 (2013)

"Undetectable quantum transfer through a continuum",
Ping, Jing; Ye, Yin; Xu, Luting; Li, Xin-Qi; Yan, YiJing; **Gurvitz, Shmuel**, *Phys. Lett. A*, 2013.01.010(2013)

ABOUT CSRC 中心简介
PEOPLE 人员情况
RESEARCH HIGHLIGHTS 科研亮点
RESEARCH PROJECTS 科研项目
PUBLICATIONS 发表论文

EVENTS 学术活动

COLLABORATIONS 合作交流
VISITORS 学术访问
FUTURE DEVELOPMENT 发展规划

中心主办、合办的学术会议（2013年）
WORKSHOPS & CONFERENCES (2013)

时间 Date	会议名称 Title
2013.04.01-04.05	格点模型中的临界现象国际研讨会
	International Workshop on Critical Behavior in Lattice Models
2013.05.20-05.24	计算与应用数学国际研讨会
	International Workshop on Computational and Applied Mathematics
2013.05.26-05.29	第五次量子光学与新材料国际会议
	Quantum Optics and New Materials (V)
2013.06.15-06.16	复杂系统的能量景观研讨会
	Workshop on Energy Landscape of Complex Systems
2013.06.19-06.20	复杂网络和统计力学研讨会
	Workshop on Complex Networks and Statistical Mechanics
2013.07.29-08.16	2013年CCAST暑期班
	CCAST-Summer School 2013
2013.08.07-08.10	第一届Calypso研讨会
	1st Workshop On Calypso
2013.08.21-08.23	第二次量子光学研讨会
	Workshop on Quantum Optics (Ⅱ)
2013.10.19-10.21	第六届固体量子计算国际研讨会
	The 6th International Workshop on Solid State Quantum Computing
2013.10.27-10.30	第十六届第一性原理电子结构计算亚洲研讨会
	16th Asian Workshop on First-Principles Electronic Structure Calculations (ASIAN-16)
2013.12.23-12.24	凝聚态理论与量子信息前沿小型研讨会
	Mini Workshop on Frontiers in Condensed Matter Theory and Quantum Information
2013.12.27-12.29	腔光力学及其应用学术研讨会
	Workshop on Cavity Optomechanics and its Applications

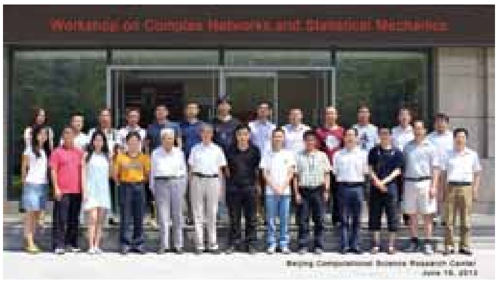
如需了解更多会议详情，请浏览：
For more details about Workshops & Conferences in CSRC, please visit：
http://www.csrc.ac.cn/events/WorkshopsConferences/

前沿讲座
CSRC COLLOQUIUM ON SCIENTIFIC FRONTIERS

2013年共8期（总17期）

日期 Date	报告人 Speaker	单位 Institute	报告题目 Title
2013-1-18	沈学础	中科院上海技术物理所	Whispering Gallery Mode Exciton Polariton in Nano ZnO Wire; Polariton Lasing & Condensation
	Xue-Chu Shen	Shanghai Institute of Technical Physics, CAS	
2013-1-31	柳清伙	厦门大学&美国杜克大学	Multiscale Computational Electromagnetics and Super-Resolution Imaging
	Qing-Huo Liu	Xiamen University and Duke University, USA	
2013-5-17	Max Gunzburger	美国弗罗里达州立大学科学计算系	Computational Approaches to Uncertainty Quantification for Systems Governed by PDEs
		Department of Scientific Computing, Florida State University	
2013-7-22	赵宏凯	美国加州大学欧文分校数学系	Computing Partial Differential Equations on Point Clouds
	Hong-Kai Zhao	Department of Mathematics, University of California, Irvine	
2013-8-9	倪明玖	中国科学院大学物理科学学院	气泡驱动液态金属流体在强磁场作用下的流动
	Ming-Jiu Ni	Shool of Physical Sciences, University of Chinese Academy of Sciences	
2013-8-12	贺贤土	北京应用物理与计算数学研究所	新型惯性约束聚变方案
	Xian-Tu He	Beijing Institute of Applied Physics and Computational Mathematics	
2013-9-9	陈志明	中科院计算数学与科学工程计算研究所	Computation of High Frequency Waves in Unbounded Domain: Perfectly Matched Layer and Source Transfer
	Zhi-Ming Chen	The Institute of Computational Mathematics and Scientific/Engineering Computing, CAS	
2013-10-9	张平文	北京大学数学科学学院	The Mathematical Problems of Liquid Crystals
	Ping-Wen Zhang	School of Mathematical Sciences, Peking University	

专题报告
CSRC SEMINAR



中心积极邀请国内外相关领域重要学者举行专题报告，活跃学术氛围，激发学术思维。2013年中心共举办专题讲座97期（总225期），报告人来自国内、香港、台湾、美国、英国、法国、澳大利亚、新加坡、瑞士、葡萄牙、日本等著名高校及科研单位。

CSRC invites national and overseas leading researchers to give academic seminars. In 2013, CSRC has already held 97 seminars.

博士后报告周会
POSTDOCTORAL SEMINAR

中心组织博士后报告周会，每周由1-2位博士后介绍其近期研究及学习心得，并与中心教授、博士后、学生及访问学者讨论交流。2013年中心共举办博士后报告43期（总130期）。

CSRC organizes postdoctoral seminar each week so to give postdoctoral fellows opportunity of exchange ideas and explore collaboration with CSRC researchers and visiting scholars. In 2013, CSRC has already held 43 postdoctoral seminars.

如需了解更多报告信息，请浏览：
For more details about Seminars in CSRC, please visit:
http://www.csrc.ac.cn/events/seminars/

ABOUT CSRC 中心简介
PEOPLE 人员情况
RESEARCH HIGHLIGHTS 科研亮点
RESEARCH PROJECTS 科研项目
PUBLICATIONS 发表论文
EVENTS 学术活动

COLLABORATIONS 合作交流

VISITORS 学术访问
FUTURE DEVELOPMENT 发展规划

北京计算科学研究中心非常重视与科研机构及高校的合作，在积极组织承办国内外学术会议之时，也鼓励科研人员与国内外其他科研机构之间的互访交流，扩展学术视野和扩大学术影响。目前已与国际数所科研机构签署了合作协议，为打造中心作为国际一流的开展计算科学及相关学科交叉研究的综合平台而不断努力。

To facilitate scientific interactions between CSRC scientists and scientists elsewhere, CSRC has developed partnerships with several universities and research institutions around the world. Besides engaging in long-term scientific collaborations, CSRC staff also host conferences, workshops, and seminars with collaborators. Through these activities, CSRC is working towards extending the frontier in computational science research and improving its competitive edge and prestige.

合作伙伴
PARTNERSHIP

- **The University of Georgia (UGA)**
- **RIkagaku KENkyusho/Institute of Physical and Chemical Research (RIKEN)**
- **Hearne Institute for Theoretical Physics, Louisiana State University (LSU)**
- **Lawrence Berkeley National Laboratory (LBNL)**
- **Old Dominion University (ODU)**
- **Korea Institute for Advanced Study (KIAS)**

ABOUT CSRC 中心简介
PEOPLE 人员情况
RESEARCH HIGHLIGHTS 科研亮点
RESEARCH PROJECTS 科研项目
PUBLICATIONS 发表论文
EVENTS 学术活动
COLLABORATIONS 合作交流

VISITORS 学术访问

FUTURE DEVELOPMENT 发展规划

中心在加强与科研机构及高校的合作交流，积极组织承办国内外学术会议之余，也鼓励科研人员与国内外其他科研机构之间的互访交流。成立至今，中心已经接待了来自10多个国家和地区超过1000人次的来访学者，中心科研人员外出参加学术交流活动超过300人次。2013年中心来访学者达470人次。

中心欢迎国内外各机构相关专业的科研人员和教师，以访问学者或客座研究人员的形式来访，进行短期或长期合作研究。中心也与同行们一起举办学术活动如会议、讲习班等。在中心访问期间，中心将提供一定的生活补助。

CSRC warmly welcomes scientists around the world to visit for collaboration and exchange. CSRC frequently hosts academic activities such as conferences, workshops, and seminars together with its counterparts. Meal allowance and housing subsidies are provided during visitor's stay at CSRC.

ABOUT CSRC 中心简介
PEOPLE 人员情况
RESEARCH HIGHLIGHTS 科研亮点
RESEARCH PROJECTS 科研项目
PUBLICATIONS 发表论文
EVENTS 学术活动
COLLABORATIONS 合作交流
VISITORS 学术访问

FUTURE DEVELOPMENT 发展规划

北京计算科学研究中心
“计算科学及应用研究能力建设项目”
主体结构封顶仪式

CORNERSTONE CEREMONY

2013年9月29日上午，北京计算科学研究中心“计算科学及应用研究能力建设项目“主体结构封顶仪式在中关村软件园二期工地举行。

参加封顶仪式的有中物院综合计划部龙江副处长、计科中心林海青主任和曲彤副主任、中建一局北京公司简文华和谢述光副总经理、京兴国际监理公司张军副总经理、中电设计院李健设计师、求实咨询公司郝文伟副总经理等领导。

在封顶仪式前，中建一局（总包单位）项目部执行经理毛传东简要汇报了项目建设和管理情况，随后京兴国际侯富江总监、中电设计院李健设计师、求实咨询公司郝文伟副总经理、中物院龙江副处长、计科中心林海青主任和曲彤副主任、中建一局北京公司简文华副总经理先后发表了热情洋溢的讲话，对计算科学及应用研究能力建设项目取得的阶段性成果表示祝贺，对参建人员表示感谢，并对下一步工作提出了希望。

〖建筑结构鸟瞰图〗

〖中关村软件园一二期鸟瞰图〗

“计算科学及应用研究能力建设”项目建于北京市海淀区中关村软件园二期（西扩）东区后25公顷G-4地块，总用地面积14104平方米，总建筑面积为45000平方米，其中地上建筑面积30324平方米，地下建筑面积14676平方米。

建设内容包括计算机房、科研业务用房、作业研究用房、学术交流用房、后勤保障用房、地下车库等设施，以及200万亿次高性能计算集群系统、计算数据可视化分析系统等设备。

该项目的实施为提供较为良好的科研办公环境奠定基础，对于提高我国科技领域核心支撑能力，确保国家战略安全具有重大意义。

CSRC is expected to move into its home building by the end of 2014. It is located at Beijing Zhong-Guan-Cun Software Park (ZPark), which is surrounded by Beijing's ecological zone, high tech industry zone, and academia zone. The construction project of CSRC covers a total area of 1.4104 hectares with total building area of 45000 square meters.