12-13-2012

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference: A Request for Funding to Support Attendee Participation. To be held Aug. 29 to Sept 1, 2011 at NYU-POLY

Carl P. Tripp
Principal Investigator; University of Maine, Orono, ctripp@maine.edu

Final Report for Period: 08/2011 - 07/2012 **Submitted on:** 12/13/2012

Principal Investigator: Tripp, Carl P. **Award ID:** 1132867

Organization: University of Maine

Submitted By:

Tripp, Carl - Principal Investigator

Title:

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference: A Request for Funding to Support Attendee Participation. To be held Aug. 29 to Sept 1, 2011 at(NYU-POLY)

Project Participants

Senior Personnel

Name: Tripp, Carl

Worked for more than 160 Hours: No

Contribution to Project:

Carl Tripp was involved in the adminstration of the awards given to attendees of this conference

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Other Collaborators or Contacts

Activities and Findings

Research and Education Activities:

The funds were used to support the attendance of reseearchers at the NANO-DDS conference. These attendees presented their work at the conference and provided feedback on their educational experience. This is provided in the uploaded file

Findings:

see attached file

Training and Development:

Funded attendees gained experience in presenting their research results at this conference. For details, see attached document.

Outreach Activities:

This conference proceeding and the technology roadmap report was distributed widely across academia/universities, government,industry and the public at-large (including the entire international community) and will serve as a useful guide for future research and educational activities.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Contributions

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Conference Proceedings

Categories for which nothing is reported:

Organizational Partners
Any Journal
Any Book
Any Web/Internet Site
Any Product
Contributions: To Any within Discipline
Contributions: To Any Other Disciplines
Contributions: To Any Human Resource Development
Contributions: To Any Resources for Research and Education
Contributions: To Any Beyond Science and Engineering
Any Conference

The University of Maine provided support to eleven attendees at the 2011 Nanoelectronics Devices for Defense & Security (NANO-DDS) Conference. The names of the attendees and the amount of support they received in attending the 2011 NANO-DDS Conference were:

NANO-DDS CONFERENCE ATTENDEE SUPPORT						ORIGINAL ALLOCATION			APPROVED ALLOCATION	
LAST	FIRST	AFFILIATION	REG FEE	TRAVEL	HOTEL	TOTAL	REG FEE	TRAVEL	HOTEL	TOTAL
Ebong	Idongesit	U. of Michigan	$250.00	$400.00	$400.00	$1,050.00	$250.00	$457.33	$400.00	$1,107.33
Gilbert	Matthew	U. of Illinois	$450.00	$500.00	$800.00	$1,750.00	$450.00	$396.80	$903.20	$1,750.00
Jornet	Josep M	Georgia Tech	$250.00	$380.00	$420.00	$1,050.00	$250.00	$371.00	$429.00	$1,050.00
Kapetanovic	Adnan	U. Washington	$250.00	$500.00	$400.00	$1,150.00	$250.00	$0.00	$0.00	$250.00
Karabiyik	Mustafa	Florida Intern. U.	$250.00	$300.00	$650.00	$1,200.00	$250.00	$622.50	$0.00	$872.50
Kolmakov	Andrei	S. Illinois U.	$450.00	$450.00	$0.00	$900.00	$450.00	$434.90	$0.00	$884.90
London	Laurisa	Clark Atlanta U.	$250.00	$350.00	$650.00	$1,250.00	$250.00	$350.00	$650.00	$1,250.00
Perez	Jesus	Paulo U. of Utah	$250.00	$500.00	$500.00	$1,250.00	$250.00	$0.00	$0.00	$250.00
Schmidt	Holger	UC Santa Cruz	$450.00	$500.00	$500.00	$1,450.00	$450.00	$419.40	$316.82	$1,186.22
Vega-Alvarez	Sascha	U. of Puerto Rico	$250.00	$750.00	$475.00	$1,475.00	$250.00	$0.00	$0.00	$250.00
Wang	Chunlei	Florida Intern. U	$450.00	$300.00	$350.00	$1,100.00	$450.00	$300.00	$347.22	$1,097.22
TOTAL			$3,550.00	$4,930.00	$5,145.00	$13,625.00	$3,550.00	$3,351.93	$3,046.24	$9,948.17

All of the supported attendees participated in the technical program of the conference. The associated abstracts for the talks/posters are provided with this report. The supported attendees were also required to submit a written response to a questionnaire distributed at the conference. In this questionnaire, the attendees described 1) their contribution to the conference which included a brief description of the research presented, 2) their activities at the conference which included the session they attended along with a detailed comments on at least two presentations that were on subjects that provided new insights that would benefit the attendee in their research activities or that were of a personal interest, 3)a 200-400 word narrative that described how their experienced at the conference would benefit their academic training and/or influence their research in the future. The complete questionnaires are provided with this report.

As is clear from the attached information, the attendee program that was supported by the NSF funding was very successful in bringing young researchers to the NANO-DDS Conference which both broadened the academic experience of the attendees. and enhanced the technical program at the meeting.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Idongesit Ebong
University: University of Michigan
Email: idong@umich.edu

Authorized Reimbursement :

$ 1107.33

Send check to :

Idongesit Ebong
2932 Birch Hollow Dr. Apt. 2B
Ann Arbor, MI 48108

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Idongesit Ebong
University: University of Michigan
Email: idong@umich.edu

Dear Mr. Ebong,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

(1) Reimbursement of the Full Conference Registration Fee of $250.00.
(2) An Allowance of up to $400.00 to cover Travel to/from the Conference.
(3) An Allowance of up to $400.00 to cover accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

IMPORTANT NOTE: To obtain the financial reimbursements listed in (1) (2) and (3) above the Conference Attendee must submit the attached Travel-Assistance Form (i.e., NANO-DDS-11-TAF) and all associated receipts after attending the conference. It will also be necessary to follow all the instructions that are included on the NANO-DDS-11-TAF form in completing and submitting the form and substantiating receipts in order to achieve the financial reimbursements. A 2 page critique post-conference is required to be submitted with your receipts. Finally, the conference is not able to provide any cash advances before the conference dates.

The organizers of the 2011 NANO-DDS Conference would like to recognize the University of Maine and the National Science Foundation (NSF) for sponsoring your travel.

Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

ADAPTIVE READING, WRITING, AND ERASING IN A MEMRISTOR CROSSBAR MEMORY

Idongesit Ebong[1], Pinaki Mazumder[2]

[1] idong@umich.edu, University of Michigan, 2260 Hayward St., Ann Arbor MI 48109
[2] mazum@eecs.umich.edu, University of Michigan, 2260 Hayward St., Ann Arbor MI 48109

SUMMARY: This work presents an adaptive method of operating a memristor crossbar memory. The method utilizes two pulses to sample the memristor device of interest. The memristor memory is prone to errors due to non-uniform resistance across the crossbar structure and high defect rate compared to flash memory. By mitigating the drawbacks of using the memristor, fast, low power, denser memories can be built to aid the ever growing reliable storage appetite of various computing applications. The proposed method is shown to be low power and process resistant in simulations using memristor models and transistors in IBM 130 nm CMOS process.

Multiple applications for Chua's memristor[1] have been proposed, but the most promising with respect to product development is the digital memory utilizing memristors as storage elements. A new paradigm with respect to memory is necessary for the continued growth in density of nonvolatile memory for anticipated growth in petascale and exascale computing. The memristor's simple structure, small size, and non-volatility make it a viable candidate for next generation memory technology.

The memristor memory presents a solution to difficulties encountered beyond CMOS scaling, but it also introduces various complications to realizing this memory system. Some of these complications are addressed within the patent database by using correcting pulses to correct resistance drift due to normal usage [2]; using a temperature compensating circuit to counter resistance drift due to temperature variation[3]; using an adaptive method to read and write to an array with non-uniform resistance profile [4]; and introducing diodes[5] to reduce leaky paths within the crossbar memory array[6]. The method presented in this abstract uses memristor properties to clearly read high and low resistance values.

The adaptive method is explicated with the aid of the flow diagram in Figure 1. Figure 1a shows the decision process for a read, while Figure 1b shows the decision process for a write or erase operation. The write and erase operations are extensions of a single cycle read operation. The "double cycle" read is given in the flow diagram, and this is dubbed double cycle because the memristor is read in one direction and then read in the reverse direction to restore state. Since each memory device in the crossbar array is different, the pulses utilized for the read operation may cause destructive reads, thereby requiring a data refresh.

Referring back to Figure 1a, an applied bias samples and minutely changes the memristor's value (Apply Sampling Pulse #1), immediately another applied bias does the same (Apply Sampling Pulse #2), then a difference is detected (calculate δ). δ signifies the amount of change that has occurred within the memristor between the two sampled pulses. The pulses are chosen in a manner that will change the conductance of the memristor. Depending on the magnitude of δ, the read circuitry will return either "Logic 0" or "Logic 1." The definitions of "Logic 0" and "Logic 1" states are designer dependent. In one state, the sampling pulses push against an upper (lower) limit, while in the other state, the sampling pulses move the memristor in a direction opposite to its current state. In the latter case, a correction is necessary. The pulses used will disturb memory state based on location and specific low/high resistance boundaries of memristors within the crossbar array.

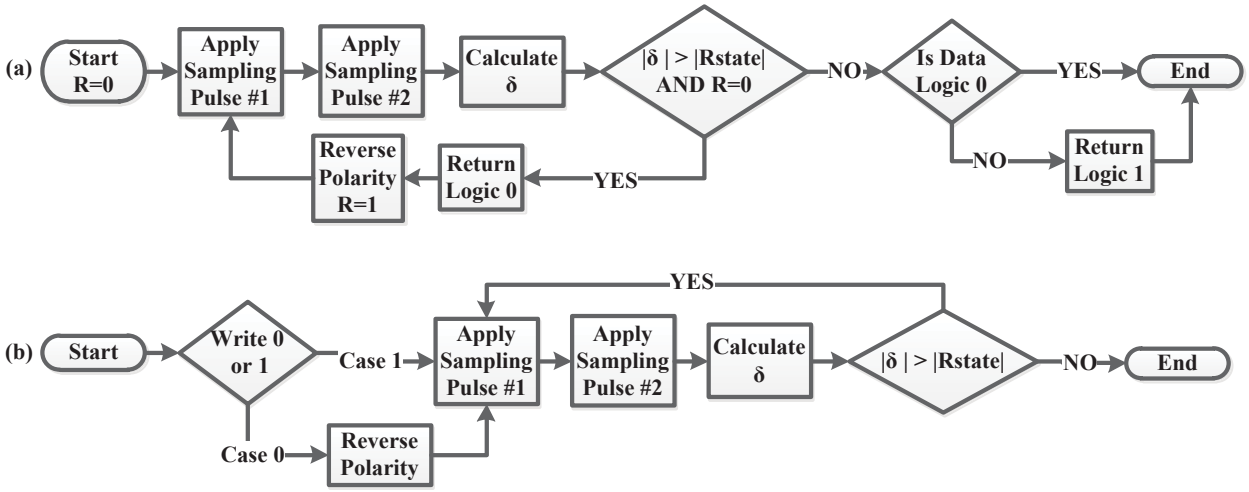

Figure 1: (a) Read flow diagram (b)Write/Erase flow diagram

The read process described in Figure 1a is extended to create Figure 1b. The goal of the latter figure is to reuse circuitry for the erase and write operations. The erase operation is defined as taking the memristor from a "Logic 0" to a "Logic 1," while the write operation changes the memristor from a "Logic 1" to a "Logic 0." These states can be interchanged depending on definition, as long as the definition is consistent across the read, write, and erase operations. The advantages of reading, writing, and erasing using this scheme includes tolerance to: crossbar variation resistance, adaptive method to write and erase a crossbar memory, and circuitry reuse for read, write, and erase.

The power consumption of the process is technology dependent and yields a write energy of 71.8 pJ, erase energy of 31 pJ, and read energy of 21 pJ and 1.3 pJ for low and high resistance states, respectively. The program energy is more than 5X improved over flash [7].

REFERENCES

[1] L. O. Chua, "MEMRISTOR - MISSING CIRCUIT ELEMENT," *IEEE Transactions on Circuit Theory,* vol. CT18, no. 5, pp. 507-&, 1971.

[2] J. T. Moore, and K. A. Campbell, *Memory device and methods of controlling resistance variation and resistance profile drift*, U.S. Patent 6,930,909 to Micron Technology, Inc., 2005.

[3] S. T. Hsu, *Temperature compensated RRAM circuit*, U.S. Patent 6 868 025,to Sharp Laboratories of America, Inc., 2005.

[4] J. Straznicky, *Method and system for reading the resistance state of junctions in crossbar memory*, U.S. Patent 7 340 356,to Hewlett Packard, 2008.

[5] L. Myoung-Jae, P. Youngsoo, K. Bo-Soo, A. Seung-Eon, L. Changbum, K. Kihwan *et al.*, "2-stack 1D-1R Cross-point Structure with Oxide Diodes as Switch Elements for High Density Resistance RAM Applications." pp. 771-774.

[6] D. Rinerson, C. J. Chevallier, S. W. Longcor, W. Kinney, E. R. Ward, and S. K. Hsia, *Re-writable memory with non-linear memory element*, U.S. Patent 6 870 755,to Unity Semiconductor Corporation, 2005.

[7] L. M. Grupp, A. M. Caulfield, J. Coburn, E. Yaakobi, S. Swanson, P. Siegel *et al.*, "Characterizing Flash Memory: Anomalies, Observations, and Applications," in Proceedings of the 42nd International Symposium on Microarchitecture, 2009.

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: IDONGESIT EBONG
Email Address: IDONG@umich.edu
Academic Department: Electrical Engineering and Computer Science
University Affiliation: University of Michigan
Research Area of Focus: Circuit Applications for Memristors and Nanodevices

(2) Attendee Contribution to the Conference

Title of Presentation: Adaptive Reading, Writing and Erasing in a Memristor Crossbar Memory
Presentation Type (Platform or Poster): Platform
Name of Session Where Presented: New System Functionality

Brief Description of the Research Presented (100 words or less):

An adaptive method of operating a memristor crossbar memory array is shown that exhibits low power operation and resistant to process variations. The method is shown to exhibit circuit reuse and provides a new paradigm to the problem of sensing memory state through intermediate device behavior

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:

New System Functionality
Nano-electronics and Nano-Optics I
Architecture Design for Sensor Platforms
Nanoscale Laser and Photonic Systems
Low Power Systems
Bio-Nano Sensors

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

Nanotube FETs for Ballistic Transport: I learned about mechanical relays in-plane that can avoid problems of the NEMs relays, especially the welding effect. I also improved my understanding of carrier confinement on nanotube FETs that have gate all around and the method to fabricate these FETs.

Orthopternet RF Communications: Power aware communications is important and I learned that insects can be used as hoppers to relay signals in areas where tower communication is not very likely. This presentation was of interest because it expanded my view of power aware circuit design and minimization. I also learned about different batteries for optimal trade off between capacity and weight.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

Talking to different individuals about work in related areas is very beneficial and the potential of building ~~relationships~~ mutually beneficial relationships. My area is application development for nanoscale technologies and the opportunity to meet individuals on the biological side has provided much insight into more overlap between emerging electronics and biology influence.

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2009 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

On attached sheet. Thank you very much for the opportunity to attend the nano conference.

The experience in the 2011 NANO-DDS conference was a godsend. I had an opportunity to nurture my teaching interests, research interests, and network with individuals. Having an opportunity to present to colleagues in the field provided a much needed training in public speaking as well as communicating ideas more effectively. My presentation was different from most of the presentations encountered because mine was a specific work that encompassed the span of a few months. Most of the presentations were an overview of ongoing research that span years. So details I hoped to find in many presentations were absent but nevertheless, the chance to see the progression of an idea is much more valuable. The conference helped foment the nature of idea evaluation and future planning. The feedback I received from the audience was beneficial, and I am very grateful for having had the opportunity to attend this conference.

I enjoyed the city of New York and the welcoming character of the inhabitants. I took time after the conference on Wednesday to survey the economic and academic potential of nanotechnology. After talking to a few individuals in the conference, I ventured out to the general populace and the students checking in for orientation. I rarely get a chance to converse about nanoscale research with entering freshmen or undergraduates because of my work schedule. I realized outside the conference, nanotechnology is a science fiction concept not well introduced to entering freshmen. The knowledge gap between the forefront of research and the future researchers seems astounding that my teaching interest piqued significantly. I plan to seek outreach programs for high school students in order to help introduce early on the excitement, potential, problems, and concepts I deal with daily in my research.

The conference presented a wealth of information with respect to novel devices and ideas. I was especially intrigued with the biological and molecular manipulation and their potential for higher level computing. Since I deal mostly with applications, my research focus will most likely need to incorporate these breakthroughs in biological manipulation to augment both CMOS and the man-made graphene and nanotubes. The next generation beyond CMOS is very exciting and filled with many possibilities; hence the opportunity to sit through the device talks was invaluable. The modeling presentations were fantastic: presenting new ways of applying old techniques.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Matthew Gilbert
University: University of Illinois
Email: matthewg@illinois.edu

Authorized Reimbursement:

$1750.00

Mail Check to :

Matthew Gilbert
4805 Allison Drive
Champaign, IL 61822

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Matthew Gilbert
University: University of Illinois
Email: matthewg@illinois.edu

Dear Prof. Gilbert,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

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(3) An Allowance of up to $800.00 to cover accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

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The organizers of the 2011 NANO-DDS Conference would like to recognize the University of Maine and the National Science Foundation (NSF) for sponsoring your travel.

Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

Vortex Lines in Topological Insulator - Superconductor Heterostructures

M. J. Gilbert[1,2,3]

[1]Department of Electrical and Computer Engineering, University of Illinois, 1406 W. Green St., Urbana IL 61801.
[2]Micro and Nanotechnology Laboratory, University of Illinois, 1406 W. Green St., Urbana IL 61801.
[3]Institute for Condensed Matter Theory, University of Illinois, 1110 W. Green St., Urbana IL 61801.

SUMMARY: The ability to precisely find and manipulate non-Abelian anyons has long been sought after as a potential means for the realization of robust quantum information processing. The simplest of these particles, Majorana fermions, have been predicted to exist in a new class of materials commonly referred to as topological insulators when they are coupled with s-wave superconducting contacts. This proposal is the focus of intense experimental research whose aim is to prove the existence of Majorana fermions trapped at the surface of topological insulators paired with superconductors. Current understanding of the problem only considers the gapless surface state Hamiltonian and ignores the properties of the bulk topological insulator. If the bulk were a trivial insulator, then this analysis would be appropriate under every circumstance, however, it is well known that topological insulators are not inert in the presence of thin flux tubes. We will present theoretical investigations into the surface properties of 3D topological insulator/superconductor junctions. We will discuss the circumstances where we may consider the surface physics alone and when the bulk physics plays an important role.

One of the most recognized potential applications of 3D time-reversal invariant topological insulators [1] is as a platform for topological quantum computation via non-Abelian anyons (Majorana bound states) [2]. The inceptive work of Fu and Kane [3] showed that the surface of a 3D topological insulator, proximity-coupled to an s-wave superconductor. Most importantly, conventional superconducting vortices in the heterostructure will harbor zero-energy states bound in the vortex cores. These zero-energy states have Majorana character, non-Abelian exchange statistics, and may be used as qubits in a topological quantum computer [2]. Nevertheless, Ref. 3 considers only the gapless surface-state Hamiltonian proximity coupled to a superconductor and ignores the properties of the bulk. If the bulk were a trivial insulator it would be inert. However, it is known that topological insulators react to the presence of thin flux tubes [4], the kind which might appear associated with the vortices in which we are interested. In this work we seek to understand exactly when it is sufficient to only consider the surface physics, and when one must include the bulk physics. We focus on the role of the applied magnetic flux necessary to create a field of vortices to be used for quantum computation.

Our model system is a 3D topological insulator with s-wave superconductors covering the top and bottom surfaces. We use a a minimal bulk model for a 3D topological insulator consisting of a gapped Dirac Hamiltonian and extend the definition of the Hamiltonian to include the superconductive pairing using a mean-field Bogoliubov-de Gennes (BdG) description. Two magnetic flux tubes are fed through the heterostructure to dynamically generate vortices at the top and bottom surfaces of the s-wave superconductors. For simplicity, we assume that the vortices do not interact with one another. Inside of the superconductor, the penetrating magnetic field satisfies the London equation near a vortex positioned at the origin,

$$B(r) - \lambda^2 \nabla^2 B(r) = \frac{\phi_0}{2} \delta(r). \tag{1}$$

Where in Eq. (1), φ_0 is the phase of the magnetic flux, $B(r)$ is the magnetic field, and λ is the penetration depth.

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: Matthew Gilbert
Email Address: matthewg@illinois.edu
Academic Department: ECE University
Affiliation: University of Illinois
Research Area of Focus: Condensed Matter Theory / Nanotechnology

(2) Attendee Contribution to the Conference

Title of Presentation: Vortex Lines in Topological Insulator – Superconductor Heterostructures
Presentation Type (Platform or Poster): Poster
Name of Session Where Presented: Poster Session on Tuesday 8/30
Brief Description of the Research Presented (100 words or less):

Majorana fermions have been predicted to exist in topological insulators when they are coupled with s-wave superconducting contacts. Current understanding of the problem only considers the gapless surface state Hamiltonian and ignores the properties of the bulk topological insulator. If the bulk were a trivial insulator, then this analysis would be appropriate under every circumstance. However, it is well known that topological insulators are not inert in the presence of thin flux tubes. We presented theoretical investigations into the surface properties of 3D topological insulator/superconductor junctions. We demonstrated that Majorana fermions are stable surface states in this system under most experimentally realizable conditions.

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:

Session IV-C2 - Low-Power Systems

Session IV-C2 - New System Functionality

Session II-A - Nanoscale Technologies and Techniques

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

Eric Pop's discussion of energy dissipation and conversion in nanoscale devices was topically relevant to me as I have an active interest in ultra-low power logic. I find it interesting that graphene is a good thermoelectric material but this is representative of most materials which are topologically invariant. The connection between thermoelectricity and topology is interesting. Clearly Pop sees weak phonon interactions, but this is a necessary yet insufficient piece of the puzzle as to why many thermoelectrics are topological.
Emanuel Tutuc's work is quite interesting to me. He seems to feel like proper engineering of separated graphene bilayers will lead to a phase transition into an indirectly bound exciton condensate at elevated temperatures. I think this is a nice idea, but impossible to

achieve due to fermionic screening of the interlayer interaction. Were this true, it would be an amazing device which could revolutionize the semiconductor industry. However, the physics is not there.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

Beyond this, I had a great discussion with David Janes about the state of semiconductor nanowire research. These nanowires are an interesting playground where Majorana states may be found due to a superconductor proximity coupled to the spin split bands of the wire. They also seem to be great sensors, a fact of which I was not completely aware.

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2009 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

Attendance at NANO-DDS has been helpful to my academic training and future academic goals in two key ways. I did learn a lot about how different numerical methods are applied to system applications such as drug delivery and biology. Though this is too far afield to be of use to me now, it is interesting and I never really understood how to approach biological problems. The main way that this conference was most useful was in terms of extending my current research on topological systems. As I mentioned, there is a strong but unknown connection between topological systems and thermoelectricity. It would seem to me that by engineering the Brillouin zone then one could expect to find a greatly enhanced Seebeck coefficient. But this does not get at the heart of the problem. While I think that graphene is a bit over-inflated in terms of usefulness, perhaps this could be appended by adding additional chemical compounds onto the surface to change the band structure. Recent theoretical work at the DFT level has shown this to be an interesting direction. Beyond the interesting connection between topologically protected surface states and thermoelectricity, I found the experiments of Tutuc interesting. They do not show any evidence of a Kosterlitz-Thouless transition from Fermi liquid to exciton condensate. This supports a recent theoretical paper I wrote in which additional fermionic flavors reduce the strength of the interlayer interactions. However, there are experiments which he did not mention that I read after his talk by Jiwoong Park which demonstrated that two nanotubes may coupled via some mechanism over much larger separations than in Tutuc's experiments. Clearly there is some interaction taking place which is of many-body nature at room temperature it is just not as simple as an exchange enhancement.

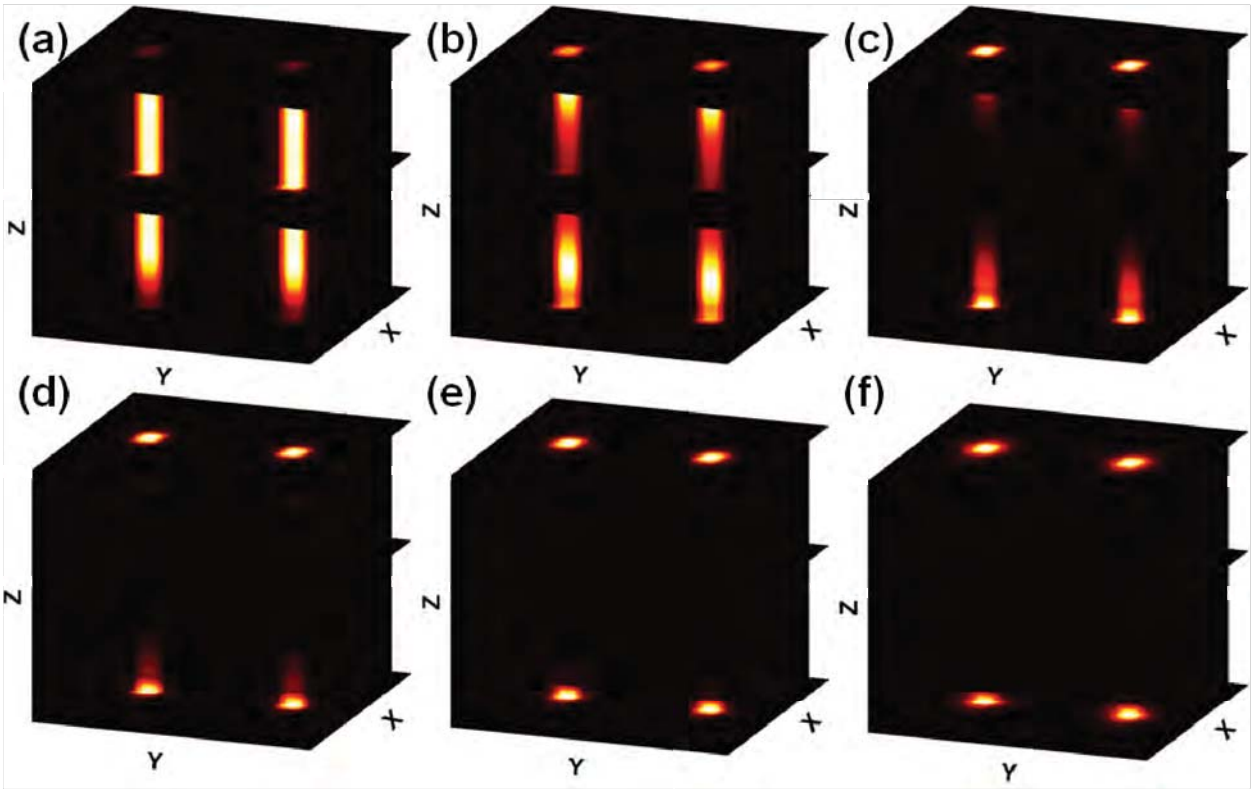

Figure 1. Plots of the probability distribution for the lowest energy states corresponding to different superconducting penetration depths, λ, corresponding to: (a) λ = 0.001, (b) λ = 0.2, (c) λ = 0.3, (d) λ = 0.4, (e) λ = 0.5, (f) λ = 1.5. Note that λ is in units of the lattice constant *a* and the entire flux is spread out in a region with a radius roughly ~ 5 λ. As λ is increased we see that the states move from being delocalized along the flux tube penetrating the bulk of the topological insulator to being pinned at the surface. The inset shows the spatial variation of the superconducting mass and the time-reversal breaking mass associated with the magnetization as λ varies.

In **Fig. 1**, we plot the probability distribution for the lowest energy states corresponding to different superconducting penetration depths, λ. Here we see a clear trend in the vortex physics. As the flux leaves the superconductor it spreads out in the topological insulator. If λ is small, as in **Fig. 1(a)**, then the flux creates a wormhole through the system destroying the Majorana fermions. However, if λ is large, as in **Fig. 1(f)** then we have distinct vortices formed at the interface of the topological insulator and the superconductor possessing the desired Majorana characteristics. These results demonstrate that Majorana fermion states are robust in topological insulator – superconductor heterostructures so long as the superconducting penetration depth is large compared to the thickness of the topological insulator.

This work is supported by the AFOSR.

REFERENCES

[1] M. Z. Hasan and C. L. Kane, Rev. Mod. Phys. **82**, 3045 (2010).
[2] C. Nayak, S. H. Simon, A. Stern, M. Friedman and S. Das Sarma, Rev. Mod. Phys. **80**, 1083 (2008).
[3] L. Fu and C. L. Kane, Phys. Rev. Lett. **100**, 096407 (2008).
[4] G. Rosenberg, H. -M. Guo and M. Franz, Phys. Rev. B **82**, 044104 (2010).

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Josep Jornet
University: Georgia Institute of Technology
Email: jmjm3@ece.gatech.edu

Authorized Reimbursement:

$1050.00

Mail Check to:

Josep Jornet
100 10th St. NW Apt 104A
Atlanta, GA 30309

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Josep Jornet
University: Georgia Institute of Technology
Email: jmjm3@ece.gatech.edu

Dear Mr. Jornet,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

(1) Reimbursement of the Full Conference Registration Fee of $250.00.
(2) An Allowance of up to $380.00 to cover Travel to/from the Conference.
(3) An Allowance of up to $420.00 to cover accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

IMPORTANT NOTE: To obtain the financial reimbursements listed in (1) (2) and (3) above the Conference Attendee must submit the attached Travel-Assistance Form (i.e., NANO-DDS-11-TAF) and all associated receipts after attending the conference. It will also be necessary to follow all the instructions that are included on the NANO-DDS-11-TAF form in completing and submitting the form and substantiating receipts in order to achieve the financial reimbursements. A two page Summary/Critique must accompany the Travel-Assistance Form. Finally, the conference is not able to provide any cash advances before the conference dates.

The organizers of the 2011 NANO-DDS Conference would like to recognize the University of Maine and the National Science Foundation (NSF) for sponsoring your travel.

Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

GRAPHENE-BASED NANO-ANTENNAS FOR ELECTROMAGNETIC COMMUNICATION AMONG NANO-DEVICES

Josep Miquel Jornet and Ian F. Akyildiz

Broadband Wireless Networking Laboratory
School of Electrical and Computer Engineering
Georgia Institute of Technology, Atlanta, GA 30332 USA
Email: {jmjornet, ian}@ece.gatech.edu

SUMMARY: Nanotechnology is enabling the development of novel devices in a scale ranging from one to a few hundred nanometers, which are able to perform only very simple tasks, such as computing, data storing, sensing and actuation. By means of communication, nano-devices will be able to overcome their individual limitations and expand their potential applications in several fields. A wireless network of nano-devices will be able to cover larger areas, to reach unprecedented locations in a non-invasive way, and to perform additional in-network processing and coordinated actuations. Recent advancements in graphene-based electronics have opened the door to electromagnetic (EM) communications at the nanoscale. In this paper, a novel antenna design based on a metallic Graphene Nanoribbon (GNR), which resembles a nano-patch antenna, is investigated. For this, a quantum mechanical framework is first set to analyze the transmission line properties of metallic GNRs with multiple conducting energy bands. Then, the proposed antenna design is analyzed and evaluated. Numerical results show that, for a maximum antenna size in the order of several hundred nanometers (the expected maximum size for an integrated nano-device), a nano-patch antenna will be able to radiate EM waves in the Terahertz band (0.1-10.0 THz). While still not solving the communication problem at the nanoscale, these results motivate a further analysis of both, novel nano-antenna structures and propagation models suited for the nanoscale.

INTRODUCTION: Nanotechnology is providing a new set of tools to the engineering community to design and manufacture integrated devices just a few hundred of nanometers in size. For example, one of the early applications of these nano-devices is in the field of nanosensing. Nanosensors are not just tiny sensors, but devices that take advantage of the properties of novel nanomaterials to identify and measure new types of events in the nanoscale. Existing nanosensors are not autonomous machines, but require the user interaction and external equipment to operate. Communication among nano-devices will expand the capabilities and applications of individual machines in terms of complexity and range of operation [1, 2]. Wireless networks of nano-devices will boost the range of applications of nanotechnology in the biomedical field (e.g., novel health monitoring systems), in environmental research (e.g., distributed air pollution control), and in military technology (e.g., Nuclear, Biological and Chemical defenses).

For the time being, the communication alternatives for nano-devices are still very limited. Focusing on the electromagnetic (EM) paradigm, there are several drawbacks in the existing silicon-based solutions that hamper their direct application in the nanoscale, such as their size, complexity and energy consumption [3]. Alternatively, the use of novel nanomaterials to build a new generation of nanoelectronic devices can aid the design of novel EM nano-transceivers. Amongst others, graphene, a one-atom-thick planar sheet of bonded carbon atoms densely packed in a honeycomb lattice, first obtained in 2004 by the Nobel laureates A. K. Geim and K. S. Novoselov [4], is expected to become the silicon of the 21st century. From the communication perspective, the electrical and optical properties observed in this novel nanomaterial will decide on the specific bandwidth for emission of EM radiation or the magnitude of the emitted power for a given input energy, amongst others.

The propagation of EM waves on infinitely large 2D graphene planes has been theoretically analyzed in [5, 6], amongst others. However, little research has been conducted on EM propagation in GNRs, which

is what is mainly needed for the design of a nano-antenna. In [7], the propagation of microwaves on GNRs was modeled and measured. The main outcome of this study is that the very large kinetic inductance that has been observed in CNTs can be drastically reduced in GNRs by increasing their width. As a result, both the contact resistance of GNRs and the surface wave propagation speed can be tuned by modifying the dimensions of the GNR.

CONTRIBUTIONS: In this paper, we analyze the performance of our recently proposed graphene-based nano-patch antenna [8] (see Fig. 1). In particular, we first develop a quantum mechanical framework based on the tight-binding model of graphene in order to obtain the transmission line properties of a loss-less metallic multi-conducing-band GNR, as functions of the antenna size, ribbon edge geometry, temperature and bias voltage. Second, we analyze and model a novel nano-antenna design based on a metallic multi-conducting band GNR and resembling a nano-patch antenna. Third, we numerically evaluate the performance of this novel nano-antenna and show that, for a maximum antenna size in the order of several hundreds of nanometers (the expected maximum size for a nano-machine), this will radiate EM waves in the Terahertz band (0.1-10~THz). In addition, our current work on the simulation of EM radiation from nano-structures obtained by means of a novel multiphysics simulation tool in order to predict the antenna radiation properties both in the near field and in the far field will be presented.

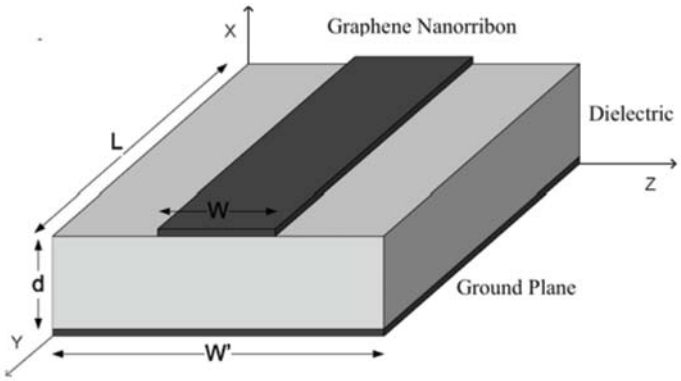

Figure 1. Graphene-based nano-patch antenna.

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[1] Akyildiz, I. F., Brunetti, F., and Blázquez, C. "Nanonetworks: a new communication paradigm," Computer Networks (Elsevier) Journal, vol. 52, no. 12, pp. 2260-2279, 2008.

[2] Akyildiz, I. F. and Jornet, J. M., "Electromagnetic wireless nanosensor networks," Nano Communication Networks (Elsevier), vol. 1, no. 1, pp. 3 – 19, 2010.

[3] Luryi, S., Xu, J. and Zaslavsky, A., "Future Trends in Microelectronics Scaling Limits of Silicon CMOS and Non-silicon opportunities," *John Wiley & Sons - IEEE Press, pp.* 203-211, 2007.

[4] A. K. Geim and K. S. Novoselov, "The rise of graphene," Nature materials, vol. 6, no. 3, pp. 183–91, March 2007.

[5] Mikhailov, S. A. and Ziegler, K., "New Electromagnetic Mode in Graphene," Physical Review Letters, vol. 99, pp. 1-4, July 2007.

[6] Hanson, G. W., "Dyadic Green's functions and guided surface waves for a surface conductivity model of graphene," Journal of Applied Physics, AIP, vol. 103, no. 6, pp. 064302, 2008.

[7] Deligeorgis, G., Dragoman, M., Neculoiu, D., Dragoman, D., Konstantinidis, G., Cismaru, A. and Plana, R., "Microwave propagation in graphene," Applied Physics Letters, no. 95, pp. 073107, 2009.

[8] Jornet, J. M. and Akyildiz, I. F., "Graphene-based nano-antennas for electromagnetic nano-communications in the Terahertz Band," in Proc. of 4th European Conference on Antennas and Propagation, EUCAP, April 2010.

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: Josep Miquel Jornet
Email Address: jmjornet@ece.gatech.edu
Academic Department: School of Electrical and Computer Engineering
University Affiliation: Georgia Institute of Technology
Research Area of Focus: Nano-Networks, Nano-Communications and Nanosensor Networks

(2) Attendee Contribution to the Conference

Title of Presentation: Graphene-based Nano-antennas for Electromagnetic Communication Among Nano-devices
Presentation Type (Platform or Poster): Platform
Name of Session Where Presented: III A2
Brief Description of the Research Presented (100 words or less):
We propose a novel graphene-based nano-antenna design for electromagnetic communications among nanosensor devices. The antenna is based on a thin Graphene Nanoribbon and resembles a nano-patch antenna. We develop a lumped element model of the nano-antenna starting from the transmission line properties of GNRs. We also model the nano-antenna as a Fabry-Perot resonant cavity and model its frequency response by starting from the optical conductivity of graphene. We compare both models and show that the frequency band of operation of a 1 micrometer long antenna is within the Terahertz Band.

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:
III A2 - Nano-Electronics and Nano-Optics II
IV C2 - Low Power Systems
IV S1 - Graphene Analysis and Characterization

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

- Conceptual design improvements for terahertz quantum cascade lasers needed for molecule detection: I believe that the proposed QCLs can also be used for short range communication among nano-devices, and we had a fruitful discussion with Dr. Kubis about it.

- Sheet resistance of multi-layer graphene in radio frequency: this presentation showed experimental measurements of graphene conductivity at difference frequencies, including the terahertz band. So far my work is mainly analytical modeling, and thus supporting measurements are necessary.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

One of the main objectives for me in participating in the conference was to look for possible partners/collaboration agreements, in order to experimentally validate our theoretical work. In particular, I had a very fruitful talk with Dr. Peter Burke, which I met for the first time after many emails and papers exchange. Not only he suggested me possible directions in my research, but we may prepare a joint proposal in the future to formally collaborate.

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2011 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

Since 2009, my research has been focused on enabling the communication among nanoscale devices in general and nanosensors in particular. Current nanosensors, such as those presented in the conference, have extremely precise sensing capabilities. However, their sensing range is limited and, moreover, external equipment is necessary to read their actual measurements.

In our vision, in a 5 to 10 year span, we will be able to develop autonomous nanosensor motes integrated by several nano-components, e.g., a nanosensing unit, an energy harvesting unit, some form of digital memory, and even some simple computing architecture. By means of communication, these nanosensor motes will be able to directly send us the information about their measurements, without the need for external devices. However, the development of a nanoscale transceiver which can be easily integrated in a nanosensor mote poses several challenges.

During this last 2 years, my work has been mainly theoretical. We have proposed novel graphene-based nano-antennas, which can radiate EM waves in the Terahertz Band. In order to further continue with our research, it is necessary to, first, obtain more accurate models for the properties of graphene and graphene nano-ribbons (e.g., optical conductivity, impact of lateral confinement, etc.). In this conference, we have seen several relevant works related to the characterization of the optical properties of graphene, from which I can benefit for my next work.

Second, it is necessary to go one step ahead and experimentally implement and measure the proposed nano-antennas. In this conference, there have been several presentations with pioneering results on experimental fabrication, assembly and measurement of graphene-based devices. The interaction during and after the conference with these experts will potentially result in fruitful collaborations. Our group does not have the facilities to grow, manipulate or measure graphene and, thus, partnering with experimental labs is of primary importance.

Finally, in addition to the nano-antenna, several researchers have discussed also with me the need for some high-speed transceivers able to generate the signals which are necessary to drive the antenna at the expected very high frequencies that we are envisioning. The interaction and future collaboration with experts in the field that participated in the conference will have a clear impact on my research.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Adnan Kapetanovic
University: University of Washington
Email: kapeta@uw.edu

Authorized Reimbursement:

$250.00

Mail Check to:

Adnan Kapetanovic
14035 33rd Avenue South
Tukwila, WA 98168

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
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Name: Adnan Kapetanovic
University: University of Washington
Email: kapeta@uw.edu

Dear Mr. Kapetanovic,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

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Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY
Travel-Assistance Form

Full Name (First, Middle Initial, Last): Adnan Kapetanovic
Work Telephone: 206-685-3581 **; Home Telephone:** 206-854-3157
Street Address*: 14035 33rd Avenue South
City: Tukwila **; State:** WA **; ZIP:** 98168
Country: USA **; EMAIL:** kapeta@uw.edu

This address will be used for mailing your reimbursement check.
Conference Registration Fee $250.00

List of Hotel Accommodation Costs:

	Date(s)	Hotel Name & Location	Total Costs (include taxes)
(1)			
(2)			
(3)			
(4)			
(5)			

List of Associated Travel Costs (Examples: Airfare, Rental Car, Parking, etc.):

	Date(s)	Travel Cost Item	Total Costs (include taxes)
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			

PART I - INFORMATION FOR PREPARATION OF REIMBURSEMENT PACKAGE
(1) List all costs above.
(2) Prepare an attachment with receipts to substantiate all items listed above.

PART II - INFORMATION FOR SUBMISSION OF FORMS & RECEIPTS:
Complete Form and Fed-ex ORIGINAL receipts to:

ARO Attn: Dr. Dwight Woolard
4300 S. Miami Blvd.
Durham, NC 27703-9142 tel: (919)457-6069.

Please scan your originals for your records before sending them to ARO.

NYU-Poly www@poly.edu to me show details Aug 22

Submitted on Monday, August 22, 2011 - 10:50pm
Submitted by anonymous user: [10.0.0.5]
Submitted values are:

--Personal Information--
Attendee First Name: Adnan
Attendee Last Name: Kapetanovic
Affiliation / University: University of Washington
E-Mail: kapeta@uw.edu
Phone: 2068543157
Fax:

--Billing Information--
Address Line 1: 14035 33rd Avenue South
Address Line 2:
City: Tukwila
State / Province / Region: WASHINGTON
Zip / Postal Code: 98168

Banquet: Zero Banquet Tickets ($0)
Conference Package: Student Conference Registration ($250) [Subject to verification]
Name on Credit Card: Azra Kapetanovic
Expiration Month: February (2)
Expiration Year: 2014

The results of this submission may be viewed at:
http://www.poly.edu/node/5335/submission/21171

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Mustafa Karabiyik
University: Florida International University
Email: mustafakarabiyik@gmail.com

Authorized Reimbursement:

$872.50

Mail Check to:

Mustafa Karabiyik
6250 NW 173rd St Apt 311
Hialeah, FL 33015

September 9, 2011

Dear Dr. Woolard;

I had applied for Travel Assistance to attend the Nano DDS 2011 conference and the committee kindly offered a travel support. Due to the inclement weather at the time, I was unable to attend the conference. However, my PhD student Mr. Mustafa Karabiyik attended and presented our paper titled " **Sub wavelength Multimode Plasmonic THz Lenses"** in the session of "**Session III-A2 Nano-Electronics & Nano-optics II".**

He is submitting the attached travel assistance form with the receipts for his expenses. I hope that you kindly accept his application.

Please do not hesitate to contact with me if you need further information.

Best regards,

Nezih Pala, PhD
Assistant Professor
Electrical & Computer Engineering
Florida International University
10555 W Flagler Street. EC 3914
Miami, FL 33174
Phone: (305) 348 3016
Fax: (305) 348 3707
email: npala@fiu.edu

Enc.
Travel Assistance offer letter for Dr. Nezih Pala
Travel Assistance Application form by Mr. Mustafa Karabiyik
Receipts of expenses by Mr. Mustafa Karabiyik

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Nezih Pala
University: Florida International University
Email: npala@fiu.edu

Dear Prof. Pala,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

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Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

SUBWAVELENGTH MULTIMODE PLASMONIC TERAHERTZ LENSES

Mustafa Karabiyik, Chowdhury Al-Amin, Ahmad N. Abbas, Nezih Pala

Electrical and Computer Engineering, Florida International University, Miami, Florida 33174, USA

SUMMARY: We have designed a new subwavelength plasmonic lens for terahertz (THz) frequencies by utilizing 2 dimensional electron gas (2DEG) at AlGaN/GaN interface. The lens consists of concentric circular metallic gratings placed on the AlGaN layer. Plasmonic modes which are excited by incident THz radiation in the 2DEG under the metal gratings can be concentrated into λ/350- diameter area. The electric field intensity under the central point is orders of magnitude higher than the outer grating area. The plasmonic lens modes supported by the system can be tuned with an applied voltage to gratings.

Terahertz technologies utilizing electromagnetic radiation in the frequency range between 300 GHz and 10 THz has potential applications in biology, chemistry, medicine and security. The THz frequencies correspond to energy levels of molecular rotations and vibrations of DNA and proteins, as well as explosives, and these may provide characteristic fingerprints to differentiate biological tissues in a region of the spectrum not previously explored for medical use or detect and identify trace amount of explosives. However one major obstacle preventing use of THz frequencies for many sensing applications in small-scale is their long wavelength which limits the maximum spatial resolution.

Excitation of plasmons in 2DEG of various HEMT structures by THz radiation have been studies in the past for resonant and non-resonant absorption characteristics.[1,2,3] HEMT structures with periodic metallic gates (grating gate) have attracted particular attention. However, all the grating gate devices reported in the literature had linear geometry. In this paper we report on the design of concentric grating structures which could be used to concentrate THz electric field into deep sub-wavelength area by plasmonic excitations. Focusing of the plasmons in visible regime has been reported by several methods but in THz range plasmon focusing has not been observed yet.

The structures investigated in this study consisted of concentric metal rings placed on AlGaN/GaN heterostructure.(Fig. 1a) The strip width of the rings was varied between L_g = 0.5-2.0 μm and the separation between the rings was varied between L_S = 0.1-1.0 μm. Propagation of a broadband pulse of EM waves in 0.5-4.0 THz was simulated by an FDTD software.

Frequency dependence of the electric field intensity under the entire plasmonic lens structure for L_g = 1.4μm and L_S = 0.2μm is shown in Fig. 1b. The frequency resonant peaks can be controlled by the applied voltage to the gratings and also modifying the duty cycle and period of the circular grating. Figure 1c shows the intensity distribution of the plasmons in between metal and 2DEG layer for all supported lens modes of circular grating in the frequency range of 0.5 THz - 4 THz. The total field intensity in a very small area (<1 μm^2) at the central metal can reach to value which is orders of magnitude higher than the outer grating area.

The results show that concentric plasmonic grating structures can be used to concentrate THz into deep sub-wavelength areas and achieve very large field enhancements by plasmonic confinement.

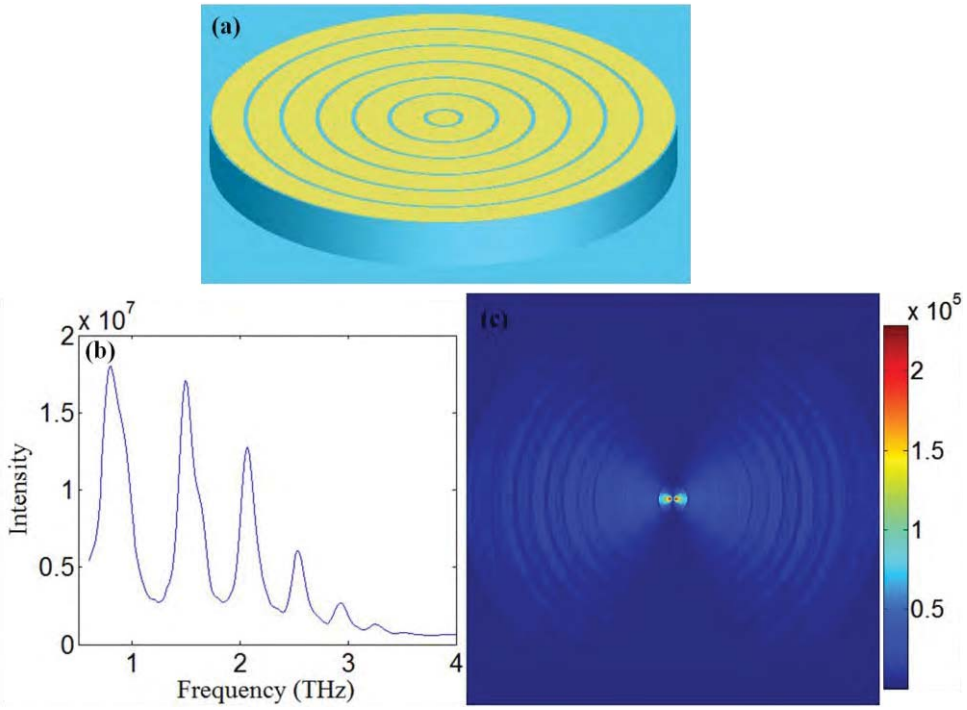

Fig. 1. (a) Schematics of the investigated concentric plasmonic THz lens **(b)** Electric field intensity vs frequency at the center of the lens **(c)** Electric field intensity profile of the plasmons under the lens.

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[1] X. G. Peralta, S. J. Allen, M. C. Wanke, N. E. Harff, J. A. Simmons, M. P. Lilly, J. L. Reno, P. J. Burke and J. P. Eisenstein, "Terahertz photoconductivity and plasmon modes in double-quantum-well field-effect transistors", *Appl. Phys. Lett*. **81,** 1627 (2002)

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[3] M. I. Dyakonov, M. S. Shur, "Two dimensional electronic flute"**,** *Appl. Phys. Lett.* **67** (8), (1995)

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information
Name: **Mustafa Karabiyik**
Email Address: **mustafakarabiyik@gmail.com**
Academic Department: **Electrical Eng. Dept.**
University Affiliation: **Florida International University**
Research Area of Focus: **THz Detection by Plasmonic Excitation**

(2) Attendee Contribution to the Conference
Title of Presentation: **t**
Presentation Type (Platform or Poster): **Platform**
Name of Session Where Presented: **SESSION III-A2 NANO-ELECTRONICS & NANO-OPTICS II**

Brief Description of the Research Presented (100 words or less):
We have designed a new subwavelength plasmonic lens that is operating at terahertz (THz) regime by utilizing 2 dimensional electron gas (2DEG) at AlGaN/GaN interface. The lens consists of concentric circular metallic gratings that are just above the AlGaN layer. Plasmonic modes which are excited in between 2DEG and metal gratings are all confined under the central ring for specific THz frequencies. The light can be squeezed around 350 times of its original wavelength when coupled to the plasmons.

(3) Attendee Activities at the Conference
Please List the Name of Relevant Sessions that were Attended at the Conference:

Nano electronics and nano optics
Micro to nano scale characterization

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

Doubly corrugates spoofed surface plasmon polariton structures with frequency selective transmission. This talk was about plasmons at metal-insulator-metal surfaces and the investigated regime was in THz spectrum. I came up with a new idea in THz plasmonic by adding a cavity to the periodic structure and localize plasmons in the structure.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

I learned a new technique about how to check hydrated samples by utilizing thin membranes that are transparent for electrons. I discussed with the chair of our session that we need to isolate our structure from the substrate to make a bolometer out of our lens design.

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2011 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

At this conference, I met with a few professors who gave me some ideas about what to do in my proceeding studies. I attended several presentations which gave me new insights and new ideas that I can combine with my research. A THz plasmonic talk influenced a new idea in THz plasmonic by adding a cavity to the periodic structure and localize plasmons in the structure. I learned new methods how to utilize from nano dots for biochemical detection. I attended a presentation that was a very novel technology and I had a chance to learn what they are doing before they publish it in Nature which was accepted by Nature. So, these conferences can help us to be from the first learners of novel technology. I had a chance to attend only for two days, it would be better for me to attend from the first day of the conferences. I saw that groups are really working hard on their research which also motivated me to be fast and catch up with them. I will try to attend for the next year Nano DDS. I hope I can give a talk again next year.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Andrei Kolmakov
University: Southern Illinois University
Email: akolmakov@physics.siu.edu

Authorized Reimbursement:

$884.90

Send Check to:

Andrei Kolmakov
1245 Lincoln Dr. Neckers 491
Physics Dept. SIUC
Carbondale, IL 62901

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
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Name: Andrei Kolmakov
University: Southern Illinois University
Email: akolmakov@physics.siu.edu

Dear Prof. Kolmakov,

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If you would like to accept this offer of Attendee-Assistance support please send an email to admin@nano-dds.com indicating your intention of attending the 2011 NANO-DDS Conference. **YOU MUST ACCEPT/DECLINE by the deadline of Friday, July 8th.**

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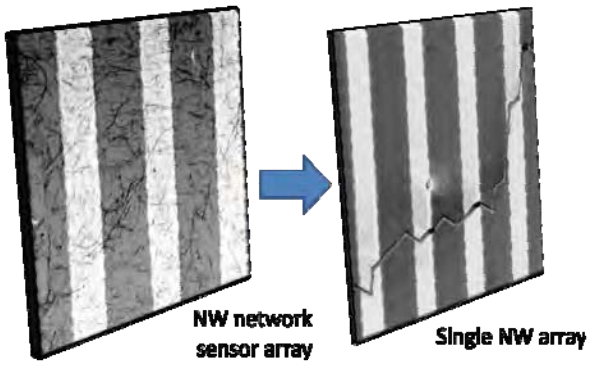
Dr. Greg Recine
2011 NANO-DDS
Conference Manager

DESIGNS AND TETS OF THE NANOWIRE BASED ELECTRONIC NOSES: FROM NANOWIRE NETWORK TO A SINGLE NANOBELT AS SENSING ELEMENTS

Andrei Kolmakov

Southern Illinois University at Carbondale, Carbondale, Illinois 62901, USA

SUMMARY: The progress in the development of the nanowire based electronic micro analytical systems for chemical sensing is described. The design evolution of the sensing elements from random nanowire network to ultimately small single nanowire is described. The performance and perspectives of such devices is analyzed.



The development of simple, inexpensive, power efficient, robust and yet sensitive nanodevices for real-time analysis of the ambient gas is currently an imperative for homeland security. One of the approaches to develop a novel sensing platform was based on mimicking the mammalian olfactory system, which nowadays is often referred to as "electronic nose" (E-nose)[1]. The recent nanotechnology advancements allow the fabrication of E-noses in the size domain where miniaturization of the "classical" thin film micro analytical systems encounters principal limitations. Here we describe the evolution of the nanowire based electronic noses. These include the e-nose systems based distributed nanowire sensors[2], integrated sensors based on nanowire networks[3] and finally the simplest and yet fully functioning E-nose made of an *individual* single-crystal metal oxide quasi-1D nanostructure[4]. The designs, fabrication protocols and performance of these three generations of NW e-noses has been comparatively described. In particular, in the single NW e-nose the nanostructure was indexed with a number of electrodes in a way that each segment of the NW between two electrodes defines an individual active element of the sensor array. The required diversity of the sensing elements was achieved via tuning the morphology of the nanostructure during its growth. The recognition ability of the single nanowire E-nose was enhanced via functionalization of selected segments with Pd catalyst and/or through longitudinal temperature gradient. The proposed fabrication protocol represents the combined bottom-up/top-down technologically viable route to develop inexpensive, robust, self-powered and sensitive analytical systems, which can be scaled down to submicron dimensions.

REFERENCES

[1] K. Persaud and G. Dodd, "Analysis of Discrimination Mechanisms in the Mammalian Olfactory System Using a Model Nose," *Nature*, vol. 299, pp. 352-355, 1982.

[2] V. V. Sysoev, B. K. Button, K. Wepsiec, S. Dmitriev, and A. Kolmakov, "Toward the nanoscopic "electronic nose": Hydrogen vs carbon monoxide discrimination with an

array of individual metal oxide nano- and mesowire sensors," *Nano Letters*, vol. 6, pp. 1584-1588, 2006.

[3] V. V. Sysoev, J. Goschnick, T. Schneider, E. Strelcov, and A. Kolmakov, "A gradient microarray electronic nose based on percolating SnO2 nanowire sensing elements," *Nano Letters*, vol. 7, pp. 3182-3188, 2007.

[4] V. V. Sysoev, E. Strelcov, M. Sommer, M. Bruns, I. Kiselev, W. Habicht, S. Kar, L. Gregoratti, M. Kiskinova, and A. Kolmakov, "Single-Nanobelt Electronic Nose: Engineering and Tests of the Simplest Analytical Element," *Acs Nano*, vol. 4, pp. 4487-4494, 2010.

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: Andrei Kolmakov
Email Address: akolmakov@physics.siu.edu
Academic Department: Phyiscs
University Affiliation: Southern Illinois University at Carbondale
Research Area of Focus: Nanotechnology, sensorics, imaging

(2) Attendee Contribution to the Conference

Title of Presentation: DESIGNS AND TETS OF THE NANOWIRE BASED ELECTRONIC NOSES: FROM NANOWIRE NETWORK TO A SINGLE NANOBELT AS SENSING ELEMENTS
Presentation Type (Platform or Poster): Platform
Name of Session Where Presented: ARCHITECTURE DESIGN FOR SENSOR PLATFORMS

Brief Description of the Research Presented (100 words or less):

The progress in the development of the nanowire based electronic micro analytical systems for chemical sensing is described. The design evolution of the sensing elements from random nanowire network to ultimately small single nanowire is described. The performance and perspectives of such devices is analyzed.

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:

I have presented three talks in ARCHITECTURE DESIGN FOR SENSOR PLATFORMS, MICRO-TO-NANOSCALE CHARACTERIZATION, BIO-NANO SENSORS and apparently
listened most talks on these sessions. In addition I found interesting to attend few talks which are related to the research we are doing in my group. Namely in NANO-ELECTRONICS & NANO-OPTICS (talk on ULTRA-LOW POWER INTERCONNECTS FOR NANOELECTRONICS), in CONTROL OF MATTER AT THE NANOSCALE talk by Babak on SURFACE-DIRECTED VAPOR-LIQUID-SOLID (SVLS) GROWTH PROCESS: OPPORTUNITIES AND CHALLENGES IN SCALABLE NANOWIRE ASSEMBLIES, UNCOOLED NANOMETRIC SCALE BOLOMETER SYSTEM FOR THZ SENSOR ARRAY by Aleksander Sesek, EXTREME ULTRAVIOLET NANOSPECTROMETRY IMAGING FOR SINGLE CELL COMPOSITION MAPPING by Carmen Menoni.

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

There were many reports which I liked, in particular I was very impressed by the research reported by: Eric Pop on heat distribution in nanodevices which directly related to our self-heated nanoscopic chemical sensors. An iteresting talk was on microsphere light traps for SERS. It was very educational to hear the talk of James Klemic on current status and needs of forensics.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

I had very important interactions and side discussion which potentially will evolve in to collaborative projects or external funds. In particular my conversation with Dr. Klemic from MITRE refined my understanding where to apply for grants for my "encapsulation" project. With Dr. Babak Nikoobakht (NIST), Prof. Alexander Sinitskii (U. Nebraska Lincoln) and Prof. Carmen Menoni (Colorado State Uni.) we decided to pursue the collaborative projects on graphene based electronic nose, epitaxial nanowires based sensors and in situ/in vivo microscopy of wet samples correspondingly. There were also very educational meetings with Mordechai Rotschild and Theodore Fedynshyn (MIT) and Prof. Holger Schmidt (Santa Cruz). The latter introduced me to teh field of modern sinsing with microfluidics where we potentially can contribute with our encapsulation/imaging technology.

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2009 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

First of all I want to thank the organizers for having me there and partial financial support.
I had an opportunity to expose three of our main research directions to the DDS community.
The conference was well organized and was up to its mission. I met interesting people and established cooperation which I am sure will result in good research and technology. Unfortunately I was not able to meet with keynote speakers due to flights delays and cancelation because of weather conditions.
On a critical note I would like to advice (and ready to help) to conduct a better search and selection of invited speakers. It was a bit strange to see 25 min invited talk on gas sensorics from the person who is not known in in the gas sensor society. The selection of topics and their partitioning also require some more work: deep breakthrough research was followed by narrow insignificant contribution.
In spite of these minor drawbacks, this is a nice conference where we participate since 2009 and I wish to support it by all means.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Laurisa London
Affiliation: Clark Atlanta University
Email: laurisalondon@gmail.com

Authorized reimbursement:

$1250.00

Send Check to:

Laurisa London
753 Lynn Milan Ln
Conyers, GA 30094

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Laurisa London
Affiliation: Clark Atlanta University
Email: laurisalondon@gmail.com

Dear Ms. London,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

(1) Reimbursement of the Full Conference Registration Fee of $250.00.
(2) An Allowance of up to $350.00 to cover Travel to/from the Conference.
(3) An Allowance of up to $650.00 to cover accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

IMPORTANT NOTE: To obtain the financial reimbursements listed in (1) (2) and (3) above you must submit the attached Travel-Assistance Form (i.e., NANO-DDS-11-TAF) and all associated receipts after attending the conference. It will also be necessary to follow all the instructions that are included on the NANO-DDS-11-TAF form in completing and submitting the form and substantiating receipts in order to achieve the financial reimbursements. Finally, the conference is not able to provide any cash advances before the conference dates.

The organizers of the 2011 NANO-DDS Conference would like to recognize the U.S Army Research Office for sponsoring your travel.

Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

Fabrication of Functional Conductive Nanofibers composed of α,ω-bi-DNP-poly(2-methoxystyrene), polystyrene including single walled carbon nanotubes for studying material-cell interactions and Gold Nanoparticle/Synthetic Functional Polymer Nanofibers for Nanobiosensors

Omotunde Olubi,[1] Darkeyah Reuven,[1] Laurisa London,[1] Deepti Gadi,[2] Biswajit Sannigrahi,[1] Maher Atteya,[3] Michael Williams,[4] Barbara Baird, [2] Ishrat Khan ,[1] Malik Maaza[5]

[1] Department of Chemistry, Clark Atlanta University, Atlanta, GA

[2] Department of Chemistry and Chemical Biology, Cornell University, Ithaca, NY

[3] Department of Chemistry, Georgia Perimeter College, Clarkston, GA

[4] Department of Physics, Clark Atlanta University, Atlanta, GA

[5] iThemba LABS, Somerset West, Western Cape Province, South Africa

ABSTRACT

Conductive fibers decorated with α,ω-bi-DNP (dinitrophenyl) groups capable of specifically binding with anti-DNP IgE have been prepared by electrospinning a solution of α,ω-bi-DNP-poly(2-methoxystyrene), polystyrene and single walled carbon nanotubes (SWCNT). The nanowires (200nm) were electrospun onto a silicon wafer substrate at a voltage of 10kV using either DMF or chlorobenzene. The bi-nitrophenyl (DNP)-functional groups were tethered to the fibers via oligo (oxyethylene) spacers. A (water and ethanol) solution consisting of poly (vinyl alcohol) and gold nanoparticles (AUNPs) were electrospun onto several substrates: glass, FTO, silicon, FTO on plastic and aluminum foil. The gold particle embedded fibers are being developed for photonic applications. The AUNPs (diameter ranged from between 3 - 43 nm in size) used in the preparation of the fibers were prepared by two methods: the liquid - liquid interface method and the one-phase synthesis technique. The α, ω-bi-DNP-poly (2-methoxystyrene) functional polymers were synthesized in the lab by first preparing the α, ω-di-hydroxyl-poly (2-methoxystyrene) by living anionic polymerization, followed by the functionalization of the di-hydroxyl polymer with the DNP functional group. The functional polymers have been characterized by ^{1}H and ^{13}C NMR, FT-IR, DSC, GPC, SEM, and TEM. Furthermore, we have also prepared conductive (based on polypyrroles) nanowire structures decorated with functional (DNP) groups capable of specifically engaging target anti- DNP IgE and IgE on mast cell surfaces. The binding affinity of nanowires containing 1% single-walled Carbon Nanotubes with anti-DNP IgE has been studied via fluorescently labeled FITC-IgE. The success achieved so far in this investigation suggests the possibility of developing functional nanofibers as the active component in biosensors.

Laurisa London
Clark Atlanta University Dept. of Chemistry
Platform presenter: paper ID # 210
Section III. Device & Sensor/ System Functionality
9/9/2011

Summary of the Nano-DDS Conference

Attending the Nanoelectronic Devices for Defense and Security (Nano-DDS) Conference allowed me to experience new evolving research and development activities that have a unique purpose for national defense and security in the future. Nanostructures have wide range of technological applications in electronic, photonic, catalytic, biomedical and water purification industries. The rapid increase in Nanoscience is due to the ability to exploit their fundamental properties at a nanoscale level; whereas would be improbable in parent bulk material.

Attending the technical sessions fostered new ideas that were applicable to my research. At section: IV. Materials, Fabrication and Integration for Sensor/System Architectures technical program I was very intrigued by the talk on *Different Metal Oxides Modified ZNO Nanowire Arrays for Highly Sensitive and Selective Gas Detection* given by Haiqiao Su. Su's research was based around the development of highly selective gas sensors using different materials. In2O3, SnO2 and WO3 were sputtered onto ZNO nanowire surface to target H2S, NO2, CO, NH3 and H2 gases.

Su et al. investigations are similar to the research that is currently being carried out in my research group. Our focus is on the direct need to identify and quantify numerous biological molecules during prognostic and evaluation of complex diseases

such as cancer. Specifically, my research is to create a biosensor capable of detecting bimolecular interactions. Both Su's and my research purposes are to develop sensor materials. I am utilizing a straight forward and cost-effective technique known as electrospinning to create non-woven polymeric fibers small in diameter. In the future, I plan to look into the possibility of using a sputtering technique similar to the kind used by the Su group to produce polymeric fibers. I will also further evaluate Su's findings to hopefully gain a new approach to effectively characterize the nanowire or fiber materials.

In conclusion, the unique experience at the Nano-DDS conference allowed me to participate in academic forums geared towards new and exciting research. It also gave me an opportunity to network with others in the scientific community. I am now equipped with the knowledge gain from the conference to foster new ideas to bridge the gap between frontier and applications portions of the nanotechnology spectrum.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Jesus Paulo Perez
University: University of Utah
Email: jpaulo.perez@utah.edu

Dear Mr. Perez,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

(1) Reimbursement of the Full Conference Registration Fee of $250.00.
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The organizers of the 2011 NANO-DDS Conference would like to recognize the University of Maine and the National Science Foundation (NSF) for sponsoring your travel.

Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

SYNTHESIS OF AIR-STABLE, UNOXIDIZED, BORON AND ALUMINUM NANOPARTICLES USING BALL MILLING TECHNIQUES

Jesus Paulo L. Perez, Brandon McMahon and Scott L. Anderson

Department of Chemistry, University of Utah, Salt Lake City, Utah 84112

SUMMARY: Boron's high energy density and clean exhaust make it a prime candidate as a next generation energy source. When burned, it generates an amount of energy four times that produced per unit volume of gasoline. However, boron's refractory nature proves to be a hindrance in efficiently harvesting this energy. A layer of inert boron oxide immediately forms on its surface once exposed to air. Aluminum nanoparticles are also interesting from the perspective of explosives and propellants, but have the same problem of delayed ignition from passivation by a native oxide layer. Here we describe a simple, scalable approach to generating large quantities of boron and aluminum nanoparticles by ball milling. By controlling surface chemistry, we are able to produce particles that are unoxidized, but air stable under ambient conditions. Ball milling of amorphous boron powder with oleic acid and liquid hexane using tungsten carbide balls and jar yields hydrocarbon and JP fuel-soluble, unoxidized boron nanoparticles that are in the 50 – 100 nm range, as characterized by scanning electron microscopy (SEM) and dynamic light scattering (DLS). Surface oxidation states of the functionalized boron were studied by X-ray photoelectron spectroscopy (XPS). The oleic acid forms a passivating layer that prevents oxidation of the boron by ambient oxygen. By changing the organic capping agent, it is possible to generate particles with dispersibility/solubility in different liquids, including polar solvents or propellant/explosive binders, water, and ionic liquid rocket propellants. Air-stable, unoxidized, soluble/dispersible aluminum nanoparticles can also be produced rapidly by milling, although a significantly different approach is required, both because aluminum is quite ductile, and because it has very high oxygen affinity. Results demonstrating air stability, as well as ready oxidation when heated, will be presented.

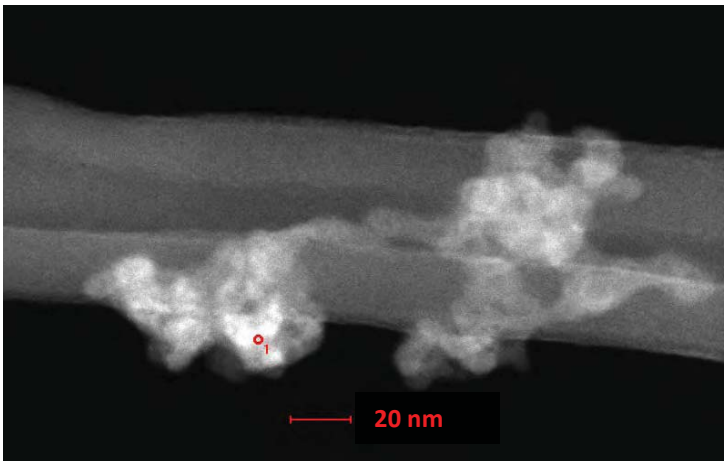

Figure 1. STEM image of functionalized boron nanoparticles. Red circle was confirmed to be Boron by EELS.

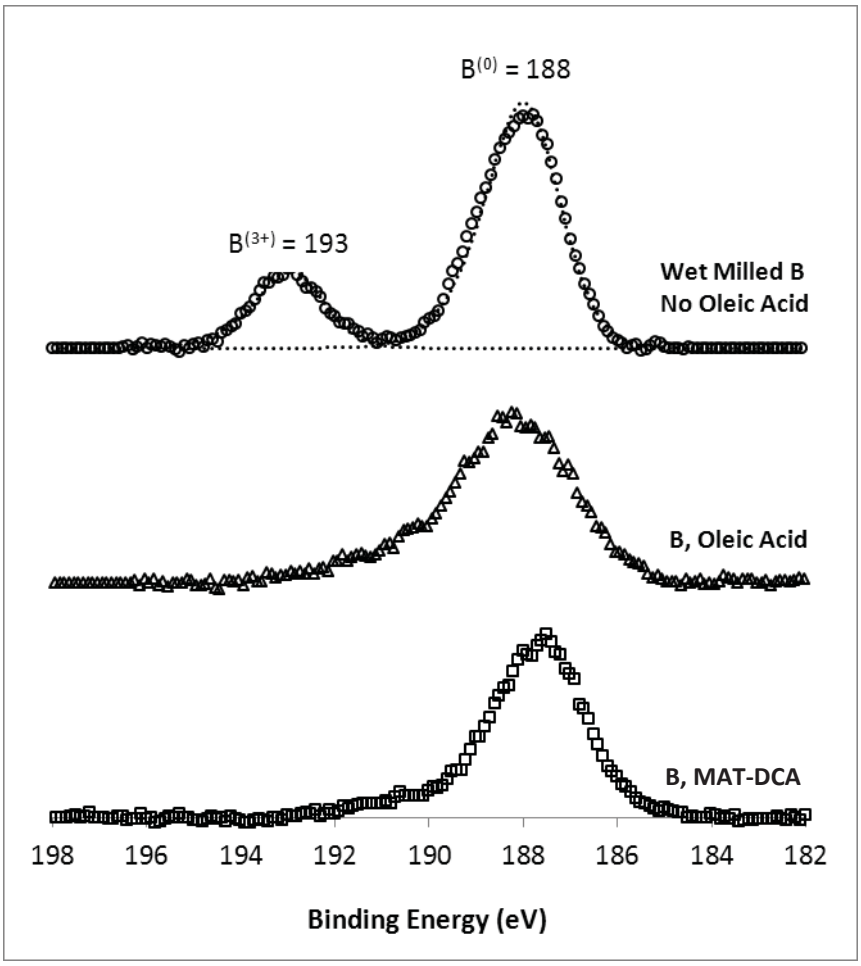

Figure 2. X-ray photoelectron spectra of Boron nanoparticles with different capping agents

Nano-DDS Registration receipt

X Inbox X

paulo to me show deta

I guess this is the registration receipt. Let me know if I forwarded the right one.

Paulo

-------- Original Message --------
Subject: Nano-DDS Registration
Date: Wed, 24 Aug 2011 13:34:44 -0600
From:NYU-Poly <registration@nano-dds.com>
To:JESUS PAULO LEYESA PEREZ <jpaulo.perez@utah.edu>

Thank you for registering for NANO-DDS 2011

The charge is for the "2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference" located at the Polytechnic Institute of New York University, Brooklyn NY, from Aug 29 - Sept 1, 2011

Please direct any billing questions to the conference manager at:
EMAIL: registration@nano-dds.com; or TEL: 718-260-3986.

REFUND POLICY:

All cancellation requests must be in writing and must contain full contact information - please FAX to Ms. Holly Halmo of NYU-Poly (FAX #: 718-269-3896), or email electronic letter (with signature) to registration@nano-dds.com. A $50 processing fee will apply to all cancellations.

Refunds are limited to 50% after July 24, 2011.

No Refunds after Aug 1, 2009.

Receipt information:

--Personal Information--
Attendee First Name: Paulo
Attendee Last Name: Perez
Affiliation / University: Department of Chemistry, University of Utah
E-Mail: jpaulo.perez@utah.edu
Phone: 8015853282
Fax:

--Billing Information--
Address Line 1: 115 South 1400 East
Address Line 2:
City: Salt Lake City
State / Province / Region: UTAH
Zip / Postal Code: 84112

Banquet: One Banquet Ticket ($45)
Conference Package: Student Conference Registration ($250) [Subject to verification]
Name on Credit Card: Paulo Perez

Reply Forward

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY
Travel-Assistance Form

Full Name (First, Middle Initial, Last): Jesus Paulo L. Perez
Work Telephone: 801-585-3282 ; **Home Telephone:** 801-835-2092
Street Address*: 1261 Alameda Ave. Salt Lake City, UT
City: Salt Lake City ; **State:** Utah ; **ZIP:** 84102
Country: USA ; **EMAIL:** jpaulo.perez@utah.edu

This address will be used for mailing your reimbursement check.
Conference Registration Fee $250 + $45 banquet ticket fee

List of Hotel Accommodation Costs:

	Date(s)	Hotel Name & Location	Total Costs (include taxes)
(1)			
(2)			
(3)			
(4)			
(5)			

List of Associated Travel Costs (Examples: Airfare, Rental Car, Parking, etc.):

	Date(s)	Travel Cost Item	Total Costs (include taxes)
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			

PART I - INFORMATION FOR PREPARATION OF REIMBURSEMENT PACKAGE
(1) List all costs above.
(2) Prepare an attachment with receipts to substantiate all items listed above.

PART II - INFORMATION FOR SUBMISSION OF FORMS & RECEIPTS:
Complete Form and Fed-ex ORIGINAL receipts to:

ARO Attn: Dr. Dwight Woolard
4300 S. Miami Blvd.
Durham, NC 27703-9142 tel: (919)457-6069.

Please scan your originals for your records before sending them to ARO.

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: Jesus Paulo L. Perez
Email Address: jpaulo.perez@utah.edu
Academic Department: Chemistry
University Affiliation: University of Utah
Research Area of Focus: Boron Nanoparticle preparation for Fuel Applications

(2) Attendee Contribution to the Conference

Title of Presentation: Synthesis of Air-Stable, Unoxidized Boron and Al Nanoparticles Using Ball Milling Technique
Presentation Type (Platform or Poster): Poster
Name of Session Where Presented:

Brief Description of the Research Presented (100 words or less):

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2009 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

Attn: Dr. Dwight Woolard

Sir:

I was supposed to attend the recently concluded Nano DDS Conference in Brooklyn New York. It was made possible by the financial support given to me by the conference organizers. However due to hurricane Irene making a landfall on New York on Sunday of that week, flight schedules were cancelled. I was hoping my airline can rebook me early so I can be at the conference the time before the poster presentation, which I was expected to attend and present my work. Unfortunately, Delta won't resume operation until Thursday, Sept.1 , which by that time the conference would have been concluded. I have no choice but to cancel my flight, my hotel reservation and also my attendance in the conference. With this I am hoping the Nano DDS organizers will also refund my registration fee and the banquet ticket fee. I hope that my circumstance will merit a full refund. Thank you very much.

Jesus Paulo L. Perez
Department of Chemistry
University of Utah
Salt Lake City 84112

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Holger Schmidt
University: UC Santa Cruz
Email: hschmidt@soe.ussc.edu

Authorized Reimbursement:

$1186.22

Send check to:

Holger Schmidt
712 Rosedale Avenue
Capitola, CA 95010

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Holger Schmidt
University: University of California-Santa Cruz
Email: hschmidt@soe.ucsc.edu

Dear Prof. Schmidt,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

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(3) An Allowance of up to $500.00 to cover accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

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The organizers of the 2011 NANO-DDS Conference would like to recognize the University of Maine and the National Science Foundation (NSF) for sponsoring your travel.

Best Regards,

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

Title: Ultrasensitive detection with planar optofluidic systems

Author: Holger Schmidt

I will review planar optofluidic approaches to ultrasensitive detection in liquids and gases. Hollow-core waveguide technology and their use for detection of bioparticles such as single viral pathogens and ribosomes will be reviewed. The opportunities and challenges to create complete optofluidic systems that include laser sources, fluidic handling and optical signal processing will be discussed.

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: HOLGER SCHMIDT
Email Address: hschmidt@soe.ucsc.edu
Academic Department: EE
University Affiliation: UC Santa Cruz
Research Area of Focus: Optofluidics

(2) Attendee Contribution to the Conference

Title of Presentation: Ultrasensitive detection with planar optofluidic systems
Presentation Type (Platform or Poster): Platform
Name of Session Where Presented: IV (S2)

Brief Description of the Research Presented (100 words or less): Described planar, optofluidic approaches to ultrasensitive detection in liquids and gases. Hollow-core waveguides and their use for single bioparticle detection such as viral pathogens and ribosomes were discussed. Opportunities and challenges to creating complete optofluidic systems including laser sources, fluidic handling and optical signal processing were discussed

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:

IV-B1 : Control of matter at the nanoscale
II-A : Nanoscale processes & interactions
IV-B1 : Sensing at the nanoscale
IV-S2 : Nanoscale lasers & photonic systems
III-C1 : Optoelectronic materials and devices

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

1) "Designed metal nanostructures and assemblies formed from scaffolded DNA origami"; A. Woolley (BYU). Learned state of the art for forming metal nanostructures from DNA templates; performance of metal nanowires and range of shapes that can be synthesized from DNA

2) "Self-organized III-V semiconductor microtube and nanowire lasers and integrated DNA sensors on a Si platform."; Z. Mi (McGill). Learned how tubes of InN or InN active laser material with smooth surfaces can be created, how the laser process works and what performance these structures had.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

I had discussions with numerous attendees that may result in future research collaborations (e.g. nanopore studies) or even new funding opportunities (e.g. SBIR on optofluidic detection systems).

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2009 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

The bulk my research deals with optofluidics, the combination of integrated optics with microfluidics in a single, chip-scale system. Our particular focus is on the use of liquid-core optical waveguides to create novel planar photonic structures that allow for analysis and manipulation of particles on the single molecule level with the convenience of an integrated optical environment using off-the-shelf fiber optics. The NANO DDS conference was important and relevant for this research in various aspects. First, it provided new insights into the APPPLICATIONS of our optofluidic technology, which lie in particle detection and sensing. Being able to attend a very broad range of talks that addressed sensing modalities and state-of-the art performance metrics in other systems will allow me and my colleagues to choose the on-chip sensing modalities for which our approach offers the biggest advantages, be it in terms of sensitivity, compactness, ease of use, etc. Secondly, the conference also provided excellent stimulation for a second area we are currently considering to expand our research: SYSTEM INTEGRATION. While most of my work has focused on the transduction mechanism of a sensing system, an important step towards moving forward is the addition of on-chip active devices such as laser sources to create a completely stand-alone detection platform. Talks on self-assembled semiconductor microtube lasers and metal-clad nanophotonic lasers, and in particular the heterogenous integration of these devices with passive silicon photonic environments have initiated a thought process that is certain to influence our own research in the next few years.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Sascha Vega-Alvarez
University: University of Puerto Rico-Mayaguez
Email: sascha.vega@upr.edu

Authorized Reimbursement:

$250.00

Mail check to:

Sascha Vega-Alvarez
Terranova St. 1195 Oasis Apt. A-1
San Juan, PR 00924

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Sascha Vega-Alvarez
University: University of Puerto Rico-Mayaguez
Email: sascha.vega@upr.edu

Dear Sascha Vega-Alvarez,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

(1) Reimbursement of the Full Conference Registration Fee of $250.00.
(2) An Allowance of up to $750.00 to cover Travel to/from the Conference.
(3) An Allowance of up to $475.00 to cover accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

IMPORTANT NOTE: To obtain the financial reimbursements listed in (1) (2) and (3) above the Conference Attendee must submit the attached Travel-Assistance Form (i.e., NANO-DDS-11-TAF) and all associated receipts after attending the conference. It will also be necessary to follow all the instructions that are included on the NANO-DDS-11-TAF form in completing and submitting the form and substantiating receipts in order to achieve the financial reimbursements. An abstract must be submitted and a brief post-conference critique must accompany your receipts to be eligible for payment. Finally, the conference is not able to provide any cash advances before the conference dates.

The organizers of the 2011 NANO-DDS Conference would like to recognize the U.S Army Research Office for sponsoring your travel.

Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY
Travel-Assistance Form

Full Name (First, Middle Initial, Last): Adnan Kapetanovic
Work Telephone: 206-685-3581 **; Home Telephone:** 206-854-3157
Street Address*: 14035 33rd Avenue South
City: Tukwila **; State:** WA **; ZIP:** 98168
Country: USA **; EMAIL:** kapeta@uw.edu

This address will be used for mailing your reimbursement check.
Conference Registration Fee $250.00

List of Hotel Accommodation Costs:

	Date(s)	Hotel Name & Location	Total Costs (include taxes)
(1)			
(2)			
(3)			
(4)			
(5)			

List of Associated Travel Costs (Examples: Airfare, Rental Car, Parking, etc.):

	Date(s)	Travel Cost Item	Total Costs (include taxes)
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			

PART I - INFORMATION FOR PREPARATION OF REIMBURSEMENT PACKAGE
(1) List all costs above.
(2) Prepare an attachment with receipts to substantiate all items listed above.

PART II - INFORMATION FOR SUBMISSION OF FORMS & RECEIPTS:
Complete Form and Fed-ex ORIGINAL receipts to:

ARO Attn: Dr. Dwight Woolard
4300 S. Miami Blvd.
Durham, NC 27703-9142 tel: (919)457-6069.

Please scan your originals for your records before sending them to ARO.

---------- Forwarded message ----------
From: **NYU-Poly** <registration@nano-dds.com>
Date: Wed, Aug 10, 2011 at 8:12 PM
Subject: Nano-DDS Registration
To: sascha.vega@upr.edu

Thank you for registering for NANO-DDS 2011

The charge is for the "2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference" located at the Polytechnic Institute of New York University, Brooklyn NY, from Aug 29 - Sept 1, 2011

Please direct any billing questions to the conference manager at:
EMAIL: registration@nano-dds.com; or TEL: 718-260-3986.

REFUND POLICY:

All cancellation requests must be in writing and must contain full contact information - please FAX to Ms. Holly Halmo of NYU-Poly (FAX #: 718-269-3896), or email electronic letter (with signature) to registration@nano-dds.com. A $50 processing fee will apply to all cancellations.

Refunds are limited to 50% after July 24, 2011.

No Refunds after Aug 1, 2011.

Receipt information:

--Personal Information--
Attendee First Name: Sascha
Attendee Last Name: Vega Alvarez
Affiliation / University: University of Puerto Rico Mayaguez
E-Mail: sascha.vega@upr.edu
Phone: 787-240-8602
Fax:

--Billing Information--
Address Line 1: Terranova st. 1195
Address Line 2: Oasis Apt. A-1
City: San Juan
State / Province / Region: PR
Zip / Postal Code: 00924

Banquet: One Banquet Ticket ($45)
Conference Package: Student Conference Registration ($250) [Subject to verification]
Name on Credit Card: Sascha M Vega Alvarez

Drosophila as an economical test platform for nanomaterial assessment

Sascha Vega-Alvarez[1], Adriana Herrera[2], Carlos Rinaldi[2], Franklin A. Carrero-Martinez[1, 3]

[1]Department of Biology, [2]Department of Chemical Engineering,
University of Puerto Rico-Mayagüez, P.O. Box 9000, Mayagüez, Puerto Rico 00681-9000
[3]Department of Anatomy and Neuroscience, University of Puerto Rico, Medical Sciences Campus, P.O. Box 365067 San Juan, Puerto Rico 00936-5067

As new applications for nanomaterials emerge, there is growing demand for systems that assess both their applications and implications. It is desirable that these biological platforms inform whether nanomaterials are safe from an environmental, health, and safety standpoint. However, taking these issues into consideration early in the R&D process could inform and/or guide rational design strategies. This information is essential for future integration with sensor systems querying biological processes. Screenings in living organisms have been limited by economical considerations. Here we validate *Drosophila* as a test platform for nanomaterial testing in a developmental context (Fig. 1) and establish two interaction routes. First, a tissue-specific targeted assay that takes full advantage of single identifiable cells in *Drosophila* and in which we microtransfer nanoparticles into developing stage 15 embryos at the A5/A6 intersegmental boundary. Light microscopy shows that following stereotypical microimplantation, colloidally unstable nanoparticles aggregate towards the visceral musculature near the injection site and result in higher mortality rates. In contrast, colloidally stable nanoparticles exhibit lower affinity for visceral tissue and resulted in lower mortality rates. Second, a passive targeting assay is introduced to assess nanoparticles ability to cross biological barriers in both embryos and larvae. Our experiments show that nanoparticles are transported across embryonic membranes and have a strong tendency to aggregate around the visceral musculature. These experiments demonstrate *Drosophila* as a suitable low cost model in a system amenable to imaging and high-throughput screenings. Furthermore, the volumes of nanomaterial required are orders of magnitude smaller when compared to other model organisms for *in vivo* analysis.

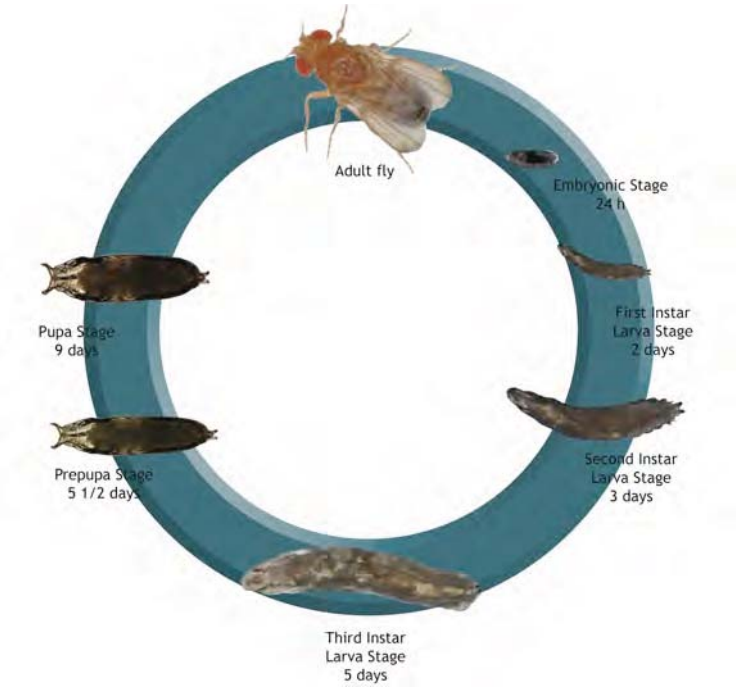

Figure 1: *Drosophila* life cycle.

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Chunlei Wang
University: Florida International University
Email: wangc@fiu.edu

Authorized Reimbursement:

$1097.22

Mail Check to:

Chunlei Wang
1060 Wilshire Circle West
Pembroke Pines, FL 33027

2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference
August 29- September 2, 2011
Brooklyn, NY

Name: Chunlei Wang
University: Florida International University
Email: wangc@fiu.edu

Dear Prof. Wang,

The organizers of the 2011 Nanoelectronic Devices for Defense & Security (NANO-DDS) Conference are pleased to be able to offer you support for attending the 2011 NANO-DDS Conference during the week of Aug. 29- Sept. 2, 2011 in Brooklyn, NY. Specifically, you will be allowed the following Attendee-Assistance support:

(1) Reimbursement of the Full Conference Registration Fee of $450.00.
(2) An Allowance of up to $300.00 to cover Travel to/from the Conference.
(3) An Allowance of up to $350.00 to cover (2) nights accommodations in the NYC metro area during the week of Aug. 29- Sept. 2, 2011.

IMPORTANT NOTE: To obtain the financial reimbursements listed in (1) (2) and (3) above the Conference Attendee must submit the attached Travel-Assistance Form (i.e., NANO-DDS-11-TAF) and all associated receipts after attending the conference. It will also be necessary to follow all the instructions that are included on the NANO-DDS-11-TAF form in completing and submitting the form and substantiating receipts in order to achieve the financial reimbursements. An abstract must be submitted and a brief post-conference critique must accompany your receipts to be eligible for payment. Finally, the conference is not able to provide any cash advances before the conference dates.

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Best Regards

Dr. Greg Recine
2011 NANO-DDS
Conference Manager

2011 Nanoelectronic Devices for Defense & Security
Aug 29-Sept 2, 2011, Brooklyn, NY

Please Complete All Items Below and Provide Details Where Relevant.

(1) Attendee Information

Name: Chunlei Wang
Email Address: wangc@fiu.edu
Academic Department: Mechanical and Materials Engineering
University Affiliation:
Research Area of Focus: Energy / MEMS / sensor

(2) Attendee Contribution to the Conference

Title of Presentation: Design. Fabrication and Evaluation of Micro super capacitor
Presentation Type (Platform or Poster): poster.
Name of Session Where Presented: Tuesday poster session

Brief Description of the Research Presented (100 words or less):

We present our recent work on design. building and testing super-capacitors based on C-MEMS technology. Integration of carbon nano materials were highlighted in the presentation.

(3) Attendee Activities at the Conference

Please List the Name of Relevant Sessions that were Attended at the Conference:

- attend "II sensor & systems applications" on Aug 30.
- attend poster session on Aug 30
- attend "Materials. Fabrication and integration for sensors"
  8/31 "Device concepts & sensor Functionality" System Architec
- 9/1: "Device Concepts & Sensor / system Functionality"

Please Identify at Least Two Presentations that were on subjects that: (a) provide new insights that will benefit you in your research activities; or (b) that were of personal interest to you, and give some specific details on what you learned:

I attend two most interesting talks:

① "on-chip Optical resonators for single nanoparticle detection and measurement

② Dr. Seaman's lunch seminar.

The first talk gave a nice overview of the optical resonator based single nanoparticle detection with excellent theoritical and experimental results.

Second talk is very inspiring, especially for junior faculty to think about research topic / interest.

Please Comment on any Special Iterations (e.g., side discussions with other attendees) and describe the potential benefit you believe you will derive from this activity:

It is a very good conference, where I got chance to talk to several project managers and industry persons. The co-orgnizer came to ask and guide me to network with others. I really appreciate the very helpful conference orgnizers.

(4) Attendee Narrative on Conference Attendance

Please write a 200-400 word narrative that describes how your experiences at the 2009 NANO-DDS Conference will benefit your academic training and/or influence your research in the future.

It is a wonderful conference, although many talks were cancelled because of weather reason. Compared to last two Nano-DDS conference, this time I could not meet many colleagues in energy field, but got good opportunity to attend sensor/device sessions. I believe it is very helpful for me to expend my research horitzon and initiate other ideas.

Dr. Seeman's seminar is very inspiring, especially when he mentioned about beginning struggles when he was in tenure-track position. I admire his great effort on assembly of DNA 3-D crystal structures and nanobots. His conceptual work and further application in DNA computing were the biggest contribution in the DNA nanotechnology. I am glad being in this seminar.