Center for Nanophysics and Advanced Materials (CNAM)

(prior to July 2007 CNAM was known as the Center for Superconductivity Research (CSR))

Goal: Enhance condensed matter experimental research at UMD

Faculty (by seniority**):**

J. Robert Anderson	Quantum information and semiconductor physics
Richard L. Greene	Superconductivity and other Novel Materials
Christopher J. Lobb	Quantum information and superconductivity
Frederick C. Wellstood	Quantum information and SQUID inspired devices
Steven M. Anlage	Superconducting Metamaterials and Wave Chaos
Min Ouyang	Nanomaterials: physics and chemistry
Ian Appelbaum	Spintronics in Silicon and other materials
Johnpierre Paglione	Physics of novel superconducting materials

Other faculty participants:

Dennis Drew (research professor)
Michael Fuhrer (departed professor with finishing PhD students)
Ellen Williams (on leave to BP, not expected to return)
Daniel Lathrop (most of his research associated with TG3)
Affiliated faculty in Chemistry, MS&E, EE, NIST and LPS (~10 right now)

CNAM Statistics

graduate students: 40
postdocs and research scientists: 15
undergraduate students: 5

Collaborative research with JQI and CMTC (the CNAM state budget provides financial support to both of these centers).

Yearly external funding from CNAM grants (includes MRSEC and two MURI awards but does not include instrumentation awards):

FY10 $5, 514, 000
FY11 $6, 102, 000
FY12 $6, 455, 000 (MRSEC not included since it was not renewed)

CNAM state operations budget ($470K/year) supports: three engineers, central experimental facilities/infrastructure, cost matches for large external grants, administrative costs, partial startup for new faculty, condensed matter seminar and distinguished visitors, partial support for postdoc and graduate student fellowships, workshops, other miscellaneous experimental costs (e.g., safety).

CNAM Research

Areas of focus during the past six years:

Graphene (Fuhrer, Williams, Drew)
Topological Insulators (Paglione, Fuhrer, Drew, Greene, Appelbaum)
Strongly correlated materials, primarily high-Tc superconductors (Paglione, Greene, Drew)
Superconducting quantum computation--with JQI (Lobb, Wellstood, Anderson)
Superconducting metamaterials , wave chaos, and microwave superconductivity (Anlage)
Spintronics with Silicon (Appelbaum)
Nanoscale materials; chemistry and physics (Ouyang)
Turbulent fluid flows and vortices in superfluid He (Lathrop)

Accomplishments and Awards:

306 publications, 6824 citations since 2006, career citations > 60, 000
350 invited talks since 2006
AAAS fellows (Greene, Fuhrer, Lathrop)
APS fellows (Lobb, Wellstood, Fuhrer, Greene, Drew, Williams)
Young investigator awards (Ouyang, Paglione)
2012 APS Stanley Corrsin Award (Lathrop)
2011 State of Maryland A. M. Haig Prize (Appelbaum)
Member of NAS and American Academy of Arts & Sciences (Williams)

Topological Insulators: SmB_6

PHYSICAL REVIEW X **3**, 011011 (2013)

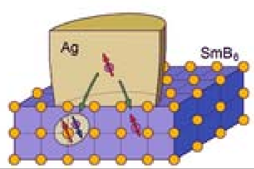
Hybridization, Inter-Ion Correlation, and Surface States in the Kondo Insulator SmB_6

Xiaohang Zhang,[1,*] N. P. Butch,[2] P. Syers,[1] S. Ziemak,[1] Richard L. Greene,[1] and Johnpierre Paglione[1]
[1]*Center for Nanophysics and Advanced Materials & Department of Physics, University of Maryland, College Park, Maryland 20742, USA*
[2]*Condensed Matter and Materials Division, Lawrence Livermore National Laboratory, Livermore, California 94550, USA*
(Received 24 November 2012; revised manuscript received 15 January 2013; published 14 February 2013)

PAGLIONE, GREENE:
First separation of bulk and surface properties in a topological Kondo Insulator

Physics
spotlighting exceptional research
Home | About | Browse | APS Journals

Synopsis: Surface Protection



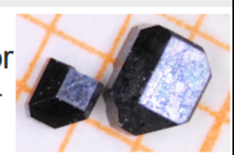
Hybridization, Inter-Ion Correlation, and Surface States in the Kondo Insulator SmB_6
Xiaohang Zhang, N. P. Butch, P. Syers, S. Ziemak, Richard L. Greene, and Johnpierre Paglione
Phys. Rev. X 3, 011011 (2013)
Published February 14, 2013

nature International weekly journal of science
Archive > Volume 492 > Issue 7428 > News > Article

NATURE | NEWS

Hopes surface for exotic insulator

Findings by three teams may solve a 40-year-old mystery.
Eugenie Samuel Reich
11 December 2012



SCIENTIFIC AMERICAN™

Exotic Quantum Effects Could Follow from Compound Now Confirmed to Conduct Only at Surface

New findings from three teams may solve a 40-year-old mystery regarding the odd electrical behavior of samarium hexaboride, which may be a topological insulator in its bulk form

By Eugenie Samuel Reich and Nature magazine | Tuesday, December 11, 2012 | 1

Science AAAS

Nonepitaxial Growth of Hybrid Core-Shell Nanostructures with Large Lattice Mismatches
Jiatao Zhang *et al.*
Science **327**, 1634 (2010);
DOI: 10.1126/science.1184769

Patent: US 20120267605

OUYANG:

Revolutionary new solution of growth of hybrid nanostructures with large lattice mismatches

MATERIALS TECHNOLOGY @ TMS
EMERGING MATERIALS TECHNOLOGIES

A Quantum Leap in Semiconductor Processing

Posted on: 3/30/2010 12:00:00 AM... University of Maryland researchers have developed a new way to produce high quality semiconductor materials for advanced microelectronics and nanotechnology.

The process uses chemical thermodynamics to produce, in solution, a broad range of different combination materials, each with a shell of structurally perfect mono-crystal semiconductor around a metal core. As reported in the March 26 issue of *Science,* this new method offers a number of advantages over the existing process, epitaxy, used to create single crystal semiconductors and related devices. According to the researchers, their non-epitaxial process avoids two key constraints of epitaxy—a limit on deposition semiconductor layer thickness and a rigid requirement for "lattice matching," which restricts the materials that can be formed with it.

The University of Maryland method also does not require a clean room facility and the materials do no not have to be formed in a vacuum, as conventional epitaxy does. In addition to semiconductor material production, the new method can also can be used to design and fabricate artificial quantum structures that help scientists understand and manipulate the basic physics of quantum information processing at the nanoscale.

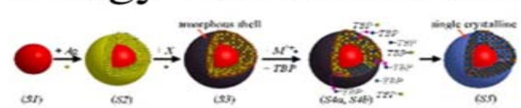
zimbio

Fundamental Advance for Production of Advanced Microelectronics and Nanotechnology Developed at University of Maryland

Written by altonparrish3 on Mar-26-10 5:51pm
From: nanopatentsandinnovations.blogspot.com

University of Maryland (College Park, MD) researchers have created a completely new wa produce high quality semiconductor materials critical for advanced microelectronics and nanotechnology. Published in the March 26 issue of ***Science***, their research is a fundament step forward in nanomaterials science that could lead to significant advances in computer ch photovoltaic cells, biomarkers and other applications, according to the authors and other experts.

Scientists Advance Quantum Computing & Energy Conversion Tech



PHYSORG.COM
SCIENCE : PHYSICS : TECH : NANO : NEWS

Spintronique : on a construit la première puce !

Par Jean-Luc Goudet, Futura-Sciences

J'aime 1 Tweeter 0 1 Partager

Utiliser les propriétés magnétiques des électrons : la spintronique et le rêve des électroniciens, qui n'y parvenaient jusque-là qu'à l'aide de structures microscopiques et de matériaux exotiques. Une équipe a construit une puce et elle est en silicium

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Technology :: News :: May 16, 2007 :: Email :: Print

Spintronics Breaks the Silicon Barrier

Elektronentol overleeft reis door silicium

Na yoghurt ook elektronica links- of rechtsdraaiend

Кремниевая спинтроника

Опубликовано Tiniel в 27 июня, 2007 - 12:54

Развитие спинтроники (где информацию хранят и переносят не заряды, а магнитные моменты или спины) во многом тормозится из-за отсутствия подходящих полупроводниковых материалов, таких же распространенных и недорогих как кремний – основа обычной электроники.

Fortschritt in der Silizium-Spintronik

Im Unterschied zur klassischen Elektronik, die auf der Steuerung von Ladungsträgern in Halbleitern beruht, versucht die Spintronik, den Elektronenspin zur Steuerung auszunutzen und auf diese Weise möglicherweise zu einer schnelleren und energetisch effizienteren Informationsverarbeitung zu gelangen. Eine Forschergruppe in den USA – Biqin Huang und **Ian Applebaum** [http://www.ee.udel.edu/~appelbau/] von

Nature Nanotechnology
Published online: 18 May 2007 | doi:10.1038/nnano.2007.174

Subject Category: Nanomagnetism and spintronics

Spintronics: Silicon joins the club

Peter Rodgers

Researchers have demonstrated electron spin transport in a silicon-based device

MIT Technology Review

COMPUTING NEWS

A New Spin on Silicon Chips

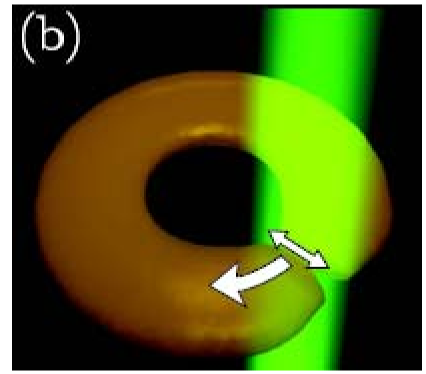
Atomic Analogs of Superconducting (and normal) circuits

PRL 106, 130401 (2011) PHYSICAL REVIEW LETTERS week ending 1 APRIL 2011

Superflow in a Toroidal Bose-Einstein Condensate: An Atom Circuit with a Tunable Weak Link

A. Ramanathan, K. C. Wright,* S. R. Muniz,† M. Zelan,‡ W. T. Hill III, C. J. Lobb, K. Helmerson,§ W. D. Phillips, and G. K. Campbell

(Editors Selection; cited 43 times as of 3/7/2013.)



PRL 110, 025302 (2013) PHYSICAL REVIEW LETTERS week ending 11 JANUARY 2013

Driving Phase Slips in a Superfluid Atom Circuit with a Rotating Weak Link

K. C. Wright,* R. B. Blakestad,† C. J. Lobb,‡ W. D. Phillips, and G. K. Campbell

(Editors Selection, Physics Synopsis feature, Nature News and Views writeup.)

SCIENTIFIC REPORTS

Analogs of Basic Electronic Circuit Elements in a Free-Space Atom Chip

Jeffrey G. Lee, Brian J. McIlvain, C. J. Lobb & W. T. Hill, III

SCIENTIFIC REPORTS | 3 : 1034 | DOI: 10.1038/srep01034

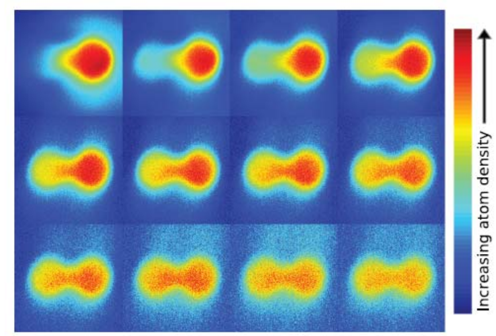


Figure 1 | Capacitor Discharge. Images of a discharging atom capacitor with a channel width of 340 μm. The atoms are loaded into the right container and released from the MOT at $t = 0$ ms. The images are snapshots at 5 ms intervals, starting at $t = 5$ ms (viewed left to right, top to bottom). Each frame is the average of eight individual experimental runs, and is scaled independently of the other frames.

Quantum Chaos

ANLAGE:

First electromagnetic nonlinear time-reversal mirror

PRL 110, 063902 (2013) PHYSICAL REVIEW LETTERS week ending 8 FEBRUARY 2013

Nonlinear Time Reversal in a Wave Chaotic System

Matthew Frazier,[1] Biniyam Taddese,[1,2] Thomas Antonsen,[1,2] and Steven M. Anlage[1,2]
[1]*Department of Physics, University of Maryland, College Park, Maryland 20742-4111, USA*

Physics
spotlighting exceptional research

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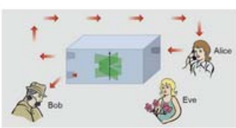
Synopsis: Alice and Bob Go Nonlinear



Nonlinear Time Reversal in a Wave Chaotic System
Matthew Frazier, Biniyam Taddese, Thomas Antonsen, and Steven M. Anlage
Phys. Rev. Lett. **110**, 063902 (2013)
Published February 7, 2013

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'Time Reversal' Research May Open Doors to Future Tech

Using a "time-reversal" technique, researchers have discovered how to transmit power, sound or images to a "nonlinear object" without knowing the object's exact location or affecting objects around it. (Credit:

UMD NEWSDESK

SCIENCE & TECHNOLOGY

For Immediate Release
November 29, 2012
Contacts: Ellen Ternes, 301-405-4621 or eternes@umd.edu

E-mail this release

UMD Time Reversal Findings May Open Doors to the Future

THE DIAMONDBACK

Univ. researchers hope to expand functions of time reversal physics

Iron-based superconductivity

nature physics | REVIEW ARTICLE
PUBLISHED ONLINE: 29 AUGUST 2010 | DOI: 10.1038/NPHYS1759

High-temperature superconductivity in iron-based materials

Johnpierre Paglione* and Richard L. Greene

PAGLIONE, GREENE:
First comprehensive review of the field (250 citations)

PAGLIONE:
First report of strain-induced superconductivity (48 citations)

PRL **103,** 037005 (2009) PHYSICAL REVIEW LETTERS week ending 17 JULY 2009

Superconducting and Ferromagnetic Phases Induced by Lattice Distortions in Stoichiometric $SrFe_2As_2$ Single Crystals

S. R. Saha, N. P. Butch, K. Kirshenbaum, and Johnpierre Paglione*
Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, Maryland 20742, USA

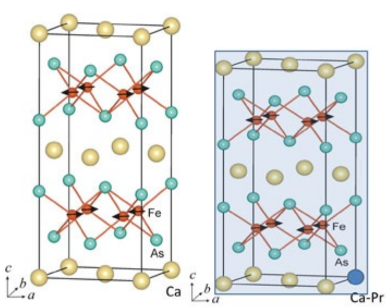
APPLIED PHYSICS LETTERS **95**, 062510 (2009)

Josephson effect between electron-doped and hole-doped iron pnictide single crystals

Xiaohang Zhang,[1,a)] Shanta R. Saha,[1] Nicholas P. Butch,[1] Kevin Kirshenbaum,[1] Johnpierre Paglione,[1] Richard L. Greene,[1] Yong Liu,[2] Liqin Yan,[2] Yoon Seok Oh,[2] Kee Hoon Kim,[2] and Ichiro Takeuchi[3]

GREENE, TAKEUCHI, PAGLIONE:
First report of Josephson effect

PAGLIONE:
Record 50 K transition temperature in intermetallic Fe-based materials



Unusual 'Collapsing' Iron Superconductor Sets Record for Its Class

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NIST Home > NCNR > Unusual 'Collapsing' Iron Superconductor Sets Record for Its Class

Unusual 'Collapsing' Iron Superconductor Sets Record for Its Class

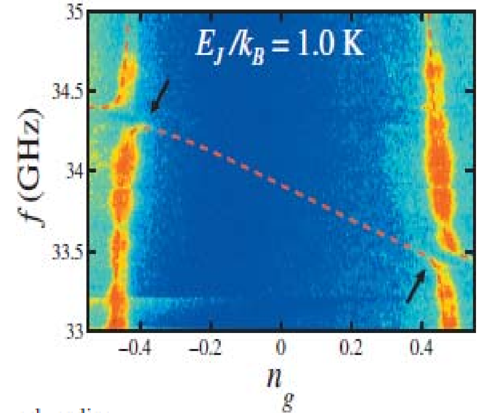
From NIST *Tech Beat*: February 7, 2012

Charge qubits: two level systems and long T_1

PHYSICAL REVIEW B **78**, 144506 (2008)

Anomalous avoided level crossings in a Cooper-pair box spectrum

Z. Kim,[1,2] V. Zaretskey,[1,2] Y. Yoon,[2] J. F. Schneiderman,[3] M. D. Shaw,[3] P. M. Echternach,[4] F. C. Wellstood,[2,5] and B. S. Palmer[1,*]
[1]*Laboratory for Physical Sciences, College Park, Maryland 20740, USA*
[2]*Department of Physics, University of Maryland, College Park, Maryland 20742, USA*
[3]*Department of Physics, University of Southern California, Los Angeles, California 90089-0484, USA*
[4]*Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109, USA*
[5]*Joint Quantum Institute and Center for Nanophysics and Advanced Materials, College Park, Maryland 20742, USA*
(Received 7 March 2008; revised manuscript received 9 September 2008; published 10 October 2008)



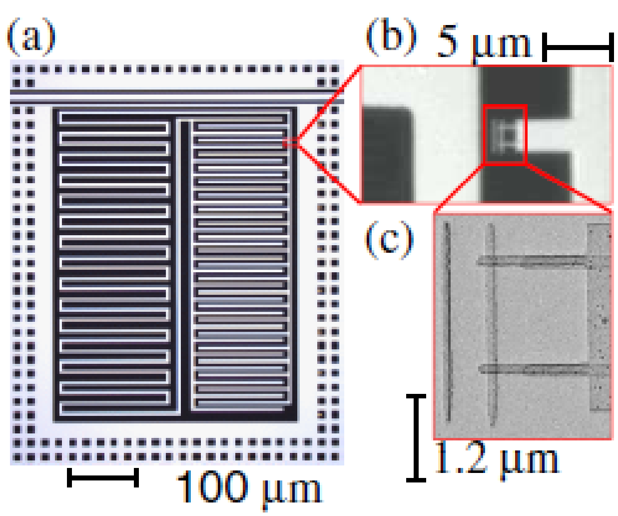
(25 citations as of 3/7/2013)

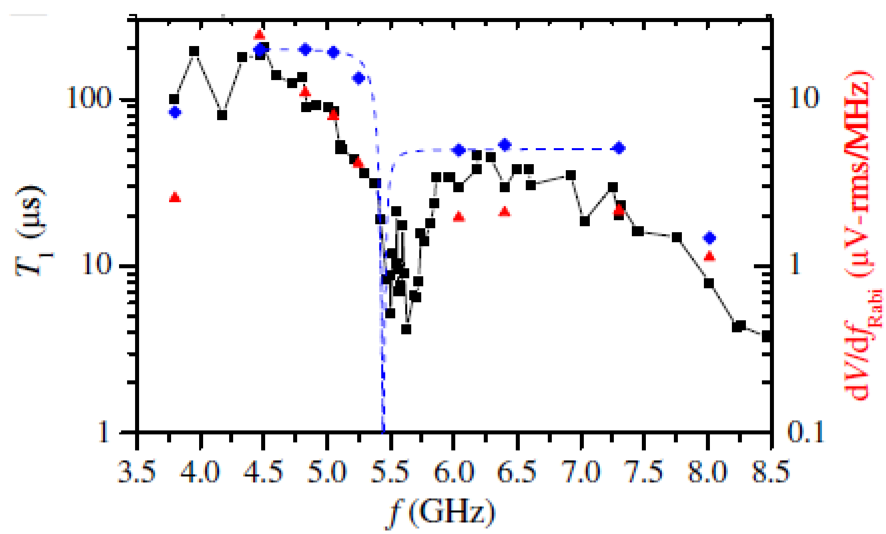
PRL **106**, 120501 (2011) PHYSICAL REVIEW LETTERS week ending 25 MARCH 2011

Decoupling a Cooper-Pair Box to Enhance the Lifetime to 0.2 ms

Z. Kim,[1,2] B. Suri,[1,2] V. Zaretskey,[1,2] S. Novikov,[1,2] K. D. Osborn,[1] A. Mizel,[1] F. C. Wellstood,[2,3] and B. S. Palmer[1]
[1]*Laboratory for Physical Sciences, College Park, Maryland 20740, USA*
[2]*Department of Physics, University of Maryland, College Park, Maryland 20742, USA*
[3]*Joint Quantum Institute and Center for Nanophysics and Advanced Materials, College Park, Maryland 20742, USA*
(Received 21 September 2010; published 22 March 2011)

(11 citations as of 3/7/2013)





CNAM Status and Future Issues

- Research productivity and outside reputation of CNAM faculty is excellent.
- The interactive and collaborative research environment of CNAM, with shared central facilities, is a major strength that should be enhanced and not taken for granted by campus administrators. It is a significant positive for future faculty recruitment.
- The loss of key senior faculty over the past six years is a significant problem for the future. CNAM has gone from 14 faculty in 2005 to 9 today (counting Lathrop). Two of the present faculty are over 74.

  Two offers at the tenure-track faculty level will be made within the next few weeks. Both candidates are outstanding and will get offers elsewhere, so the odds of getting both to accept are low.
- CNAM laboratory space (and office space) is old and cannot support futures hires. Space in the new building will help for 1-2 new hires, but the phase II building is needed to adequately support all of CNAM.

The following slides are a few more examples of CNAM research accomplishments over the past six years based only upon the research of the present CNAM faculty

Copper-based superconductivity

GREENE:

Definitive review of electron-doped cuprates (65 citations)

REVIEWS OF MODERN PHYSICS, VOLUME 82, JULY–SEPTEMBER 2010

Progress and perspectives on electron-doped cuprates

N. P. Armitage
Johns Hopkins University, Baltimore, Maryland 21218, USA
P. Fournier
Université de Sherbrooke, Sherbrooke, Québec, Canada J1K 2R1
R. L. Greene
Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, Maryland 20742, USA

GREENE, PAGLIONE:

Confirmation of magnetic origin of superconductivity in cuprates (21 citations)

LETTER

doi:10.1038/nature10308

Link between spin fluctuations and electron pairing in copper oxide superconductors

K. Jin[1,2], N. P. Butch[1,2], K. Kirshenbaum[1,2], J. Paglione[1,2] & R. L. Greene[1,2]

HIGH-TEMPERATURE SUPERCONDUCTIVITY

RESEARCH NEWS & VIEWS

The great quantum conundrum

Twenty-five years on from its discovery, high-temperature superconductivity remains without a satisfactory explanation. The latest studies on the electronic phase diagram of copper oxide compounds reveal why this is so. SEE LETTER P.73

PAGLIONE, GREENE:

First definitive evidence of quantum criticality in cuprates

PNAS

8440–8444 | PNAS | May 29, 2012 | vol. 109 | no. 22

Quantum critical scaling at the edge of Fermi liquid stability in a cuprate superconductor

Nicholas P. Butch[1], Kui Jin[1], Kevin Kirshenbaum, Richard L. Greene[2], and Johnpierre Paglione

Center for Nanophysics and Advanced Materials and Department of Physics, University of Maryland, College Park, MD 20742

Topological Insulators: Bi_2Se_3

PAGLIONE, DREW:

First report of surface scattering in Bi_2Se_3

PHYSICAL REVIEW B **81**, 241301(R) (2010) RAPID COMMUNICATIONS

Strong surface scattering in ultrahigh-mobility Bi_2Se_3 topological insulator crystals

N. P. Butch,* K. Kirshenbaum, P. Syers, A. B. Sushkov, G. S. Jenkins, H. D. Drew, and J. Paglione
Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, Maryland 20742, USA
(Received 12 May 2010; published 1 June 2010)

nature physics LETTERS
PUBLISHED ONLINE: 15 APRIL 2012 | DOI:10.1038/NPHYS2286

Surface conduction of topological Dirac electrons in bulk insulating Bi_2Se_3

Dohun Kim[1†], Sungjae Cho[1†‡], Nicholas P. Butch[1‡], Paul Syers[1], Kevin Kirshenbaum[1], Shaffique Adam[2], Johnpierre Paglione[1] and Michael S. Fuhrer[1*]

FUHRER, PAGLIONE:

First report of Dirac conduction characteristics in a TI

FUHRER, PAGLIONE, DAS SARMA:

First characterization of surface electron-phonon scattering – theory and exp't

PRL **109**, 166801 (2012) PHYSICAL REVIEW LETTERS week ending 19 OCTOBER 2012

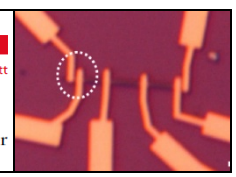
Intrinsic Electron-Phonon Resistivity of Bi_2Se_3 in the Topological Regime

Dohun Kim,[1] Qiuzi Li,[2] Paul Syers,[1] Nicholas P. Butch,[1,*] Johnpierre Paglione,[1] S. Das Sarma,[1,2] and Michael S. Fuhrer[1,†]
[1]*Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, Maryland 20742-4111, USA*
[2]*Condensed Matter Theory Center, Department of Physics, University of Maryland, College Park, Maryland 20742-4111, USA*

NANO LETTERS Letter
pubs.acs.org/NanoLett

Topological Insulator Quantum Dot with Tunable Barriers

Sungjae Cho,[†] Dohun Kim, Paul Syers, Nicholas P. Butch,[‡] Johnpierre Paglione, and Michael S. Fuhrer
Center for Nanophysics and Advanced Materials, University of Maryland, College Park, Maryland 20742-4111, United States



FUHRER, PAGLIONE:

First quantum dot experiment in a TI

APPLIED PHYSICS LETTERS **101**, 023102 (2012)

Towards spin injection from silicon into topological insulators: Schottky barrier between Si and Bi_2Se_3

C. Ojeda-Aristizabal, M. S. Fuhrer, N. P. Butch,[a] J. Paglione, and I. Appelbaum
Center for Nanophysics and Advanced Materials, University of Maryland, College Park, Maryland 20742-4111, USA

APPELBAUM, FUHRER, PAGLIONE:

Spin Injection: proof of principle

nature materials

Tailoring properties and functionalities of metal nanoparticles through crystallinity engineering

YUN TANG AND MIN OUYANG*
Department of Physics, University of Maryland, College Park, Maryland 20742, USA
*e-mail: mouyang@umd.edu

Published online: 19 August 2007; doi:10.1038/nmat1982

OUYANG:

First report of crystallinity control of metal nanoparticles and of roles of defect on fundamental electron-phonon interactions

NEWS & VIEWS

NANOPARTICLE CRYSTALLINITY

Is perfect better?

A synthetic method of producing metal nanoparticles of chosen crystallinity can help us understand how crystal defects affect their physical and chemical properties.

Gregory V. Hartland
is in the Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame, Indiana 46556, USA.
e-mail: ghartlan@nd.edu

bulk, as nanoparticles absorb and scatter light extremely efficiently, which has led to applications in molecular sensing[3] and the decorative arts[4]. The effect of twinning defects — boundaries between multiple

comparison of nanoparticles that are the same size and shape, and differ only by the presence or absence of twinning defects. Using this protocol, the authors demonstrate that crystal defects can

nature nanotechnology

Research Highlights

Nature Nanotechnology
Published online: 31 August 2007 | doi:10.1038/nnano.2007.303

Subject Categories: Nanoparticles | Synthesis and processing

Nanoparticle synthesis: Tailor made

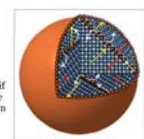
Jessica Thomas

The crystallinity of silver nanoparticles can be controlled by tuning the chemical environment in a simple 'one-pot' synthesis

Nanoparticles made from noble metals — such as silver, platinum and gold — have a number of uses in fields ranging from catalysis to optics. Whether or not the metal nanoparticles are perfect crystals is an important consideration in these applications, but this property is often difficult to control during synthesis.

To tackle this problem, Yun Tang and Min Ouyang[1] at the University of Maryland in the US took advantage of the fact that the chemical reactivity of a surface depends on its crystal structure. Thus, in a particular chemical environment, certain crystal faces are formed in preference to others and, in principle, one 'crystallite' will dominate. It is found that if the nanoparticles are made from silver-based complexes that contain nitrates, they comprise multiple crystallites. If the complexes contain chloride ions, however, perfectly crystalline nanoparticles can be synthesized — at least under certain conditions. Apparently, the chloride ions act as strong etchants whenever a boundary forms between two distinct crystallites, therefore favouring single-crystal growth.

Tang and Ouyang find significant differences in the reactivity and optical properties of single-crystal and polycrystalline silver particles. Moreover, the tunable crystallinity can be used to test theories in fundamental physics and chemistry.



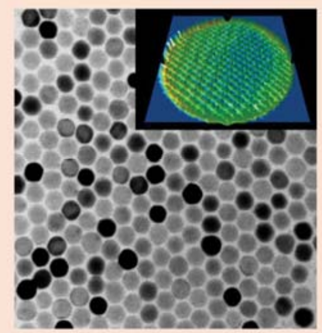
RESEARCH NEWS

Route to engineering nanoparticle crystallinity

NANOTECHNOLOGY

There is a myriad of uses for nanoparticles and the list is growing. The name of the game, then, is to control their properties to match the application. Each week sees more methods to control nanoparticle size and size distribution, shape, and composition. But the crystalline purity of nanoparticles remains a tough nut to crack.

Researchers from the University of Maryland have devised a means of engineering nanoparticle crystallinity that is as straightforward as it is promising. The ratio of single-crystal to multiply-twinned nanoparticles can be reliably controlled by simply adjusting the available ligands in the precursors [Tang and Ouyang, *Nat. Mater.* (2007) doi: 10.1038/nmat1982]. Starting with phosphine complexes $(PPh_3)_3Ag$–*R* and using either chlorine or nitrate as the monovalent ligand *R*, the researchers found that chlorine inhibits the growth of twinned clusters, leading to pure, single-crystal Ag nanoparticles. The authors suggest that controlling the rate of this



15 nm single-crystal Ag nanoparticles. Inset: a single particle shows perfect lattice fringes. (Courtesy of Min Ouyang.)

Vol 466 | 1 July 2010 | doi:10.1038/nature09150

nature

LETTERS

Tailoring light–matter–spin interactions in colloidal hetero-nanostructures

Jiatao Zhang[1], Yun Tang[1], Kwan Lee[1] & Min Ouyang[1]

OUYANG:

Discovery of resonant plasmon-exciton interaction and first realization of coherent spin manipulation in colloidal nanostructures

ScienceDaily

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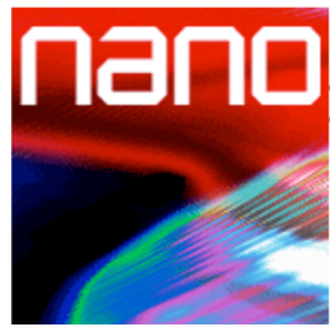
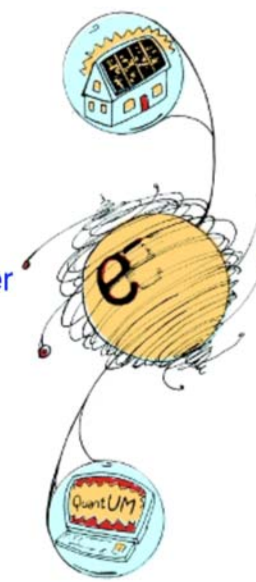
New Type of Light-Matter Interaction: Advance in Quantum Computing and Energy Conversion Technology



New type of light-matter interaction revealed by nanostructure



Nanostructures, Large Advances

New discovery takes scientists a step closer to quantum computers - IndiaVision News

New discovery takes scientists a step closer to quantum computers

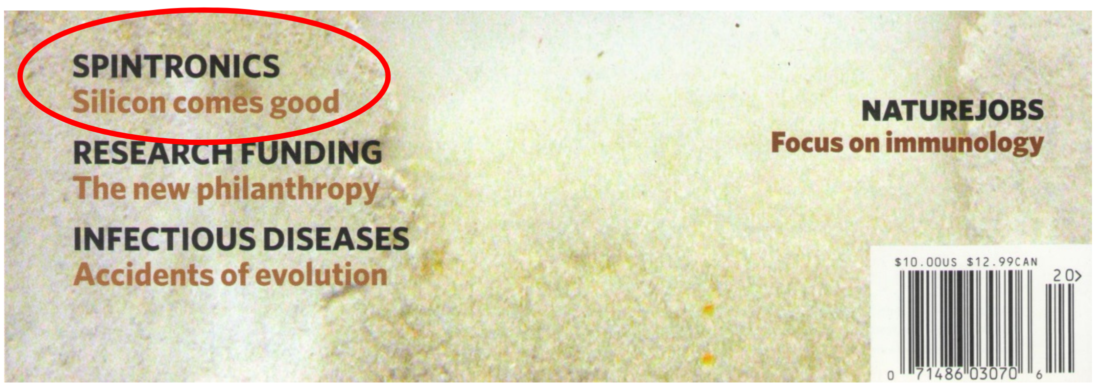
Saturday - Jul 03, 2010, 11:05pm (GMT5.5)

London(ANI): Taking a step nearer to quantum computers, University of Maryland researchers have used a unique hybrid nanostructure to show a new type of light-matter interaction.

LETTERS

Electronic measurement and control of spin transport in silicon

Ian Appelbaum[1], Biqin Huang[1] & Douwe J. Monsma[2]



PRL 108, 157201 (2012) PHYSICAL REVIEW LETTERS week ending 13 APRIL 2012

Field-Induced Negative Differential Spin Lifetime in Silicon

Jing Li,[1] Lan Qing,[2] Hanan Dery,[2,3] and Ian Appelbaum[1,*]

PRL 106, 217202 (2011) PHYSICAL REVIEW LETTERS week ending 27 MAY 2011

Spin-Polarized Transient Electron Trapping in Phosphorus-Doped Silicon

Yuan Lu,[*] Jing Li, and Ian Appelbaum[†]

RAPID COMMUNICATIONS

PHYSICAL REVIEW B 82, 241202(R) (2010)

Time-of-flight spectroscopy via spin precession: The Larmor clock and anomalous spin dephasing in silicon

Biqin Huang[*] and Ian Appelbaum[†]

PRL 103, 117202 (2009) PHYSICAL REVIEW LETTERS week ending 11 SEPTEMBER 2009

Spin Polarized Electron Transport near the Si/SiO_2 Interface

Hyuk-Jae Jang and Ian Appelbaum[*]

PRL 99, 177209 (2007) PHYSICAL REVIEW LETTERS week ending 26 OCTOBER 2007

Coherent Spin Transport through a 350 Micron Thick Silicon Wafer

Biqin Huang,[1,*] Douwe J. Monsma,[2] and Ian Appelbaum[1]

Basic Physics of Superconductors

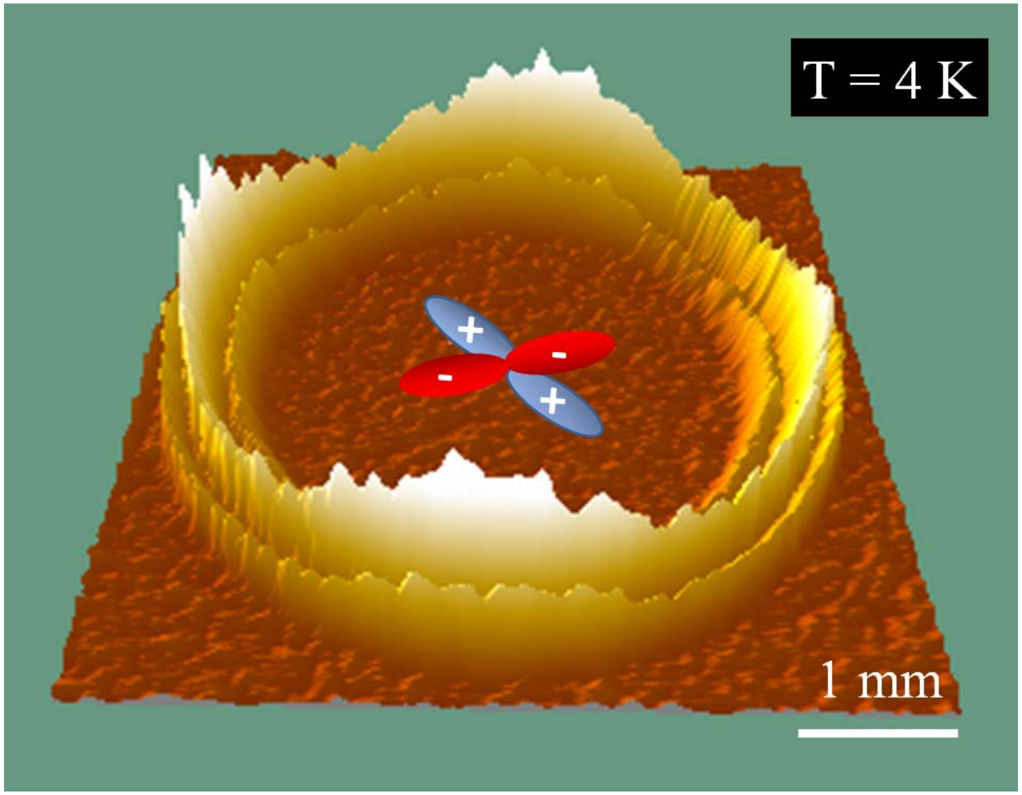
PRL 110, 087002 (2013) PHYSICAL REVIEW LETTERS week ending 22 FEBRUARY 2013

Imaging the Anisotropic Nonlinear Meissner Effect in Nodal $YBa_2Cu_3O_{7-\delta}$ Thin-Film Superconductors

Alexander P. Zhuravel,[1] B. G. Ghamsari,[2] C. Kurter,[2] P. Jung,[3] S. Remillard,[4] J. Abrahams,[2] A. V. Lukashenko,[3] Alexey V. Ustinov,[3] and Steven M. Anlage[2,3]

ANLAGE:

First measurement of the anisotropic nonlinear Meissner effect in unconventional superconductors



Superconducting Metamaterials

ANLAGE:

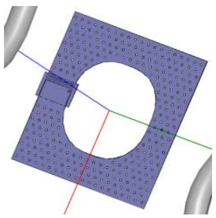
Pioneered the field of superconducting metamaterials

PRL **109**, 243904 (2012) PHYSICAL REVIEW LETTERS week ending 14 DECEMBER 2012

Modulating Sub-THz Radiation with Current in Superconducting Metamaterial

V. Savinov,[1,*] V. A. Fedotov,[1] S. M. Anlage,[2] P. A. J. de Groot,[3] and N. I. Zheludev[1,4]

PRL **107**, 043901 (2011) PHYSICAL REVIEW LETTERS week ending 22 JULY 2011



Classical Analogue of Electromagnetically Induced Transparency with a Metal-Superconductor Hybrid Metamaterial

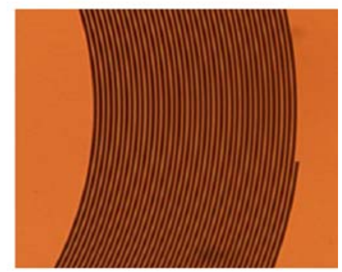
Cihan Kurter,[1] Philippe Tassin,[2,3] Lei Zhang,[2] Thomas Koschny,[2] Alexander P. Zhuravel,[4] Alexey V. Ustinov,[5] Steven M. Anlage,[1] and Costas M. Soukoulis[2,6]

APPLIED PHYSICS LETTERS **100**, 121906 (2012)

Switching nonlinearity in a superconductor-enhanced metamaterial

Cihan Kurter,[1] Philippe Tassin,[2,3,a)] Alexander P. Zhuravel,[4] Lei Zhang,[2] Thomas Koschny,[2] Alexey V. Ustinov,[5] Costas M. Soukoulis,[2,6] and Steven M. Anlage[1,5]

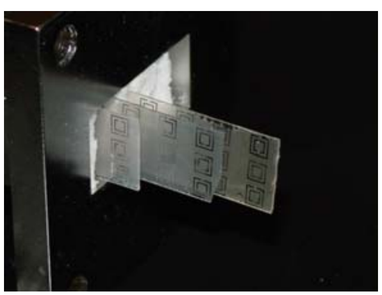
APPLIED PHYSICS LETTERS **96**, 253504 (2010)



Miniaturized superconducting metamaterials for radio frequencies

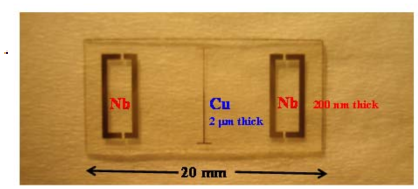
Cihan Kurter,[1,a)] John Abrahams,[1,2] and Steven M. Anlage[1]

APPLIED PHYSICS LETTERS **88**, 264102 (2006)



Single superconducting split-ring resonator electrodynamics

Michael C. Ricci and Steven M. Anlage



APPLIED PHYSICS LETTERS **87**, 034102 (2005)

Superconducting metamaterials

Michael Ricci, Nathan Orloff, and Steven M. Anlage[a)]

Superconductor Electrodynamics

ANLAGE:

Superconductor electrodynamics with near-field microwave microscopes

Nanoscale Electrodynamic Response of Nb Superconductors

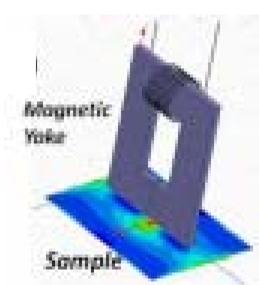
Tamin Tai, Behnood G. Ghamsari, and Steven M. Anlage

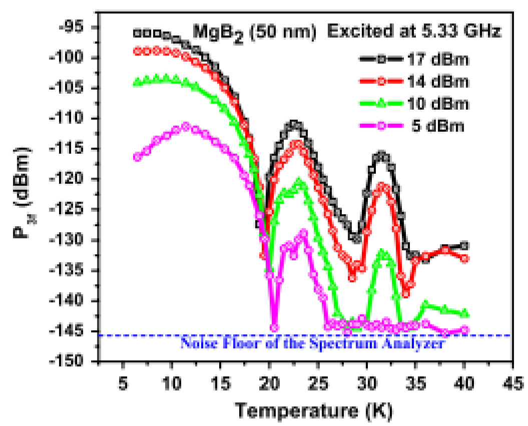
MgB_2 nonlinear properties investigated under localized high rf magnetic field excitation

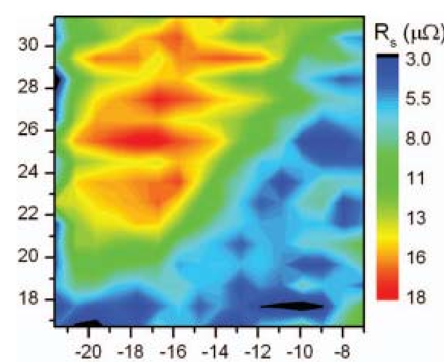
Tamin Tai,[1,2] B. G. Ghamsari,[2] T. Tan,[3] C. G. Zhuang,[3] X. X. Xi,[3] and Steven M. Anlage[1,2]

Low temperature laser scanning microscopy of a superconducting radio-frequency cavity

G. Ciovati,[1,a)] Steven M. Anlage,[2] C. Baldwin,[1] G. Cheng,[1] R. Flood,[1] K. Jordan,[1]







Physics

Physics **4**, 88 (2011)

Viewpoint

Retrospective—Electromagnons offer the best of two worlds

Michel Kenzelmann
Laboratory for Developments and Methods, Paul Scherrer Institute, Bldg. WHGA/131, CH-5232 Villigen-PSI, Switzerland

Published October 31, 2011

Electromagnons open up new opportunities to control electric and magnetic properties.

Subject Areas: **Magnetism, Materials Science**

A Viewpoint on:
Electromagnons in Multiferroic YMn2O5 and TbMn2O5
A. B. Sushkov, R. Valdés Aguilar, S. Park, S-W. Cheong, and H. D. Drew
Phys. Rev. Lett. **98**, 027202 (2007) – Published January 10, 2007

Drew

SPIE Newsroom

10.1117/2.1201208.004418

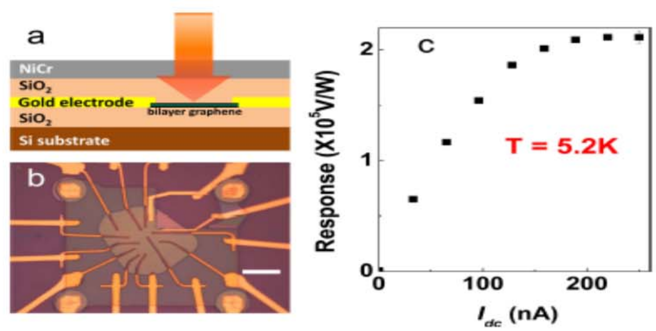
Graphene holds promise for hot-electron bolometers

Drew and Fuhrer, Nature Nanotechnology **7**, 472 (2012)

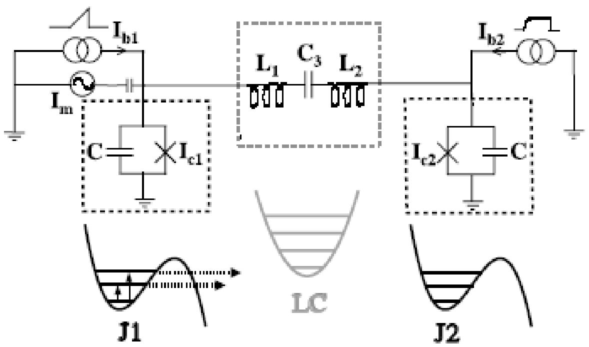
Jun Yan, Myoung-Hwan Kim, H. Dennis Drew, and Michael S. Fuhrer

The superior capability of graphene to limit electronic energy from being dissipated within the lattice makes it a fast photon detector with unprecedented sensitivity.

A bolometer is an electronic device that converts light into heat, which can then be detected by a thermometer. The thermal resistance, R_H, provides the coefficient linking incident power P and change in temperature ΔT, such that $\Delta T = PR_H$. An important consideration in designing a bolometer is the time taken for it to recover, given by $\tau = R_H C$, where C is the heat capacity. This has influenced the design of bolometers, which



Charge and phase qubits



PRL 94, 027003 (2005) PHYSICAL REVIEW LETTERS week ending 21 JANUARY 2005

Spectroscopy of Three-Particle Entanglement in a Macroscopic Superconducting Circuit

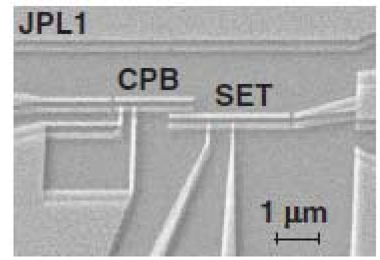
Huizhong Xu,[1] Frederick W. Strauch,[1] S. K. Dutta,[1] Philip R. Johnson,[1] R. C. Ramos,[1] A. J. Berkley,[1,2] H. Paik,[1] J. R. Anderson,[1] A. J. Dragt,[1] C. J. Lobb,[1] and F. C. Wellstood[1,*]

(41 citations as of 3/7/2013

PHYSICAL REVIEW B 76, 054501 (2007)

Steady-state thermodynamics of nonequilibrium quasiparticles in a Cooper-pair box

B. S. Palmer,[1,*] C. A. Sanchez,[1,†] A. Naik,[1,‡] M. A. Manheimer,[1] J. F. Schneiderman,[2] P. M. Echternach,[3] and F. C. Wellstood[4]
[1]*Laboratory for Physical Sciences, College Park, Maryland 20740, USA*
[2]*Department of Physics, University of Southern California, Los Angeles, California 90089-0484, USA*
[3]*Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109, USA*
[4]*Center for Superconductivity Research and Joint Quantum Institute, Department of Physics, University of Maryland,*

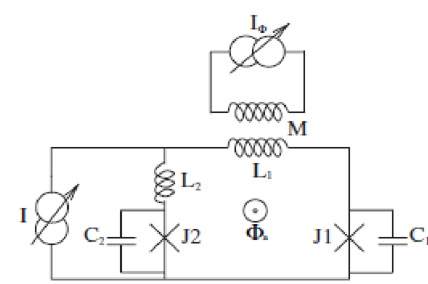


PHYSICAL REVIEW B 77, 214510 (2008)

Decoherence in dc SQUID phase qubits

Hanhee Paik, S. K. Dutta, R. M. Lewis, T. A. Palomaki, B. K. Cooper, R. C. Ramos,* H. Xu,†
A. J. Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood
Department of Physics, Center for Nanophysics and Advanced Materials and Joint Quantum Institute,
University of Maryland, College Park, Maryland 20742-4111, USA
(Received 8 February 2008; revised manuscript received 23 April 2008; published 13 June 2008)

We report measurements of Rabi oscillations and spectroscopic coherence times in an Al/AlO_x/Al and three Nb/AlO_x/Nb dc SQUID phase qubits. One junction of the SQUID acts as a phase qubit and the other junction

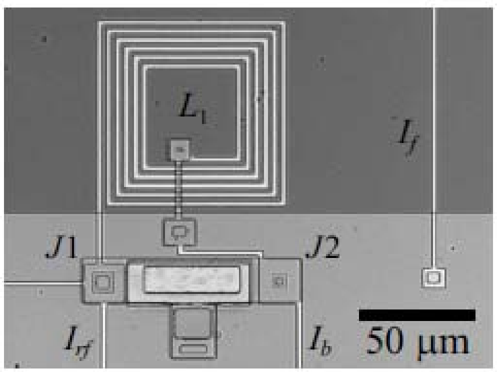


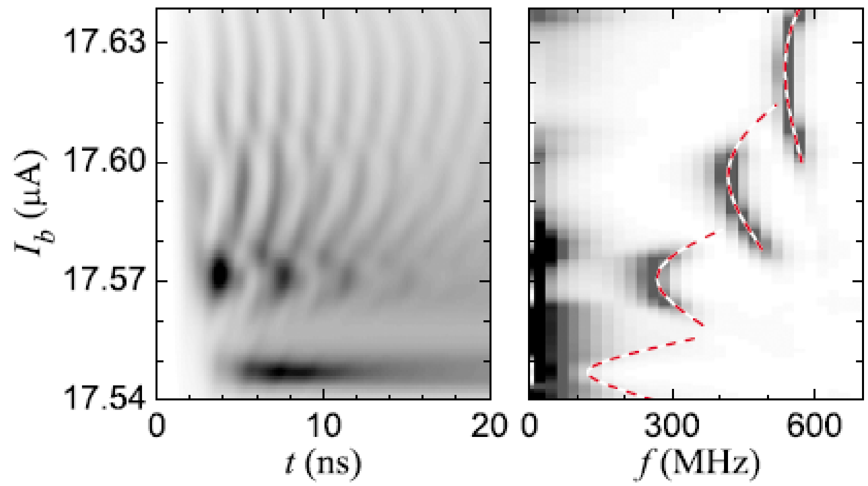
phase qubits: two-level systems and coherence

PHYSICAL REVIEW B **78**, 104510 (2008)

Multilevel effects in the Rabi oscillations of a Josephson phase qubit

S. K. Dutta,[1] Frederick W. Strauch,[2] R. M. Lewis,[1] Kaushik Mitra,[1,2] Hanhee Paik,[1] T. A. Palomaki,[1]
Eite Tiesinga,[1,2] J. R. Anderson,[1] Alex J. Dragt,[1] C. J. Lobb,[1] and F. C. Wellstood[1]
[1]*Center for Nanophysics and Advanced Materials and Joint Quantum Institute, Department of Physics, University of Maryland, College Park, Maryland 20742-4111, USA*
[2]*National Institute of Standards and Technology, Gaithersburg, Maryland 20899-8423, USA*
(Received 31 May 2008; revised manuscript received 15 August 2008; published 15 September 2008)





PHYSICAL REVIEW B **81**, 144503 (2010)

Multilevel spectroscopy of two-level systems coupled to a dc SQUID phase qubit

T. A. Palomaki,* S. K. Dutta,† R. M. Lewis,‡ A. J. Przybysz, Hanhee Paik,§ B. K. Cooper, H. Kwon, J. R. Anderson, C. J. Lobb, and F. C. Wellstood
Joint Quantum Institute and Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland, College Park, Maryland 20742, USA