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Kimmelman Building


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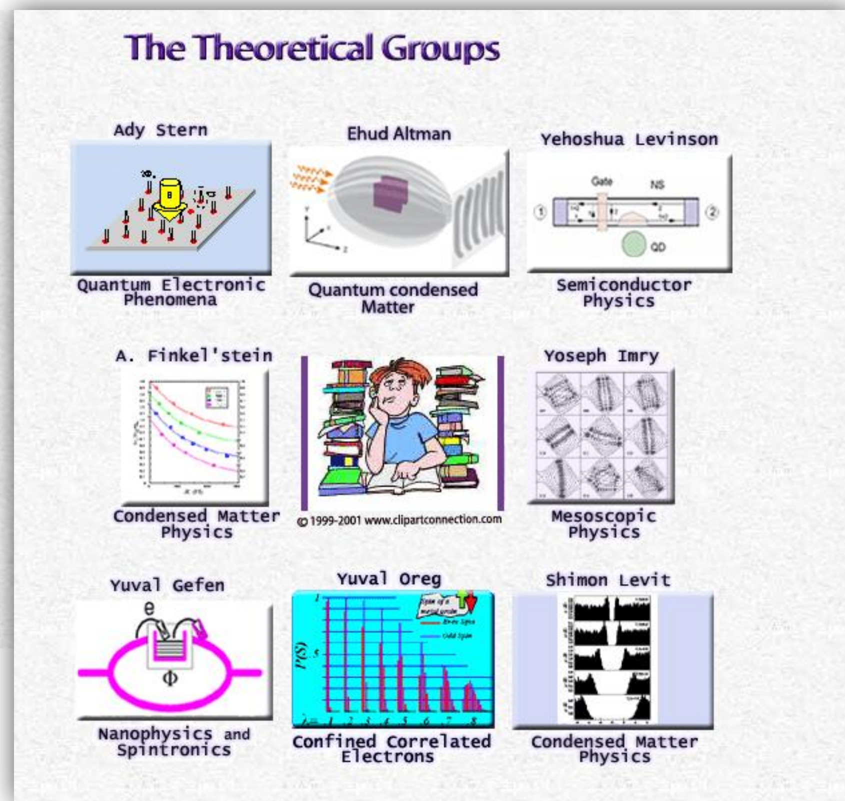
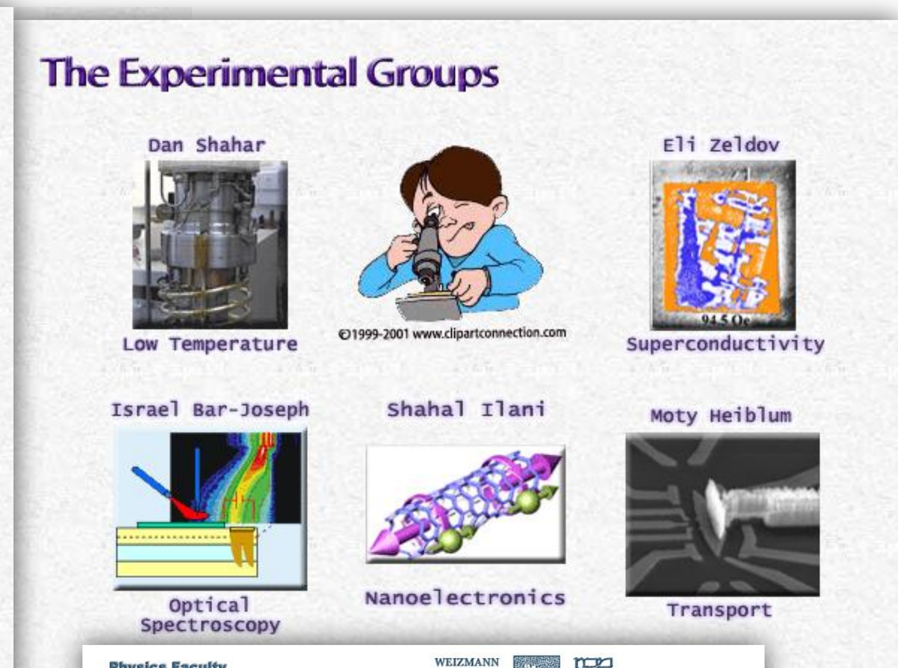
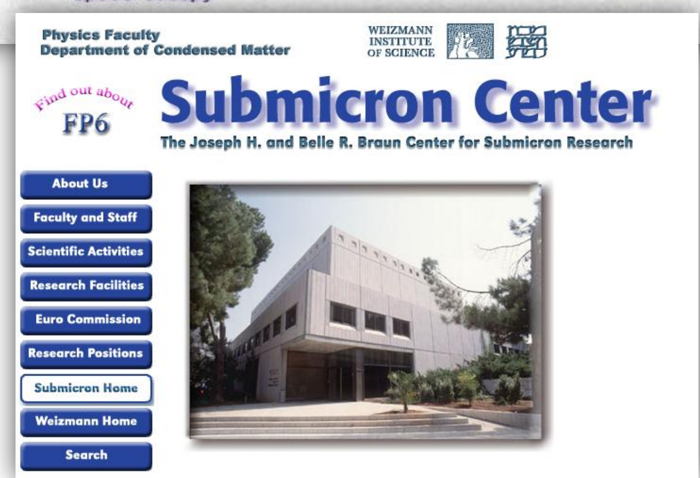
Goldschleger Life Sciences Library

Department of Condensed Matter Physics

Faculty







Department of Condensed Matter Physics

Research Facilities

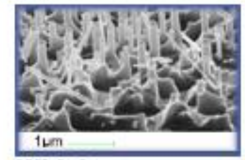

MBE


SEM


Processing


Lithography


E-beam

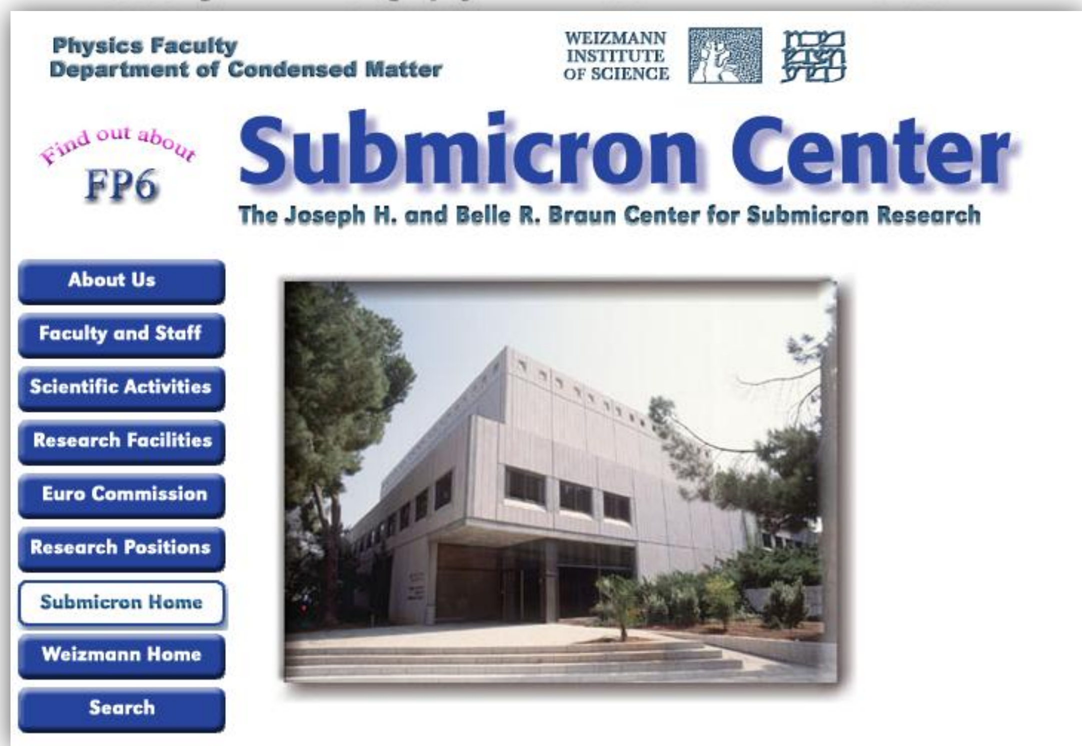


Whiskers


Optics


Local Probes


Transport



Dr. Diana Mahalu
Eng. Olga Raslin

With the support of:
Eng. Yoram Rotblat

Typical Scientific Projects

nature International weekly journal of science

Full text access pr

Observation of neutral modes in the fractional quantum Hall regime

Aveek Bid, N. Ofek, H. Inoue, M. Heiblum, C. L. Kane, V. Umansky & D. Mahalu

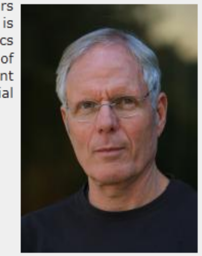
Affiliations | Contributions | Corresponding author

Nature **466**, 585–590 (29 July 2010) | doi:10.1038/nature09277
Received 01 April 2010 | Accepted 17 June 2010

Abstract

The quantum Hall effect takes place in a two-dimensional electron gas under a strong magnetic field and involves current flow along the edges of the sample. For some particle–hole conjugate states of the fractional regime (for example, with fillings between 1/2 and 1 of the lowest Landau level), early predictions suggested the presence of counter-propagating edge currents in addition to the expected ones. When this did not agree with the measured conductance, it was suggested that disorder and interactions will lead to counter-propagating modes that carry only energy—the so called neutral modes. In addition, a neutral upstream mode (the Majorana mode) was expected for selected wavefunctions proposed for the even-denominator filling 5/2. Here we report the direct observation of counter-propagating neutral

Professor Mordehai(Moty) Heiblum



Graduated with a Ph.D. from U. C. Berkeley; spent 12 years with IBM Research Center in Yorktown Heights, and is currently a Professor in the Condensed Matter Physics Department (from 1991). Presently serving as the director of the Braun Center for Submicron Research and the department chair. An incumbent of the Alex and Ida Sussman Professorial Chair in Submicron Electronics.

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Department of Condensed Matter Physics
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Current Members

Post-Docs

Hyungkook Choi
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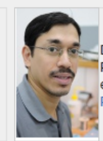
email : Hyungkook.Choi + suffix
Personal Home Page



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Ph.D. & M.Sc. students

Emil Weisz
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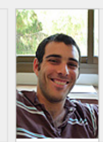
Personal Home Page



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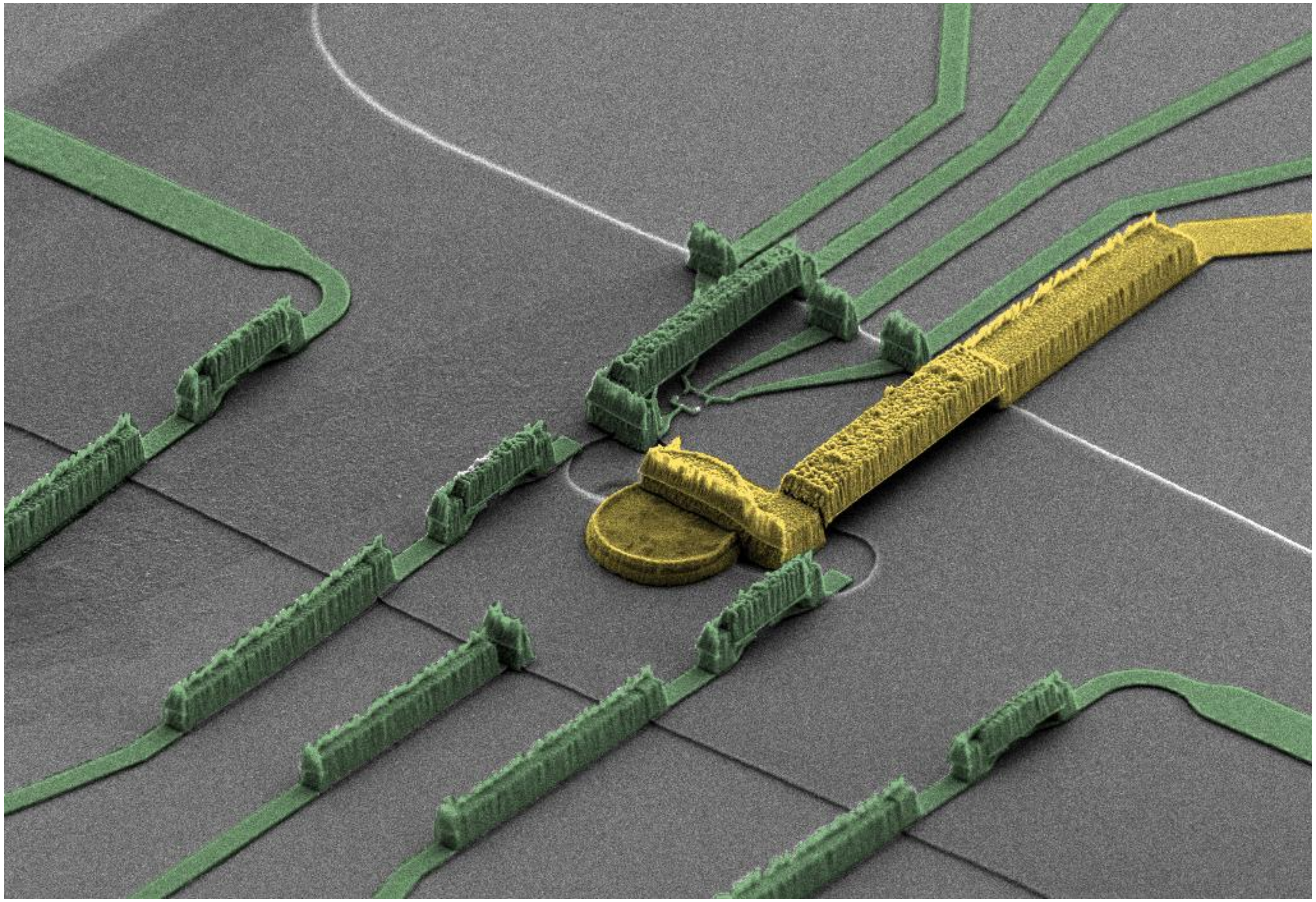
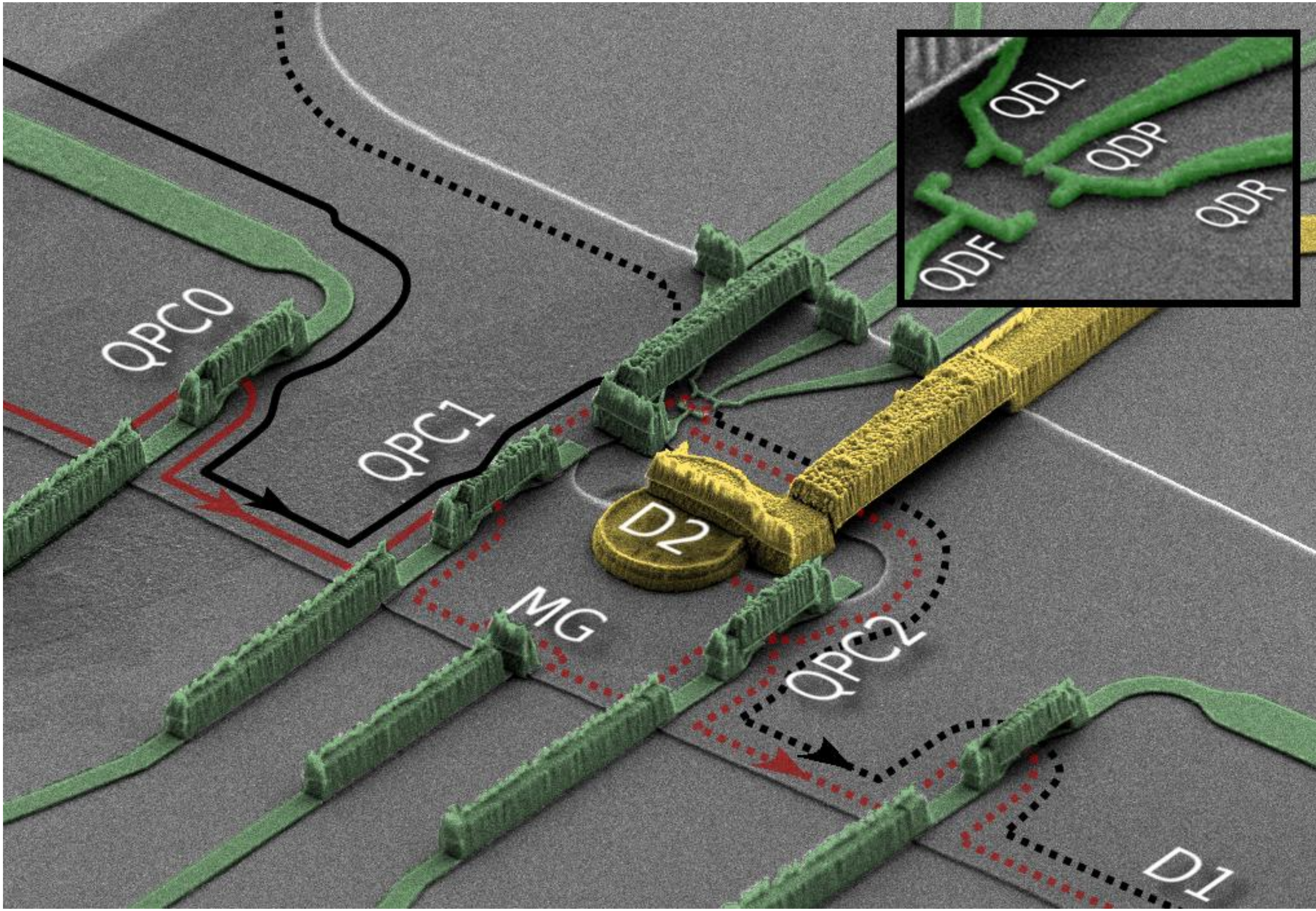


Emil Weisz



Emil Weisz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Nissim Ofek
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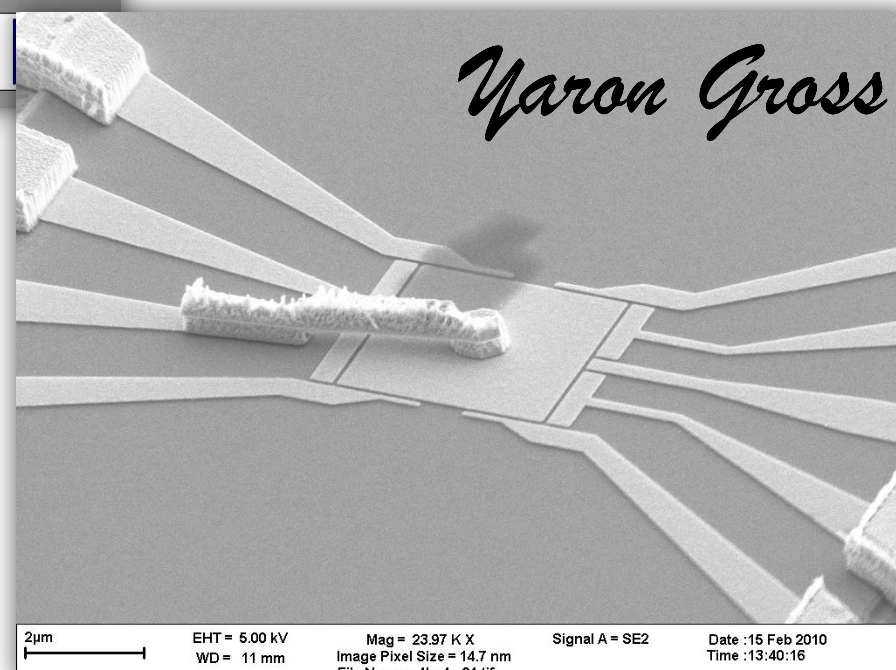
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AIP Applied Physics Letters

Self-assembly of metallic double-dot single-electron device

A. Guttman, D. Mahalu, J. Sperling, E. Cohen-Hoshen, and I. Bar-Joseph

Citation: Appl. Phys. Lett. **99**, 063113 (2011); doi: 10.1063/1.3624899
View online: http://dx.doi.org/10.1063/1.3624899
View Table of Contents: http://apl.aip.org/resource/1/APPLAB/v99/i6
Published by the American Institute of Physics.

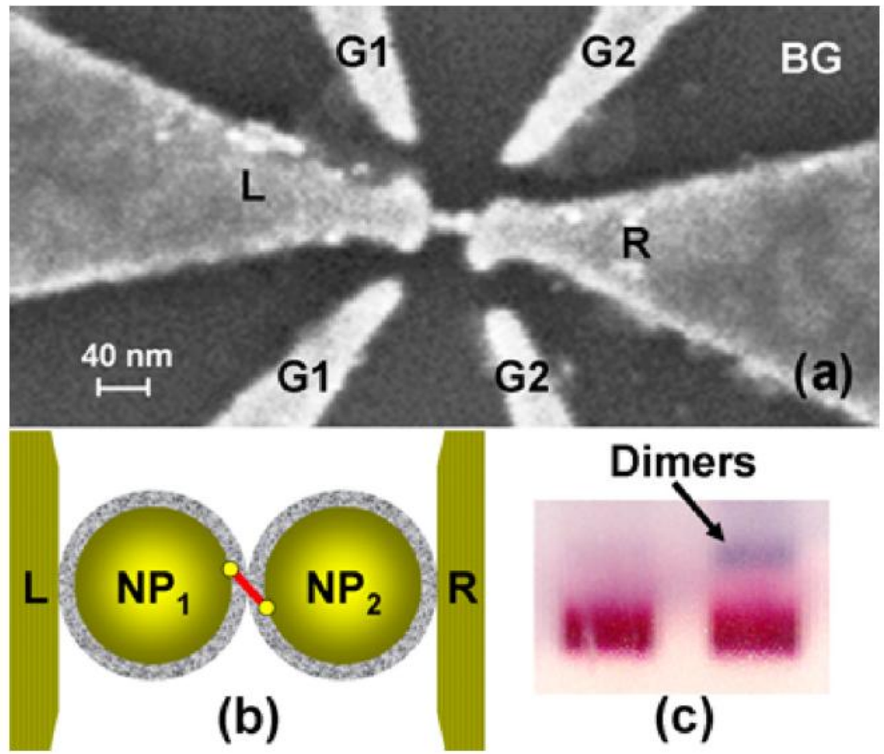
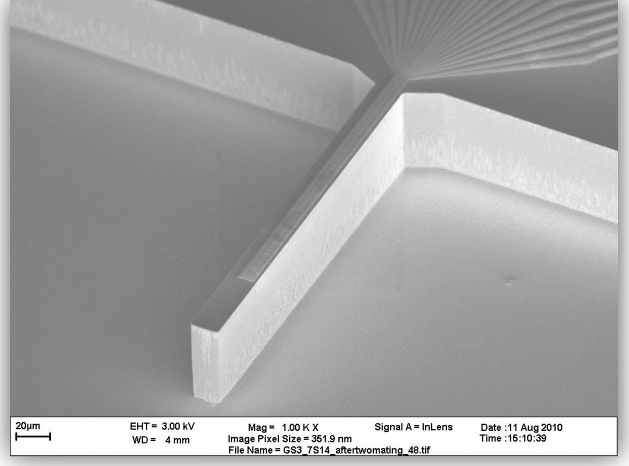
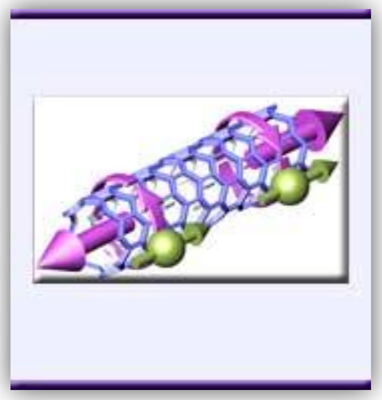
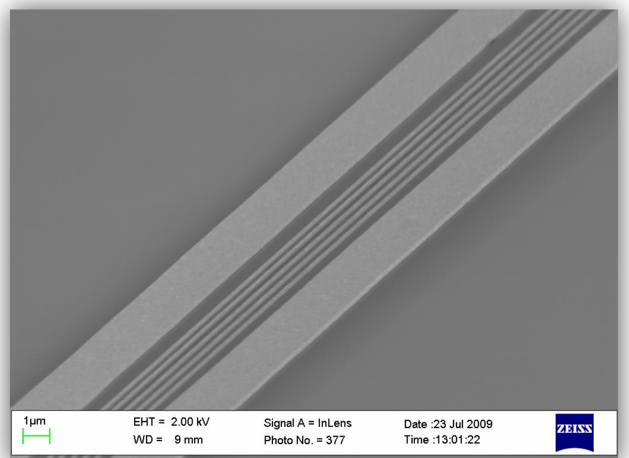


FIG. 1. (Color online) (a) Scanning electron microscope image of the double-dot device. The dimer, which is composed of 17 nm NPs, is aligned in series with the lead electrodes (L and R). (b) A sketch of the dimer and leads region, showing the capping layers and the linker molecule. (c) Gel matrix loaded with 34 nm NPs' solution that includes the linker molecule (right) and a corresponding control (left).





Dr Shahal Ilani

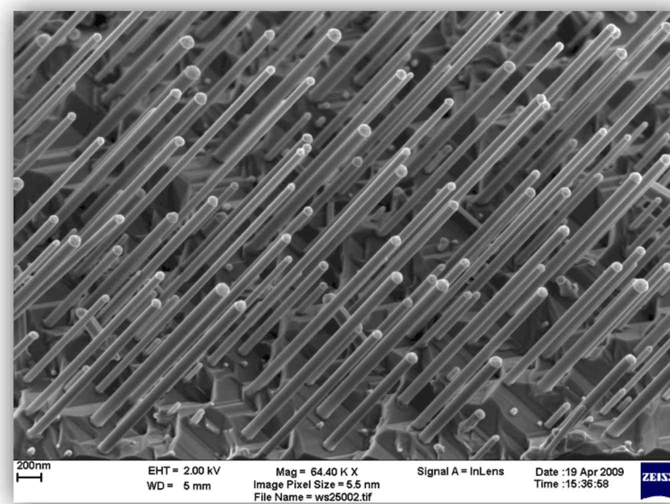


Quantum phenomena in small systems,
such as carbon *nanotubes and graphene*
Study of quantum behavior in highly-controlled settings, including:

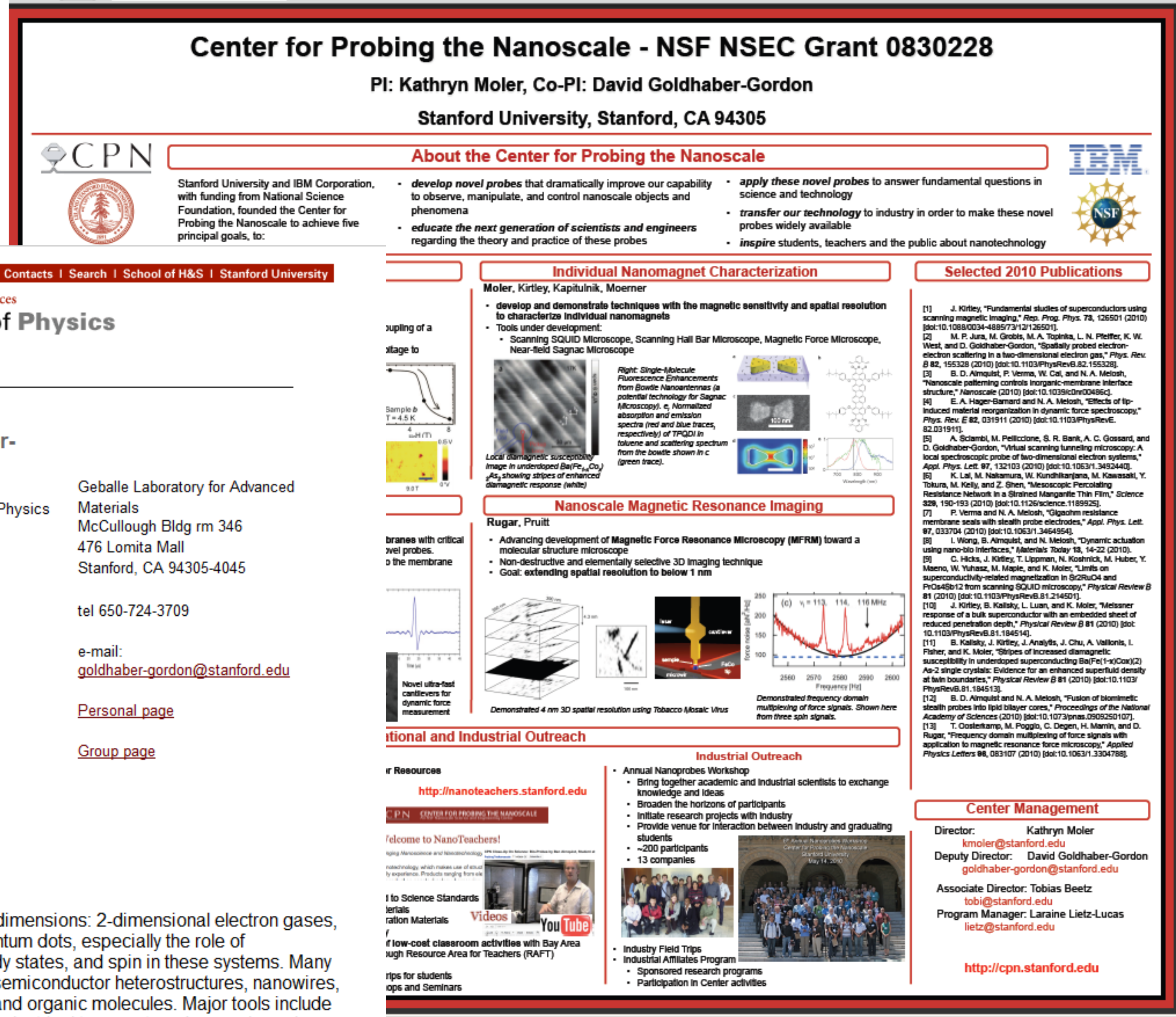
- Physics of electrons in one and two dimensions
- Imaging of quantum phenomena on atomic scales
- Single-spin quantum manipulation

Dr Hadas Strikman

- GaAs and InAs nano wires



Collaborations with other Centers/Universities
International Programs



School of Humanities and Sciences

Department of Physics

People

- Academics
- Research
- People
- Facilities
- History
- Alumni
- Links

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Personal page

Group page

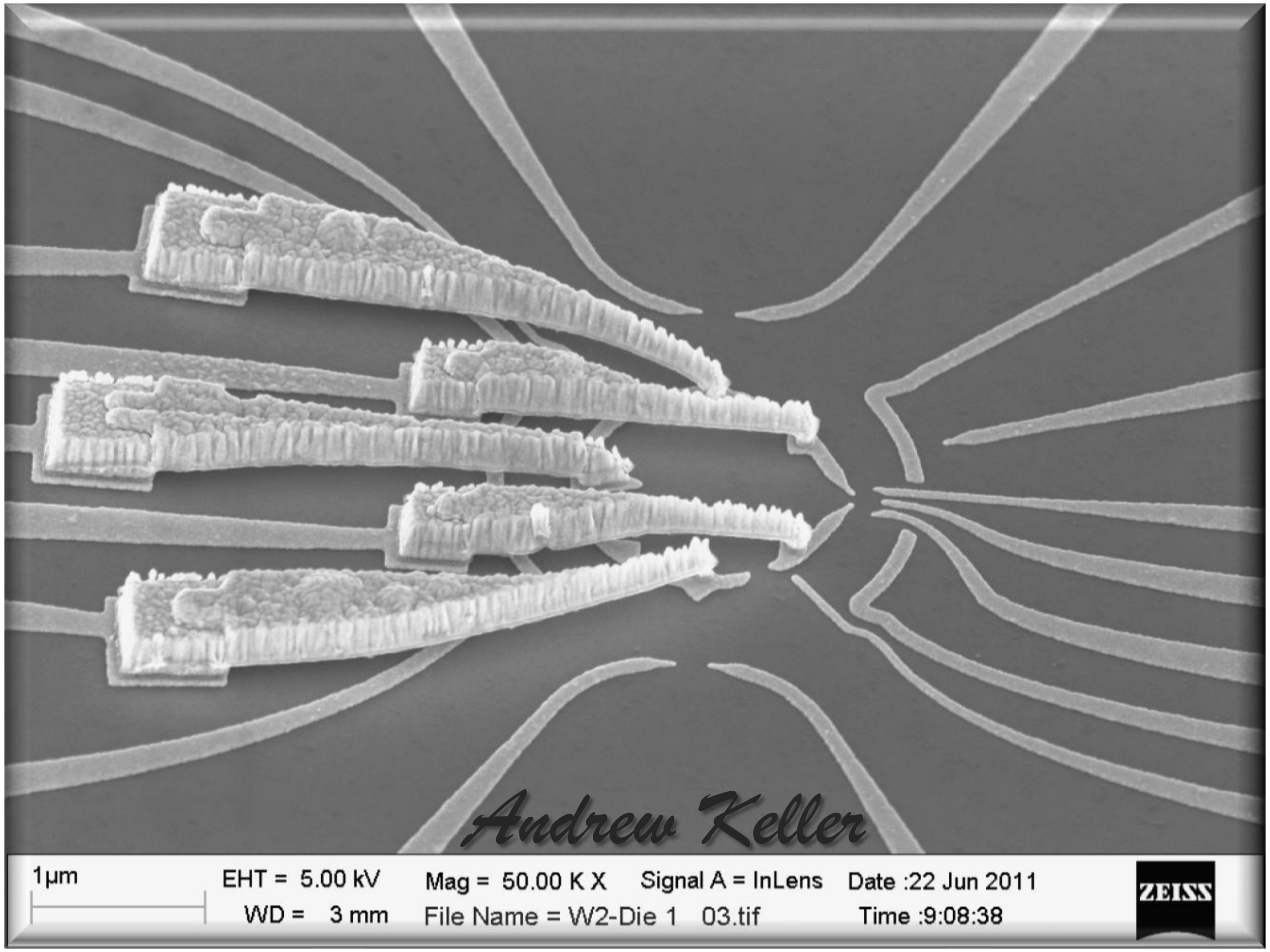
Research Interests

Experimental Condensed Matter

Research focuses on electrons in reduced dimensions: 2-dimensional electron gases, quantum wires and point contacts, and quantum dots, especially the role of interactions, quantum coherence, many-body states, and spin in these systems. Many materials are used, including conventional semiconductor heterostructures, nanowires, carbon (nanotubes and graphene sheets), and organic molecules. Major tools include nanolithography, precision low-temperature electrical transport, and several novel scanning probe techniques.

Related research groups:

- Experimental Condensed Matter
- Mesoscopic Physics
- Microscopy and Imaging.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Time :9:08:38
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nature physics
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NATURE PHYSICS | LETTER

Dephasing time of GaAs electron-spin qubits coupled to a nuclear bath exceeding 200 μs

Hendrik Bluhm, Sandra Foletti, Izhar Neder, Mark Rudner, Diana Mahalu, Vladimir Umansky & Amir Yacoby

Affiliations | Contributions | Corresponding author

Nature Physics **7**, 109–113 (2011) | doi:10.1038/nphys1856
Received 10 June 2010 | Accepted 20 October 2010 | Published online 12 December 2010

Qubits, the quantum mechanical bits required for quantum computing, must retain their quantum states for times long enough to allow the information contained in them to be processed. In many types of electron-spin qubits, the primary source of information loss is decoherence due to the interaction with nuclear spins of the host lattice. For electrons in gate-defined GaAs quantum dots, spin-echo measurements have revealed coherence times of about 1 μs at

Affiliations

Department of Physics, Harvard University, Cambridge, Massachusetts 02138, USA
Hendrik Bluhm, Sandra Foletti, Izhar Neder, Mark Rudner & Amir Yacoby

Braun Center for Submicron Research, Department of Condensed Matter Physics, Weizmann Institute of Science, Rehovot 76100, Israel
Diana Mahalu & Vladimir Umansky

Contributions

Electron-beam lithography and molecular-beam-epitaxy growth were carried out by D.M. and V.U., respectively. H.B., S.F. and A.Y. fabricated the sample, planned and executed the experiment and analysed the data. I.N., M.R., H.B. and A.Y. developed the theoretical model. H.B., S.F., I.N., M.R. and A.Y. wrote the paper.

FACULTY

Amir Yacoby

Professor of Physics
PhD 1994, Weizmann Institute of Science

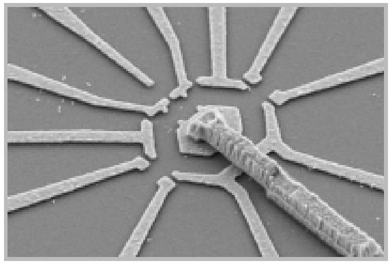
Professor Yacoby is an experimental condensed matter physicist. His current research interests are focused at unraveling the underlying phenomena governing low dimensional systems. Starting with two dimensional electron systems, the group uses novel scan probe techniques that are capable of detecting electric charge with a resolution of 10 -4 of one electron and spatial resolution of 100nm. This technique enables them to image the distribution of electrons and the way they localize in space in various material systems such as GaAs or single monolayers of graphite as well as under various ground state conditions such as the integer and fractional quantum Hall effect. Of particular interest is the 5/2 fractional quantum Hall ground state where the elementary excitations carry a fractional charge of e/4 and obey non-Abelian statistics. Such a system is a model system for topological quantum computation.

Reducing dimensionality further to one dimension opens up a fascinating world where electrical conduction is strongly governed by the interaction between electrons. Here the group explores experimentally Luttinger liquid behavior whose strongest manifestation is the separation of spin and charge of the elementary excitations.

Finally going down to zero dimensional systems, know as quantum dots, the group studies various approaches to storing and manipulating quantum information using the spin of individual electrons.

Mesocopic and Quantum Device Laboratory

In Mesoscpic and Quantum Device Laboratory, we study quantum-mechanical properties of electrons in quamtum devices such as electron interferometer, quantum dots and etc. To achieve this goal, we study electron transport trough our quantum devices at an extremely low temperature(~around 10mK) in a dilution fridge. To fabricated such quantum device, electron-beam lithography technique is used. The SEM picture shown below is one example picture of our devices.



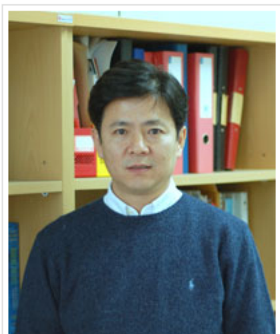
An electron interferometer fabricated on top of ultra-high mobility 2DEG wafer with a quantum dot embeded inside the interferometer and a neary by electron detector to collect path information of the electrons inside the interferometer. The overall size of the device (honey-comb-shaped structure) is around 1um in diameter.
Currently, we are interested in observing sigle electron interference and realizing spin entangled quantum states of electrons by using two-path electron interferometer, which is quite similiar to the one described above. We are also interested in observing orbital Kondo effect by using parrallel double quantum dots.

Collaborators

We really thanks to our collaborators who have been helping us in many ways and supportive for years. The links shown below are our collaborators' websites.

WEIZMANN INSTITUTE OF SCIENCE KRISS

Professor



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Homepage : http://meso.phys.pusan.ac.kr/person/ycchung.html
e-mail : ycchung@pusan.ac.kr
Telephone : 051-510-2729
Education
- Ph.D : 1990-1995, Physics, Korea University
- M.S. : 1988-1990, Physics, Korea University
- B.S. : 1984-1988, Physics, Korea University

Career
- Research Associate at Oxford University, 1996 ~ 2000
- Visiting Scientist at Weizmann Institute of Science, 2000 ~ 2003
- Assistant Professor at Pusan National University, 2003. 11. ~ 2008. 2
- Associate Professor at Pusan National University, 2008. 3. ~ present

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Proceedings / Volume 8169 / Microoptics and Microstructures I | Previous Article | Next Article

Fabrication and testing of highly efficient resonance domain diffractive optical elements

Proc. SPIE 8169, 81690D (2011); doi:10.1117/12.898991

Wednesday 7 September 2011
Marseille, France
Optical Fabrication, Testing, and Metrology IV
Angela Duparré, Roland Geyl

Abstract | References (12) | Alerts | Tools | Share

Omri Barlev, Michael A. Golub, and Menachem Nathan
Tel Aviv Univ. (Israel)
Asher A. Friesem and Diana Mahalu
Weizmann Institute of Science (Israel)

Structuring of optical surfaces with surface-relief diffractive optical elements is an enabling technology for achieving considerable spatially varying changes in light propagation direction and wavefront curvature. This way, Bragg effects, angular and spectral selectivity and nearly 100% diffraction efficiency usually attributed to volume optical holograms can be achieved by surface relief computer generated holograms and diffractive optical elements. Several methods for fabricating deep "resonance domain" diffraction structures with periods, exceeding the subwavelength limit but near to the wavelength, were compared and optimized. Results of

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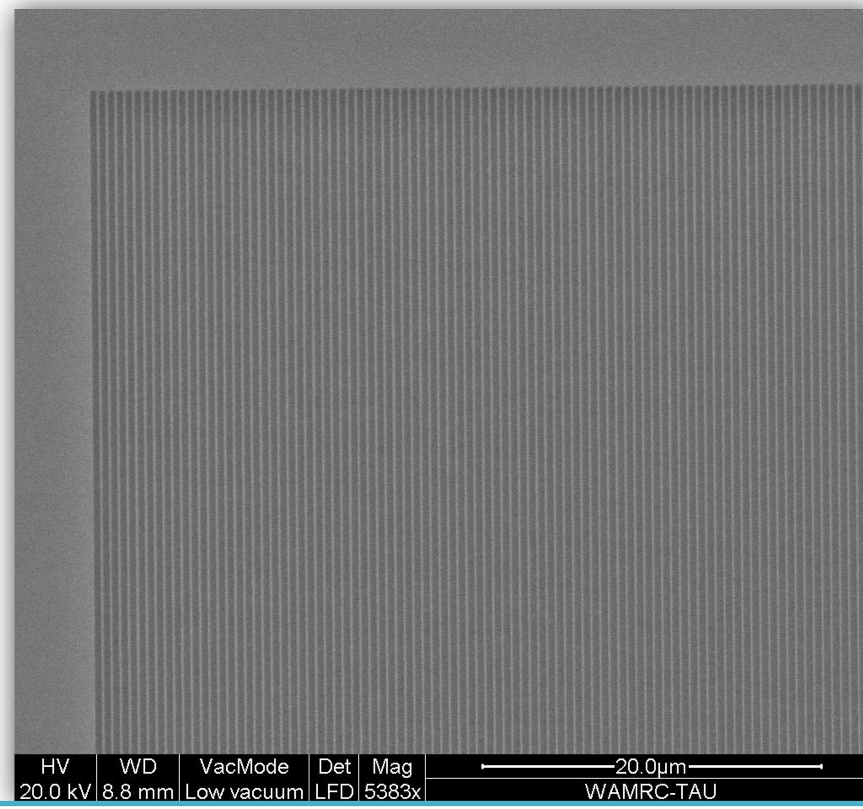
Cooled silicon crystal monochromator test results
Proceedings of SPIE 1739, 622 (1993)

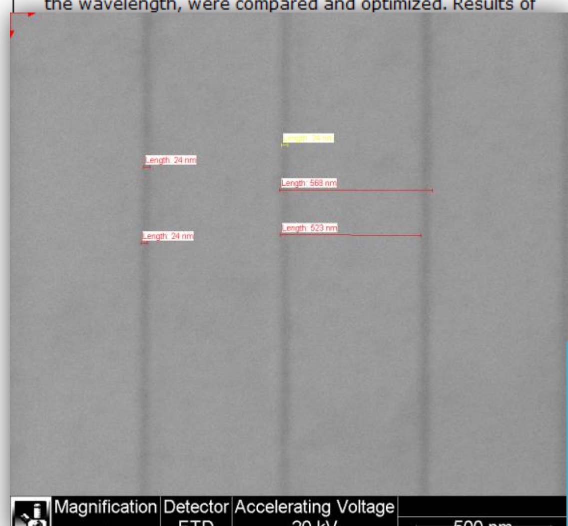
High efficiency Silicon-on-Insulator grating coupler between submicron waveguides and fibers
Proceedings of SPIE 7516, 75160A (2009)

Highly efficient second-harmonic generation in mixture films of p-nitroaniline and methacrylate polymers
Proceedings of SPIE 2025, 436 (1993)

Novel method for patterned fabric



Grating size: 2 mm X 2 mm (4[mm^2)
Period of 520nm and stripe width of 150nm (~ 1% error measured)
Lift –off of Cr followed by Etching on fused silica.



Period of 520nm and stripe width of 25nm
Lift –off of Cr followed by Etching on fused silica.

Biocatalytic microreactor incorporating HRP anchored on micro-/nano-lithographic patterns

Madalina Tudorache[a], Diana Mahalu[b], Cristian Teodorescu[c], Razvan Stan[d], Camelia Bala[e], , Vasile I. Parvulescu[a], ,

[a] University of Bucharest, Department of Chemical Technology and Catalysis, Bd. Regina Elisabeta 4-12, Bucharest 030016, Romania

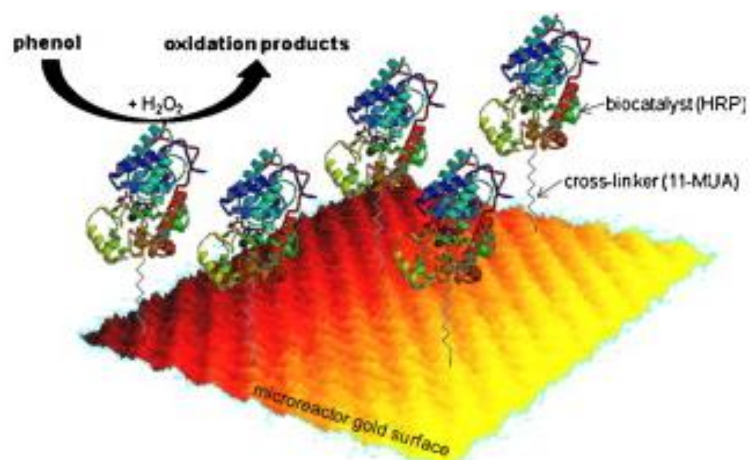
[b] Braun Center for Submicron Research, Department of Condensed Matter Physics, Weizmann Institute of Science, PO Box 26, Rehovot 76100, Israel

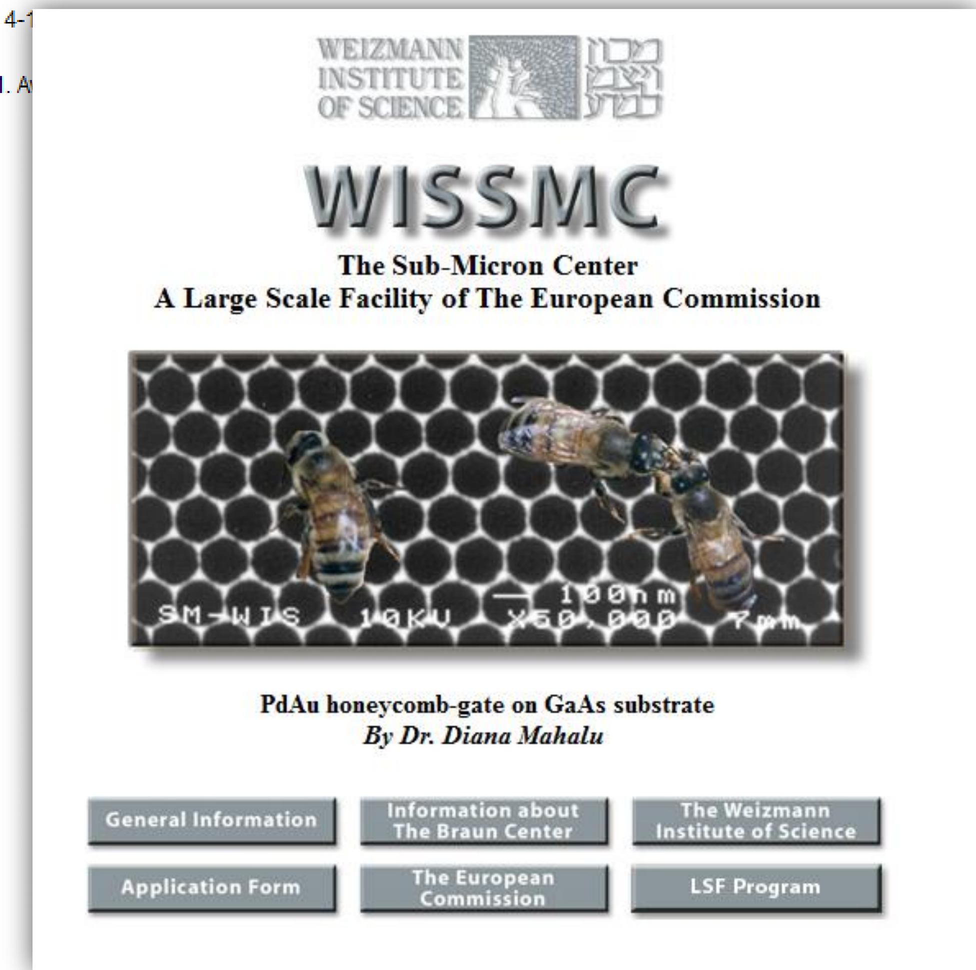
[c] National Institute of Materials Physics, Atomistilor Str. 105bis, PO Box MG 7, Magurele-Bucharest 077125, Romania

[d] Huygens Laboratory, Biophysics Dept., Leiden University, PO Box 9500, 2300 RA Leiden, The Netherlands

[e] University of Bucharest, Department of Analytical Chemistry, Bd. Regina Elisabeta 4-1

Received 8 September 2010; revised 15 December 2010; Accepted 19 January 2011. A





Source: JOURNAL OF MOLECULAR CATALYSIS B-ENZYMATIC **Volume:** 69 **Issue:** 3-4 **Pages:** 133-139 **DOI:** 10.1016/j.molcatb.2011.01.007 **Published:** MAY 2011

GenISys GmbH

Submicron Center

WEIZMANN INSTITUTE OF SCIENCE

Special Electron Beam Lithography WorkShop

organized by
Nezih Unal (GenISys GmbH.) and
Diana Mahalu (Weizmann)
http://www.genisys-gmbh.de/
http://www.weizmann.ac.il/condmat/mahalu.html

July 14th

Weizmann Inst. of Science – SubMicron Center

Session 1: 10.00h – 13.00h

Lunch: 13.00h – 14.00h

Session 2: 14.00h -16.00h

Session 1:

- **Layout preparation strategies for e-beam writing ~45 min**
  - **"Cleaning" overlaps gaps**
  - **Design grid vs fracture grid vs shot pitch**
  - **Field positioning strategies**
  - **Writing time optimization (bordering, coarse-fine split,.**
- **Proximity Effect and Correction strategies ~45 min**

Third dimension of proximity effect correction (PEC)

Author(s): Unal, N.; Mahalu, D.; Raslin, O.; Ritter, D.; Sambale, C.; Hofmann, U.

Source: Microelectronic Engineering **Volume:** 87 **Issue:** 5-8 **Pages:** 940-2 **Published:** May-Aug. 2010 **DOI:** 10.1016/j.mee.2009.12.002

Abstract: New nano applications, like T-gates, bridges, mirror arrays, blazed gratings, 3D zone plates, 3D holograms and MEMS devices require highly a
process for high resolution patterning in lateral dimensions. The aforementioned 3D applications, imply accurate control of resist thickness, after develo
dimension. We show a feasibility test for a new 3D PEC approach, using Layout BEAMER e-beam lithography software. [All rights reserved Elsevier].

Accession Number: 11586021

Document Type: Journal Paper

Language: English

Treatment: Practical, Experimental

Controlled Indexing: electron beam lithography; nanotechnology; photoresists; proximity effect (lithography)

Uncontrolled Indexing: proximity effect correction; T-gates; mirror arrays; bridges; blazed gratings; 3D zone plates; 3D holograms; MEMS devices; 3D pat
process; 3D PEC approach; layout BEAMER e-beam lithography software

Classification Codes: B2550G Lithography (semiconductor technology)

International Patent Classification: B82; G03F7/00; H01L21/02

Author Address: Unal, N.; Ritter, D.; Sambale, C.; Hofmann, U.; GenISys GmbH, Taufkirchen, Germany.; Mahalu, D.; Raslin, O.; Weizmann Inst. of Sci., Re

Publisher: Elsevier Science B.V., Netherlands

Number of References: 3

CODEN: MIENEF

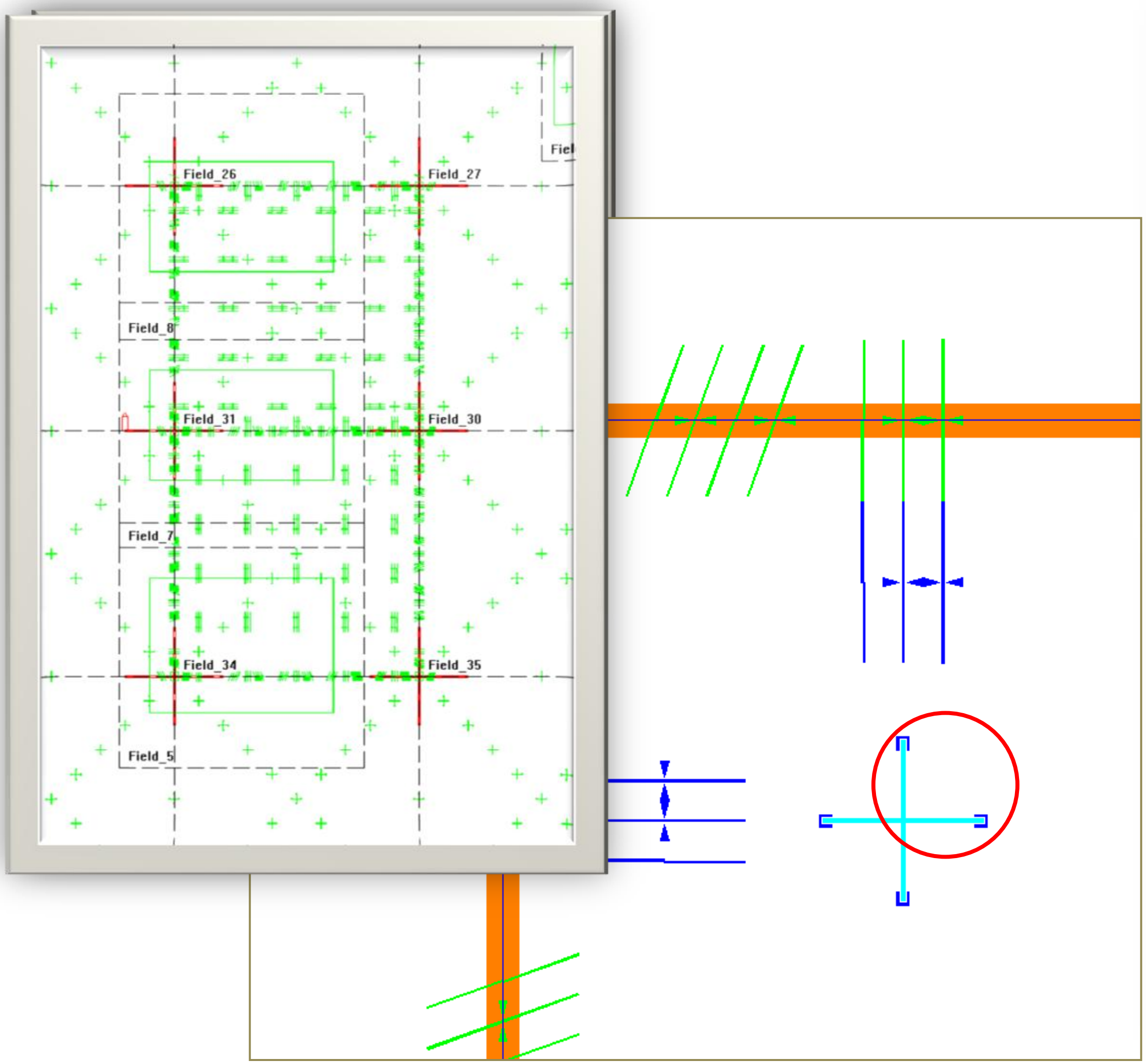
ISSN: 0167-9317

Document Number: S0167-9317(09)00836-3

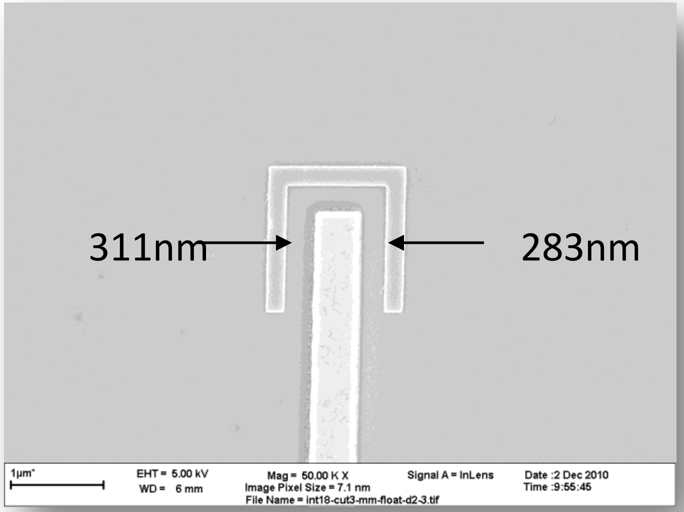
Floating Fields

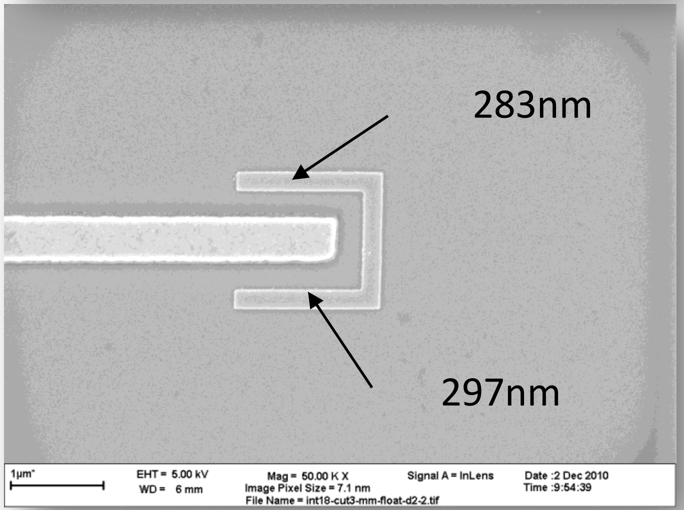
こんにちは！
JEOL！

Alignment (mix and match MM - Floated)



Floated < 15nm MM alignment





LB extract layers 34,100,110 with extraction region 101 (block size)