SPIE UNM Chapter Annual Report

December 2009

The University of New Mexico SPIE Student Chapter

Light up your Life!!

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Chapter Goals:

We aspire to create a sense of community for our members through activities such as outreach projects, BBQ dinners and technical events. Our mission is also not to lose sight of the individual in an entire crowd, but to nurture intellectual growth especially in the field of light through talks, exposure to others in the field through SPIE conferences, journals, and digital libraries.

History of the Chapter:

Our SPIE chapter at UNM began in August 2006 with 12 students. This student body went on to elect 4 student officers in September 2006 that remained until December 2007 when a new set of officers were elected. Ever since then we have continued the tradition of officer elections in December. Our current officers are listed below. Throughout the existence of this organization we have had the honor of having Prof. Sanjay Krishna as our chapter advisor and mentor. His support and vision has been the driving force behind our success.

2008 Officers of the Chapter:

President: Stephen Myers - smyers@chtm.unm.edu

Vice President: Ajit Barve - ajitvb1@gmail.com

Secretary: Maya Narayanan Kutty- mnkutty@unm.edu

Treasurer: Freddie Santiago - fred.san@gmail.com

Chapter Advisor:

Dr. Sanjay Krishna – skrishna@chtm.unm.edu
# List of Current Members:

<table>
<thead>
<tr>
<th>Number</th>
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<td>1</td>
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<td>31 December 2009</td>
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<td>Fei-Hung Chu</td>
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<td>Erika Cooley</td>
<td>25 June 2010</td>
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<td>Nutan Gautam</td>
<td>27 September 2010</td>
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<td>5</td>
<td>Jeff Hunker</td>
<td>30 September 2010</td>
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<tr>
<td>6</td>
<td>Hasul Kim</td>
<td>9 July 2010</td>
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<td>7</td>
<td>Sunish Mathews</td>
<td>28 February 2010</td>
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<td>8</td>
<td>Stephen Myers</td>
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<td>9</td>
<td>Maya Narayanan Kutty</td>
<td>30 September 2010</td>
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<td>10</td>
<td>Nishant Patel</td>
<td>13 April 2010</td>
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<td>11</td>
<td>Alex Raub</td>
<td>28 February 2010</td>
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<td>12</td>
<td>Freddie Santiago</td>
<td>31 December 2009</td>
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<td>13</td>
<td>Paul Schanwald</td>
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<td>14</td>
<td>Andreas Schmitt-Sody</td>
<td>18 October 2010</td>
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<td>15</td>
<td>Jiayi Shao</td>
<td>8 January 2010</td>
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<td>16</td>
<td>Svyatoslav Smolev</td>
<td>31 January 2010</td>
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<tr>
<td>17</td>
<td>Andreas Velten</td>
<td>19 February 2010</td>
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Chapter Events:

In 2009, we at the UNM chapter of SPIE have had the privilege of organizing two major events at UNM.

1. SouthWest Optics Student Conference (SWOSC):

   The first annual Southwest Optics Student Conference was held this year at the University of New Mexico. This event was a great opportunity for students across the Southwest to interact with other students from numerous universities in the region. The conference also enabled interaction with industry and national lab representatives who were attending the Mirror Tech Days Workshop which was held jointly with the student conference. The program contained many exciting events. First, there were lab tours at CVI Melles Griot, Emcore, AMO wavefront, and Schott Solar. Second, our keynote speaker was Dr. Phillip Wyatt, who talked about the combination of research and industry. Third, our technical talks and poster sessions encouraged interaction with peers and professionals. The conference was concluded with a panel discussion about what future employers expect from students before they apply to work for them. In the future, we hope this event will continue, alternating among the different Southwestern universities. The panel included Professor Steven R. J. Brueck Director of the Center for High Technology Materials, Professor Luke Lester UNM General Chair for Optical Science and Engineering, Dr. Jim McNally Chairman for the New Mexico Optics Industry Association, Dr. Eileen V. Ryan Director of the Magdalena Ridge Observatory, Dan Ronneau Deputy Director of the Integrated Military Systems Development Center at Sandia National Laboratories, and the panel was moderated by Dr. David Wick an optical engineer working in Integrated Military Systems at Sandia National Laboratories.
2. CHTM Silver Celebration Event:

The Center for High Technology Materials (CHTM) celebrated its 25th anniversary this year in which there was organized a special technical symposium, a CHTM open house, and a social event for CHTM alumni. The SPIE student chapter organized the lab tours and CHTM along with a poster session to show case the work that is done at CHTM by graduate students.
Chapter Activities:

1. SPIE Talks

   All the talks were hosted at CHTM’s conference room based on the UNM south campus. A light lunch was provided at most of the talks by the SPIE-UNM chapter.

   i. “Electron Spin Injection and Transport in Semiconductors” by Dr. Daryl Smith

   On 25th of March 2009 we had the opportunity to organize the first talk of the year given by Dr. Daryl Smith of Los Alamos National Laboratory, Los Alamos, NM. An author of more than 200 papers, Dr. Smith has been leading figure in the field of Infrared detectors. The talk mainly focused on his work on optical and electrical spin injection in inorganic semiconductors. It also comprised of contrast considerations for spin injection in inorganic and organic semiconductors.

   SPIE/OSA Talks: The following talks were carried out in partnership with the UNM-OSA chapter.

   ii. “Untwinkling of the Stars: The History and Practice of Adaptive Optics” by Dr. Sergio Restaino

   We had the opportunity to organize a talk by Dr. Sergio Restaino of the Naval National Laboratories, Albuquerque, NM, on April 3rd 2009. A fellow of SPIE, Dr. Restaino currently serves as the section head for the Wavefront Sensing and Control Section of the Remote Sensing Division of the Naval Research Laboratory along with being an author and co-author of over 150 scientific papers and three books. In his talk, Dr. Restaino briefly reviewed the history of adaptive optics, the main sources of aberrations, and their effect on an imaging system, along with reviewing some of the more common wavefront sensing and correction systems.
He also presented experimental results from various Adaptive Optics systems and applications and concluded with a view forward of what the future research topics are for this ever growing area of research.

iii. “VCSELs for Atomic Clocks” by Dr. Darwin K. Serkland

On May 6th 2009, we organized the talk by Dr. Serkland, who leads a team at Sandia National Laboratories, Albuquerque, NM, working on research and development of surface-normal compound-semiconductor optoelectronic devices, including vertical-cavity surface-emitting lasers, electro-absorption modulators, resonant-cavity photodiodes, and their integration with micro-optics. The talk described VCSEL requirements for CPT-based atomic clocks, which include single mode operation, single polarization operation, modulation bandwidth > 4 GHz, low power consumption (for the CSAC), narrow linewidth, and low relative intensity noise (RIN).

iv. “Introduction to FDTD and its Applications to Optics” by Jamesina Simpson

Prof. Jamesina Simpson from the Department of Electrical and Computer Engineering at University of New Mexico, Albuquerque, NM gave us a talk on July 29th 2009. Prof. Simpson's work has spanned applications ranging from geophysically induced electromagnetic propagation and phenomena in the Earth-ionosphere system, to electromagnetic compatibility issues arising in compact portable electronic devices and to optical interactions with living tissues.

v. “Ultrashort laser pulses” by Dr. Wolfgang Rudolph
On October 23rd 2009, we organized a talk by Prof. Wolfgang Rudolph who is Professor in the Department of Physics and Astronomy and the Department of Electrical Engineering and has been appointed as a Regents' Professor since 2006 at University of New Mexico, Albuquerque, NM. Dr. Rudolph's awards and honors include Gustav Hertz Prize of the National Physical Society (1988), Prize of the Faculty of Natural Science (1989) and Fellow of the Optical Society of America. He has published more than 130 refereed and invited articles and co-authored two books including Ultrashort Laser Pulse Phenomena. His presentation described the ongoing research of his group to understand laser induced breakdown of dielectric materials (laser damage), to produce femto-seconds (fs) beams with orbital angular momentum, and to explore fs four-wave mixing microscopy.

vi. “Recent Success of SLS FPAs and MDA’s new direction for development” by Dr. Meimei Tidrow

On November 4th 2009, we organized a talk by Dr. Meimei Tidrow of the Missile Defense Agency (MDA), Ft. Belvoir, VA. Dr. Tidrow holds the highest technical rank ST (Senior Technical Professional) in US government at the Army Night Vision Lab. Her presentation discussed the most recent progress made in Strained layer Superlattices (SLS) along with discussion on MDA’s new direction for this technology development. She also talked about the plan to use a horizontal integration approach instead of adhering to the existing vertical integration model. This new horizontal approach is explored to increase the number of industrial participants working in SLS, and leveraging the existing III-V semiconductor foundries.

vii. “III-Sb lasers on GaAs using interfacial misfit dislocation arrays” by Prof. Ganesh Balakrishnan

On November 13th 2009, we organized a talk by Prof. Ganesh Balakrishnan of Electrical and Computer Engineering at University of New Mexico, Albuquerque, NM. This presentation overviewed the role of Interfacial Mis-Fit (IMF) technology in the development of a novel high-power vertical external cavity surface emitting lasers (VECSELs) for Mid-IR operation with an InGaSb QW
active region \((a_0 = 6.09 \text{ Å})\) on a GaAs/AlGaAs Distributed Bragg Reflector (DBR) \((a_0 = 5.65 \text{ Å})\). The talk also took a comprehensive look at the factors that affect the residual threading dislocations in such a growth mode and discussed strategies to achieve sub- \(5 \times 10^5\) threading dislocations/cm\(^2\).

viii. “Femtosecond Laser Technologies for EUV and X-ray sources” by Dr. Franz X. Kärtner (MIT)

SPIE/OSA UNM chapters were privileged to organize a talk on November 20\(^{th}\) 2009 by Dr. Kärtner of Massachusetts Institute of Technology (MIT) at Dane Smith Hall on UNM Main Campus. In this presentation, he discussed some of the laser technologies and physics central to fully coherent soft and hard x-ray sources that range from table-top size to kilometer long seeded FELs sources. He also talked about the scaling of seed radiation in the EUV and XUV generated via high harmonic generation along with discussing his group’s progress in the development of large average power few-cycle optical parametric chirped pulse amplifiers in the 800 nm to 2 micron range for driving the harmonic generation process. He concluded his talk by discussing the first results on a 2 micron drive laser system and power scaling with cryogenically cooled Yb: YAG.

2. SPIE/OSA BBQ

The SPIE/OSA Fall BBQ was held on the first Friday of the semester, Aug. 28th at the Physics and Astronomy building on North campus. It is an opportunity for chapter members and non-members to mingle in an informal setting. It also gives us an opportunity to show case the student organizations and recruit new members.
3. Outreach

i. New Mexico State Fair (September 18, 2009):

Each year the New Mexico State fair dedicates a day to science & technology. This year the UNM SPIE student chapter along with the OSA student chapter and the department of optical sciences and engineering hosted a booth and offered demonstrations of light and optics at the event. This day on average has an attendance of three thousand people. Kids of all backgrounds got the opportunity to experiment with beads that change color when exposed to UV light, a camera that sees infrared, the inner workings of a telescope, the mysteries of kaleidoscopes and much more.
ii. **American Indian Science & Engineering Society (AISES) camp (June 19th, 2009):**

The American Indian Science and Engineering Society and UNM hosted a summer science camp program this year for elementary and middle school students. The UNM SPIE student chapter assisted Professor Olga Lavrova, of the department of electrical and computer engineering, educate students on matters of alternative energy sources especially solar power. The students engaged in presentations of solar power and constructed projects that incorporated solar panels to power toy cars and animals.
iii. UNM School of Engineering Open House (November 14, 2009):

Every year the UNM School of engineering hosts an open house in which potential UNM students visit with current UNM undergraduate and graduate students. This year SPIE worked with the department of electrical and computer engineering to introduce students to the life and research of students working in optics and engineering related fields.


This year SPIE officers mentored high school and undergraduate students. Ajit Barve mentored a student from India as part of the Expanding Your Engineering Skills (EYES) program which offers internships for international students. Stephen Myers mentored a student from La Cueva High School which is a local high school in Albuquerque.
4. **SPIE Student Chapter Travel Grant**

Maya Narayanan Kutty received the SPIE Chapter Officer Travel Grant to attend the 54th SPIE Annual Conference and the Leadership Workshop in August 2009 in San Diego, California. This grant aided her to present her work at the Annual Meeting and gave her the opportunity to interact and learn from others in her field of research. The Leadership Workshop allowed her to connect with officers of SPIE student chapters from around the world, facilitating exchange of ideas and leading to collaboration with other chapters.

**Member Contributions:**

Our Chapter members have been hard at work and highly successful in publishing a plethora of papers this year. The following is a brief list of publications they have contributed to in 2009 alone.

**2009 Publications:**

1. Chapter Member Alexander Albrecht submitted “Photoluminescence investigation of InAs quantum dots incorporating D Wellsell structures on patterned and planar GaAs (100) substrate” (Conference Proceedings)
   Authors: B. Liang, P. S. Wong, B. V. Dorogan, et al.
   Published: 17 Feb 2009

2. Chapter Member Arezou Khoshakhlagh submitted “Long wavelength InAs/GaSb superlattice detectors based on nBn and pin design”, SPIE Conference Proceedings,
   Authors: A. Khoshakhlagh, H. Kim, S. Myers, et al.
   Published: 06 May 2009

3. Chapter Member Hasul Kim submitted “Improved performance of InAs/GaSb strained layer superlattice detectors with SU-8 passivation” SPIE Conference Proceedings,
   Authors: H. S. Kim, E. Plis, S. Myers, et al.
   Published: 09 Sep 2009

4. Chapter Member Sunish Mathews submitted “Experimental demonstration of a ferroelectric liquid crystal tunable filter for fast demodulation of FBG sensors” (Conference Proceedings)
   Authors: Sunish Mathews, Yuliya Semenova, Ginu Rajan, et al.
   Published: 18 May 2009
5. Chapter Member Sunish Mathews submitted “Tunable properties of liquid crystal filled photonic crystal fibers” (Conference Proceedings)
   Authors: Sunish Mathews, Yuliya Semenova, Ginu Rajan, et al.
   Published: 27 Apr 2009


7. Chapter Member Maya Narayanan Kutty submitted “Investigation of multi-stack quantum dots-in-double-well infrared detectors” (Conference Proceedings)
   Authors: M. N. Kutty, Y. Sharma, A. Barve, et al.
   Published: 09 Sep 2009

8. Chapter Member Freddie Santiago submitted “Characterization and training of a piezoelectric deformable mirror for operation at 1550 nm” (Conference Proceedings)
   Authors: Carlos Font, G. Charmaine Gilbreath, Blerta Bajramaj, et al.
   Published: 09 May 2009

9. Chapter Member Freddie Santiago submitted “The Naval Research Laboratory MEM adaptive optics program” (Conference Proceedings)
   Authors: Sergio Restaino, Ty Martinez, Jonathan Andrews, et al.
   Published: 23 Feb 2009

10. Chapter member Jiayi Shao submitted “Demonstration of the quantum dot avalanche photodiode (QDAP)” (Conference Proceedings)
    Authors: David Ramirez, Jiayi Shao, Majeed Hayat, et al.
    Published: 29 Apr 2009

**2009 Conference Presentations:**

11. Chapter Member Stephen Myers submitted “Heterostructure Engineering in Type II InAs/GaSb Strained Layer Superlattices” 2009 International Symposium on Compound Semiconductors

Future Activities:

1. Election of New Officers:

We intend to hold a pizza party in December at the end of the Fall-2009 semester to appreciate our chapter members for all their support and hard work in organizing events, activities and outreach programs throughout the year. We hope to take this opportunity to elect 4 new officers for the term of 2010.

2. Outreach Collaboration with SPIE/OSA Stanford Chapter:

We are currently partnering with the SPIE/OSA Stanford chapter on their 2010 Student Photography Contest. This contest has been an excellent outreach tool as it is geared towards pre-university students, bringing about an effective way of stimulating interest in optics.

Financial Summary:

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