Phononics 2011

1st International Conference on Phononic Crystals, Metamaterials & Optomechanics

May 29-June 2 2011, Santa Fe, New Mexico, USA

Welcome from the Chairs of *Phononics 2011*

Ihab El-Kady
Sandia National Laboratories

Mahmoud I. Hussein
University of Colorado at Boulder

Dear Colleagues and Conference Participants,

We would like to thank you all for your participation in Phononics 2011: The First International Conference on Phononic Crystals, Metamaterials and Optomechanics – which is being held in Santa Fe, New Mexico, USA, from May 29 – June 2, 2011.

For decades there has been a strong passion within the physics and engineering communities for the study of the propagation of elastic and acoustic waves in periodic and nonperiodic media across different length scales. In recent years this interest has lead to the emergence of phononic crystals and acoustic metamaterials as new types of material systems with a potential to revolutionize many technological applications. In parallel, the conventional discipline of heat transfer has witnessed a strategic shift towards the nanoscale in pursuit of a more fundamental understanding of the underlying thermal phenomena. This transformation has been guided by the conviction that for best results a rigorous mechanistic description of phonon transport ought to be adopted. Optomechanics is another key area of research which studies coupled phenomena involving phonons. The coherent intersection between optical and mechanical waves lies at the micro/nanoscale. This area of research holds promise to solve important issues in the general field of optics and more specifically for photonic devices.

The rapid and simultaneous growth of these closely-related disciplines has provided a converging point of historical significance for the science of phonons. Two years ago, in June

2009, an International Workshop on Phononic Crystals was co-organized by Professors Ali Adibi and Abdelkrim Khelif. This workshop took place in Nice, France and was attended by around thirty experts in the field from around the world. Building on this effort, we along with our colleagues in the organizing committees felt it is timely to establish a larger international forum that unifies all the phonon-related areas by creating a conference where experts could interact and cross-fertilize. *Phononics 2011* - the first international conference of its kind - aims to fulfill this mission.

Phononics 2011 aims to bring together researchers with emphasis in both theory and experiments. As such, sessions cover theoretical studies, numerical simulations, fabrication, and characterization of appropriate structures. Furthermore, these areas can be broken down by their frequency ranges which entail different modeling approaches. More specifically, this conference covers seven themes: (1) Phononic crystals, (2) Phononic metamaterials, (3) Wave propagation in periodic structures, (4) Nanoscale phonon transport, (5) Phononic MEMS and RF applications, (6) Optomechanics, and (7) Fabrication and characterization for phononics. For more information on the conference and its themes, please visit the conference website at: *www.phononics2011.org*.

We hope that *Phononics 2011*, and the subsequent *Phononics 20xx* conferences which will take place on a biannual basis, will provide a unique avenue for dissemination and exchange of knowledge in all the themes related to phonons, across the different length scales and disciplines. It is our aspiration that this forum's participants will together lay the foundation for the emerging field of *phononics*.

Yours sincerely,

Ihab El-Kady
Sandia National Laboratories

Mahmoud I. Hussein
University of Colorado at Boulder

Albuquerque and Boulder, April 2011

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Phononics

2011

1st International Conference on Phononic Crystals, Metamaterials & Optomechanics

Information About the Conference

The study of phonons - although a core discipline in the conventional condensed matter physics literature - is currently being viewed in a new light. Whether examined at the nanoscale, microscale or larger scales, the analysis and manipulation of phonons (aka *phononics*) is opening up a new technological frontier with a potential impact that could match that of electronics almost half a century ago. Indeed a rival field, photonics, is gathering similar momentum. Looking closely, phononics encompass a range of interconnected disciplines, usually labeled in terms of the type of host "material" that provides the medium for phononic wave propagation. These include *phononic crystals*, *phononic metamaterials*, *crystalline materials* and *periodic structures*. The application domains that these phononic materials are impacting, with increasing promise, range from vibration isolation in MEMS components, through frequency sensing in RF communications, to nano-scale thermal transport control in semiconductors. With the recent advent of metamaterials, exotic applications are now added to the list such as acoustic cloaking and superlensing. The interaction of mechanical waves with their optical counterpart in a lattice, i.e., optomechanics, is opening up yet another barrage of opportunities especially in telecommunications.

Phononics 2011 provides a unique avenue for dissemination and exchange of knowledge in all the themes mentioned previously. In particular, the conference is divided into the following topical themes:

(1) Phononic crystals,

(2) Phononic metamaterials,

(3) Wave propagation in periodic structures,

(4) Nanoscale phonon transport,

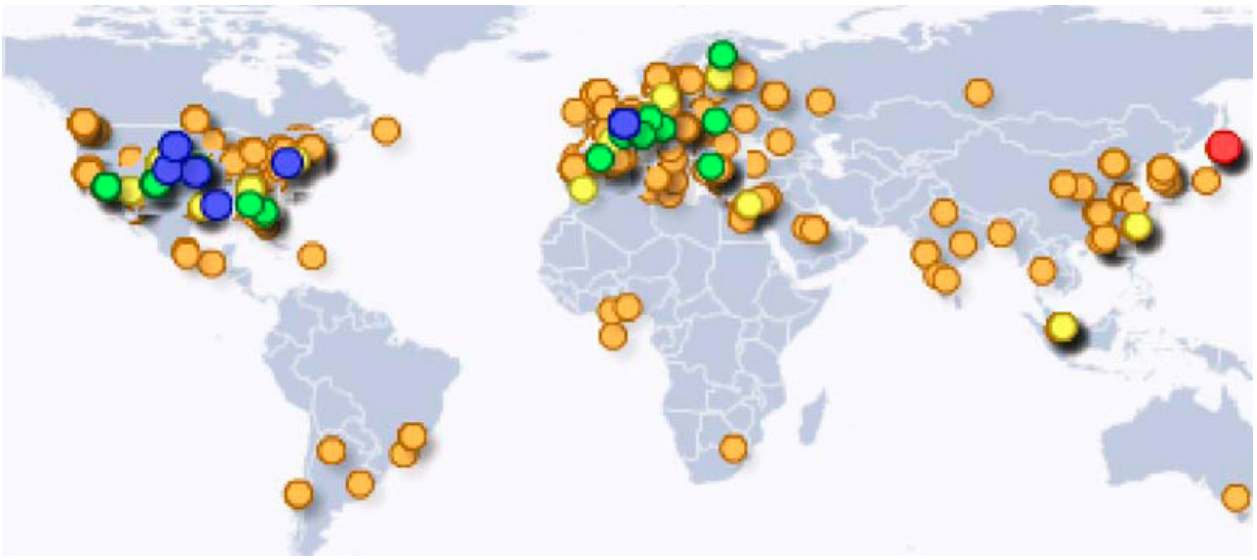
(5) Phononic MEMS and RF applications,

(6) Optomechanics,

(7) Fabrication and characterization for phononics

The number of abstracts submitted to the conference exceeded 180, including over 60 distinguished invited speakers, and represent a large number of nations from across the globe. The figure below captures the geographical distribution of the most recent visitors to the conference website (in April 2011). Furthermore, the *Felix Bloch Lecture* is being inaugurated at *Phononics 2011* as a named lecture to honor researchers who have made outstanding contributions to the field. More information on the Felix Bloch lecture and this year's lecturer is available in a separate brochure. For more information on the conference and the participants, please visit the conference website at: *www.phononics2011.org*.

Courtesy: Web-Stat.com



Visits to *www.phononics.org* from across the globe

Conference Organizers and Committees

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Sandia National Laboratories / University of New Mexico (USA)

Mahmoud I. Hussein
University of Colorado at Boulder (USA)

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M. L. Dunn (USA)
M. Lipson (USA)
M. M. Farag (Egypt)
M. Ruzzene (USA)
M. Sigalas (Greece)
M. Spector (USA)
M. Su (USA)
O. Painter (USA)
O. Sigmund (Denmark)
P. Deymier (USA)
P. E. Hopkins (USA)
P. Rakich (USA)
R. Camacho (USA)
R. H. Olsson (USA)
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S. Nemat-Nasser (USA)
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U. Jonas (Greece)
V. Laude (France)
V. Romero-Garcia (Spain)
W. Akl (Egypt)
X. Zhang (USA)
Y. Pennec (France)
Z. C. Leseman (USA)

Sponsors

The conference chairs and organizing committee members wish to acknowledge and express their deepest gratitude towards the following institutions for their financial support:

- **Sandia National Laboratories, USA**
- **Office of Naval Research, USA**
- **National Science foundation, USA**
- **FEI Electron Microscopes, USA**

The conference organizers also wish to express their appreciation to the following institutions for their direct support to the efforts of the conference chairs:

- **Sandia National Laboratories, USA**
- **University of Colorado at Boulder, USA**
- **University of New Mexico, USA**

Furthermore, the conference organizers are grateful to the following institutions for their honorary and technical sponsorship in support of the conference efforts:

- **Sandia National Laboratories, USA**
- **University of Colorado at Boulder, USA**
- **University of New Mexico, USA**
- **National Taiwan University, Taiwan**
- **Universidad Politecnica de Valencia, Spain**
- **Centre National de la Recherche Scientifique, France**
- **Georgia Institute of Technology, USA**
- **California Institute of Technology, USA**
- **American University in Cairo, Egypt**
- **Ain Shams University, Egypt**
- **Cairo University, Egypt**
- **Beni Suef University, Egypt**
- **Acoustical Society of Egypt, Egypt**

Acknowledgments

The conference chairs would like to express their deepest gratitude to the members of the International Organizing Committee for their efforts in inviting speakers and their invaluable feedback on the organization of the conference and its structuring.

We would also like to acknowledge the tremendous effort and support of the Technical Program Committee members in the organization of the technical program.

We further wish to express our sincerest gratitude to members of Local Organizing Committee for their efforts especially at the early stages prior to the change of venue from Sharm El-Sheikh, Egypt to Santa Fe, New Mexico, USA.

In addition, we wish to voice our deepest appreciation to our sponsoring organizations for the financial and technical support of the conference efforts.

We would like to extend our warmest thanks to all the conference participants. The enthusiasm they showed and their early confirmation to attend was very important for the successful launch of this new conference.

Moreover, we wish to acknowledge the efforts of those individuals who went out of their way to ensure the success of the conference well beyond the call of duty. As such we would like to voice our gratitude to Dr. Mehmet F. Su, Chair of the Technical Program Committee for his tremendous efforts pertaining to the conference website and electronic abstract submissions. Prof. Zayd C. Leseman, Co-Chair of the Technical Program Committee for his efforts in pursuing prospective sponsors and his tremendous help in the review of the final conference program. Last but certainly not least we wish to thank Ms. Linda Wood, Department of Program and Business Development, Sandia National Laboratories for her pivotal efforts in securing the conference venue and facilities, and her dedication to ensuring that the finest details are addressed and well taken care of.

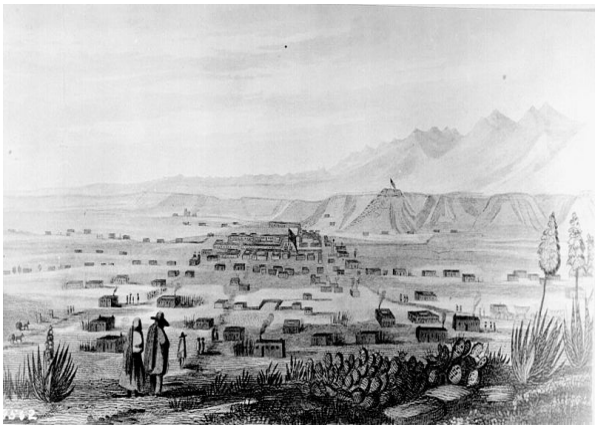
Finally, we would like to thank our respective spouses Inas El-Shazly and Alaa Ahmed for their continuous emotional support and their patience during long hours that have been spent on ensuring a successful conference especially after the unforeseen venue change and the tremendous effort that went in relocating the conference.

Yours sincerely,

Ihab El-Kady & Mahmoud I. Hussein
Albuquerque and Boulder, April 2011

Santa Fe, New Mexico

History of Santa Fe

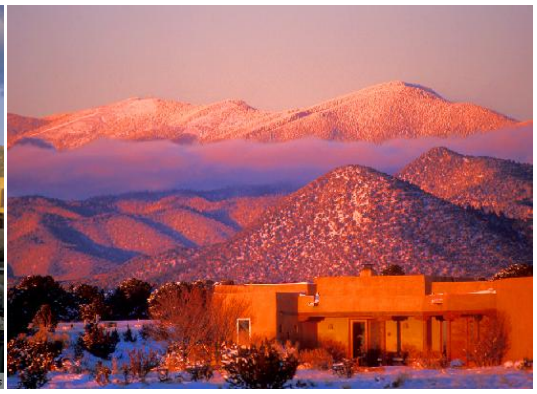


Santa Fe, New Mexico is the third oldest surviving American city founded by European colonists and has a very rich and exciting history. This region was originally settled by a number of Pueblo Indian villages that were founded between 1050 and 1150 AD. In the year 1540, Spanish colonists under Francisco Vásquez de Coronado claimed "The Kingdom of New Mexico" under the Spanish Crown, and the capital of Santa Fe was established in 1598. Shortly after this, in the year 1610, the famous San Miguel Chapel was constructed, making it the oldest standing church in the United States. Turbulent times followed, with a number of Pueblo revolts and attempts to drive out the Spanish. This region remained under Spanish control until the Mexican War or Independence in 1810, when Mexico gained control of the city. In 1846, the United States declared war on Mexico and gained New Mexico through the treaty of Guadalupe Hidalgo. In the year 1912, New Mexico, with Santa Fe as its capital, became the 47th state to join the union.

Santa Fe, the capital of New Mexico, is located approximately 300 miles south of the Colorado boarder. With an elevation of 7,199 ft, Santa Fe is the highest state capital in the United States, as well as the oldest. The local population of about 72,000 makes Santa Fe the fourth largest city in New Mexico, and it continues to grow. With Santa Fe Institute, Sandia National Laboratories, Los Alamos National Laboratories in close proximity, Santa Fe routinely hosts a number of well-renowned technical conferences. Its rich history and emphasis on artistic culture also make it a very popular tourist destination (Source Wikipidia.com).

Santa Fe's Art

Santa Fe has been home to many famous artists, including painter Georgia O'Keeffe and photographer Eliot Porter. Much of the art showcased in the city's hundreds of galleries focuses on Santa Fe's breathtaking landscapes, Spanish influence, and southwestern style. Santa Fe is also home to the Santa Fe opera, a major performing arts venue that has hosted a myriad of plays, festivals, and concerts.



Economy and Tourism

Tourism accounts for the second largest percentage of Santa Fe's economy. With its gorgeous mountains and breathtaking views, much of the tourism in Santa Fe revolves around nature and outdoor activities such as skiing, hiking, camping, and rafting. Host to thousands of galleries, Santa Fe is also famous for its emphasis on the arts, being named the second largest art center in the United States after New York City.

Transportation

Air: The closest international airport to Santa Fe is the Albuquerque Sunport (ABQ) and is approximately two hours away by shuttle. Santa Fe is home to a smaller airport (SAF), so connecting flights may be available.

Bullet Train: The Rail Runner Express runs between downtown Albuquerque and Santa Fe, and a cab can then be taken from the depot in Santa Fe to the conference hotel. Please visit http://www.nmrailrunner.com for the Rail Runner website.

Shuttle: There are several reliable shuttles that run between the Albuquerque Sunport and Santa Fe, and the cost is approximately $25/person each way. Please visit http://www.sandiashuttle.com for the Sandia Express shuttle service website.

Day 0: May 29th Sunday

17:00	**Registration**
19:30	**Reception**
21:00	**Adjourn**

Day 1: May 30th Monday

7:30	**Registration**	
8:00	**Opening Ceremony**	
Serial Sessions	**Phononic Crystals**	
8:30	**J.H. Page (Plenary)**	
9:00	**M. Sigalas (Plenary)**	
9:30	**B. Bonello (Keynote)**	
9:55	**B. Djafari-Rouhani (Keynote)**	
10:20	**Coffee**	
10:45	**V. Laude (Keynote)**	
11:10	**C. Hladky-Hennion (Keynote)**	
11:35	**T.T. Wu (Org. Colloquium)**	
12:00	**M.I. Hussein (Org. Colloquium)**	
12:25	**Lunch**	
Serial Sessions	**Phononic Metamaterials**	
14:00	**A.N. Norris (Plenary)**	
14:30	**S.A. Cummer (Plenary)**	
15:00	**J. Christensen (Keynote)**	
15:25	**J. Li (Keynote)**	
15:50	**G. Orris (Keynote)**	
16:15	**S. Sanchez-Dehesa (Org. Colloquium)**	
16:40	**A. Khelif (Org. Colloquium)**	
17:05	**Coffee**	
Parallel Sessions:	**Phononic Crystals**	**Phononic Metamaterials**
17:30	**O. Wright (Invited Oral)**	**A. Krokhin (Invited Oral)**
17:50	**G.A. Gazonas (Invited Oral)**	**D. Torrent (Invited Oral)**
18:10	**Y. Achaoui (Contrib. Oral)**	**A. Spadoni (Contrib. Oral)**
18:25	**P.H. Otsuka (Contrib. Oral)**	**R. Pourabolghasem (Contrib. Oral)**
18:40	**N.-K. Kuo (Contrib. Oral)**	**B. Assouar (Contrib. Oral)**
18:55	**R. Lucklum (Contrib. Oral)**	**Y. Wang (Contrib. Oral)**
19:10	**Adjourn**	

Day 2: May 31st Tuesday

8:00	**Announcements**	
Serial Sessions	**Periodic Structures**	
8:30	**P. Deymier** (Plenary)	
9:00	**G.M. Hulbert** (Plenary)	
9:30	**J.S. Jensen** (Keynote)	
9:55	**J. Wen** (Keynote)	
10:20	**Coffee**	
10:45	**M.J. Leamy** (Keynote)	
11:10	**A.S. Phani** (Keynote)	
11:35	**V. Romero-Garcia** (Keynote)	
12:00	**C. Daraio** (Org. Colloquium)	
12:25	**Lunch**	
Serial Sessions	**Phonon Transport**	
14:00	**B. Li** (Plenary)	
14:30	**A. Balandin** (Plenary)	
15:00	**A.J.H. McGaughey** (Keynote)	
15:25	**K.P. Pipe** (Keynote)	
15:50	**P.E. Hopkins** (Keynote)	
16:15	**I. Maasilta** (Keynote)	
16:40	**I. El-Kady** (Org. Colloquium)	
17:05	**Coffee**	
Parallel Sessions:	**Periodic Structures**	**Phonon Transport**
17:30	**M.M. Neves** (Invited Oral)	**M. Maldovan** (Invited Oral)
17:50	**O. Umnova** (Invited Oral)	**H. Elsayed-Ali** (Invited Oral)
18:10	**N. Swinteck** (Contrib. Oral)	**K. Muralidharan** (Contrib. Oral)
18:25	**V. Tournat** (Contrib. Oral)	**B.L. Davis** (Contrib. Oral)
18:40	**H. Estrada** (Contrib. Oral)	**E. Chavez** (Contrib. Oral)
18:55	**M. Zubtsov** (Contrib. Oral)	**M.C. George** (Contrib. Oral)
19:10	**Adjourn**	

Day 3: June 1st Wednesday

8:00	**Announcements**	
Serial Sessions	**Optomechanics**	
8:30	**O. Painter (Plenary)**	
9:00	**H. Tang (Plenary)**	
9:30	**T. Carmon (Keynote)**	
9:55	**T. Kippenberg (Keynote)**	
10:20	**Coffee**	
10:45	**S. Benchabane (Keynote)**	
11:10	**G. Cole (Keynote)**	
11:35	**P. Rakich (Org. Colloquium)**	
12:00	**R. Camacho (Org. Colloquium)**	
12:25	**Lunch**	
Parallel Sessions	**Optomechanics**	**Fab Characterization & Applications**
14:00	**C.W. Wong (Invited Oral)**	**B. Kim (Invited Oral)**
14:20	**M.S. Kang (Invited Oral)**	**M. Ziaei-Moayyed (Invited Oral)**
14:40	**C.M. Reinke (Invited Oral)**	**M.F. Su (Invited Oral)**
15:00	**Poster Session***	
17:05	**Coffee**	
17:30	**Sia Nemat-Nasser (Felix Bloch Lecture)**	
18:30	Free Time	
19:00	**Banquet (Phononics 2013 Announcement)**	
22:00	**Adjourn**	

*Poster Session:

1- S. Alaie
2- G. Bastian
3- O.R. Bilal
4- S. Bringuier
5- C.-T. Bui
6- A.L. Chen
7- W.S. Chang
8- M. Frazier
9- D.F. Goettler
10- M.V. Golub
11- Q. Guo
12- T.J. Isotalo
13- H. Ketata
14-G. Kevin L. Manktelow
15- Y. Pennec
16- O. Poncelet
17 & 18- V. Romero-Garcia (2)
19- M. Senesi
20- A. Tomchek
21- V. Tournat
22- Y.-S. Wang
23- A. Young
24- X.-Z. Zhou
25- G. Zhu

Day 4: June 2nd Thursday

8:00	**Announcements**	
Serial Sessions	**Fabrication and Characterization for Phononics**	
8:30	**G. Bogart (Plenary)**	
9:00	**G. Piazza (Keynote)**	
9:25	**G. Fytas (Keynote)**	
9:50	**Z.C. Leseman (Org. Colloquium)**	
10:15	**Coffee**	
Serial Sessions	**Phononic MEMS and RF Applications**	
10:40	**A. Adibi (Plenary)**	
11:10	**Y. Pennec (Keynote)**	
11:35	**J. Vasseur (Keynote)**	
12:00	**I. Psarobas (Keynote)**	
12:25	**R.H. Olsson (Org. Colloquium)**	
12:50	**Lunch**	
Parallel Sessions:	**Phon. Crystals & Phon. Transport**	**Periodic Structures**
14:00	**S. Alaie (Contrib. Oral)**	**A. Leonard (Contrib. Oral)**
14:15	**R.A. Wildman (Contrib. Oral)**	**G. Theocharis (Contrib. Oral)**
14:30	**M.V. Golub (Contrib. Oral)**	**V.J. Sánchez-Morcillo (Contrib. Oral)**
14:45	**F. Scarpa (Contrib. Oral)**	**G. Wang (Contrib. Oral)**
15:00	**R.J. Magyar (Contrib. Oral)**	**Y. Xiao (Contrib. Oral)**
15:15	**M. Blair (Contrib. Oral)**	**S. Chen (Contrib. Oral)**
15:30	**Coffee**	
Parallel Sessions:	**Phonon Transport**	**Fabrication and Characterization**
15:55	**P.-O. Chapuis (Contrib. Oral)**	**T.J. Isotalo (Contrib. Oral)**
16:10	**M. C. George (Contrib. Oral)**	**D.F. Goettler (Contrib. Oral)**
16:25	**M. Prunnila (Contrib. Oral)**	**D. Lanzillotti-Kimura (Contrib. Oral)**
16:40	**Adjourn**	

1st International Conference on Phononic Crystals, Metamaterials & Optomechanics

Sunday: May 29	Detailed Program Information
Registration (Promenade)	**5:00pm - 7:30 pm**
Reception (Pool)	**7:30 pm - 9:00 pm**
Adjourn	**9:00 PM**

Monday: May 30 Detailed Program Information

Registration (Promenade)	**7:30 am - 12:00 pm**
Opening Ceremony (Mesa BR)	**8:00 am - 8:30 am**
Track 1: Phononic Crystals	
Session: 1 (Mesa Ballroom)	**8:30 am - 10:20 pm**
Session Chair: T. T. Wu	
Author: J.H. Page	**Category: Plenary Talk**
Paper #: 0109	**Time:** 8:30 am -9:00 am
Title: Ultrasonic Wave Transport in Phononic Crystals	
Abstract: *Ultrasonic experiments on phononic crystals provide a powerful method for investigating the profound effects of periodic structure on wave propagation. We summarize recent progress that has been achieved by combining experiments with multiple scattering theory and FDTD calculations to study bandgap, negative refraction and focusing phenomena.*	
Author: M. Sigalas	**Category: Plenary Talk**
Paper #: 0061	**Time:** 9:00 am -9:30 am
Title: Phononic Crystal Sensors	
Abstract: *Numerical studies of phononic crystals for sensors applications are presented. The sensitivities of the structures on their parameters are studied. Particular attention was given in structures that can be probed with both electromagnetic and elastic waves.*	
Author: B. Bonello	**Category: Keynote Talk**
Paper #: 0024	**Time:** 9:30 am -9:55 am
Title: Phononic Crystals to Control the Propagation of Elastic Waves: Recent Advances	
Abstract: *In this paper, we briefly review the recent advances made worldwide to control the propagation of elastic waves using phononic crystals (PCs). We show how new effects, including the opening of band gaps in silicon PC plates and the negative refraction of elastic waves, could be at the origin of new Micro ElectroMechanical Systems compatible with CMOS processes.*	

Author: B. Djafari-Rouhani	**Category: Keynote Talk**
Paper #: 0059	**Time:** 9:55 am -10:20 am
Title: Engineering of the Band gaps and transmissions in Phononic and phoxonic Crystal Slabs and Waveguides	
Abstract: *We report on our theoretical works about the engineering of band structures in phononic as well as dual phononic-photonic slabs and strips waveguides. Besides the conventional structure made of a periodic array of holes in a plate, we discuss the more recent geometry of pillars on a membrane or on a substrate. We discuss the best phoxonic structures displaying dual phononic-photonic band gaps and slow modes.*	
Coffee Break (Promenade)	**10:20 am - 10:45 am**
Track 1: Phononic Crystals	
Session: 2 (Mesa Ballroom)	**10:45 am - 12:25 pm**
Session Chair: J. H. Page	
Author: V. Laude	**Category: Keynote Talk**
Paper #: 0087	**Time:** 10:45 am -11:10 am
Title: Evanescent Bloch Waves in Phononic Crystals: Complex Band Structure, Losses, and Guidance	
Abstract: *The complex band structure of evanescent Bloch waves in phononic crystals is elucidated by formulating an eigenvalue problem for the wavevector versus the frequency. It is used to explore the effects of material losses and the phononic crystal guidance mechanism. The method, originally formulated for plane waves, is extended to finite element models.*	
Author: C. Hladky-Hennion	**Category: Keynote Talk**
Paper #: 0056	**Time:** 10:10 am -11:35 am
Title: Negative refraction of elastic waves in 2D phononic crystals	
Abstract: *Negative refraction of elastic waves is evidenced in a two-dimensional phononic crystal (PC), made of a triangular lattice of steel rods embedded in epoxy. Experiments are carried out on a prism shaped PC inserted inside an epoxy block. The influence of different parameters is discussed in terms of image reconstruction.*	

Author: T. T. Wu	**Category: Org. Colloquium**
Paper #: 0127	**Time:** 11:35 am -12:00 pm
Title: Focusing and Waveguiding of Lamb Waves in Phononic Plates	
Abstract: *In this talk, focusing of Lamb waves using the GRIN PC will be introduced first, and then followed by a concept demonstration of utilizing the focusing feature to compress Lamb waves into a phononic plate waveguide. Results of the study showed that beam width of the lowest anti-symmetric Lamb wave in a silicon PC thin plate can be compressed efficiently and fitted into the tungsten/silicon PC plate waveguide over a wide range of frequency.*	

Author: M. I. Hussein	**Category: Org. Colloquium**
Paper #: 0182	**Time:** 12:00 am -12:25 pm
Title: Multiscale Dispersive Design: A Building Blocks Approach to Phononics	
Abstract: *When infinite in extent, spatial periodicity constitutes a periodic "material". When truncated to finite dimensions, a periodic "structure" is formed. Between the two entities there is an abundance of opportunities for shaping a desired dynamical response. In this work we will re-visit the concept of Multiscale Dispersive Design and use it towards the exploration of new avenues in phononics.*	

Lunch Break (Chamisa)	**12:25 pm - 2:00 pm**
Track 2: Phononic Metamaterials	
Session: 3 (Mesa Ballroom)	**2:00 pm - 5:05 pm**
Session Chair: M. Spector	
Author: A. N. Norris	**Category: Plenary Talk**
Paper #: 0037	**Time:** 2:00 pm -2:30 pm
Title: Metal Water: A Metamaterial for Acoustic Cloaking	
Abstract: *A generic metamaterial is described that is suitable for making acoustic cloaking devices. The fundamental property is that it mimics the acoustic properties of water, yet can be modified to display anisotropic elastic properties suitable for cloaking. It has the important property that the amount of void space is conserved: a "conservation of cloaked space".*	

Author: S. A. Cummer	**Category: Plenary Talk**
Paper #: 0068	**Time:** 2:30 pm -3:00 pm
Title: Phononic Metamaterials for Transformation Acoustics Applications	
Abstract: *We review the detailed development and derivation of the concept of transformation acoustics and demonstrate several approaches for engineering materials with the acoustic properties needed to realize transformation acoustics devices.*	

Author: J. Christensen	**Category: Keynote Talk**
Paper #: 0144	**Time:** 3:00 pm -3:25 pm
Title: Perforated acoustic metamaterials	
Abstract: *In this presentation we focus on perforated plates, which is governing the study of enhanced acoustic transmission through subwavelength apertures and in addition supports metamaterial typical phenomena like perfect imaging, negative refraction such as full attenuation of sound . We will discuss both theoretical and experimental results related to these items.*	

Author: J. Li	**Category: Keynote Talk**
Paper #: 0132	**Time:** 3:25 pm -3:50 pm
Title: Transformation Acoustics Media with Periodically Layered Structures	
Abstract: *Periodically layered structures have been used to construct acoustic superlenses and hyperlenses as precursors for transformation acoustics. With the transformation approach, we can now investigate the bandwidth and relationship between an acoustic hyperlens and superlens and construct transformation media through bending periodically layered structure.*	

Author: G. Orris	**Category: Keynote Talk**
Paper #: 0135	**Time:** 3:50 pm -4:15 pm
Title: Impedance Matching for Aqueous Inertial Metafluid Devices	
Abstract: *Several interesting metafluid devices have been investigated for use at frequencies in the low tens of kilohertz, including gradient index lenses, directional antennas and tuneable scattering elements. For 3D or orthotropic devices whose operating frequencies are less than a few 10's of kHz additional and significant practical issues can arise for inertial metafluids: dynamic impedance matching, mass and volume.*	

Author: J. Sanchez-Dehesa	**Category: Org. Colloquium**
Paper #: 0140	**Time:** 4:15 Pm -4:40 Pm
Title: Applications of Metafluids based on Phononic Crystals	
Abstract: *Acoustic metamaterials or metafluids based on the homogenizat ion of periodic distributions of sound scatterers (phononic crystals) are reviewed. It will be shown that periodically microstructured solids effectively behave like fluidlike materials with dynamical mass anisotropy. Also, it will be shown that the acoustic refractive index can be locally tailored in order to get molding of the sound waves. Applications of these types of metafluids as acoustic cloaks, gradient index refractive lenses, perfect absorbers and radial sonic crystal will be reported.*	
Author: A. Khelif	**Category: Org. Colloquium**
Paper #: 0139	**Time:** 4:40 pm -5:05 pm
Title: Locally resonant structures for low frequency surface acoustic band gaps	
Abstract: *We present in this paper a theoretically and experimentally study of the propagation of surface acoustic waves in a two-dimensional array of cylindrical pillars on the surface of a semi-infinite substrate. Low-frequency, markedly lower than those expected from the Bragg mechanism, band gaps were demonstrated.*	
Coffee Break (Promenade)	**5:05 pm - 5:30 pm**
Parallel Sessions	
Track 1: Phononic Crystals	
Session: 4 (Mesa Ballroom A)	**5:30 pm - 7:10 pm**
Session Chair: M. Sigalas	
Author: O. Wright	**Category: Invited Oral**
Paper #: 0084	**Time:** 5:30 pm -5:50 pm
Title: Dynamic Imaging of Gigahertz Phonons on Phononic Crystal Slabs	
Abstract: *Surface phonon propagation on microscopic phononic crystal slabs of Si is dynamically imaged in two dimensions at frequencies up to 1 GHz by an ultrafast optical technique. The acoustic dispersion relations obtained by spatial and temporal Fourier transforms reveal stop bands and the eigenmode patterns. Phonon guiding and confinement in phononic crystal waveguides and cavities are also presented.*	

Author: G. A. Gazonas	**Category: Invited Oral**
Paper #: 0149	**Time:** 5:50 pm -6:10 pm
Title: Resonance in m-layered Goupillaud-type Elastic Media	
Abstract: *Explicit analytical and recursive stress solutions and corresponding natural frequencies are derived for an m-layered Goupillaud-type elastic medium from a coupled firstorder system of difference equations using z-transform methods. The exact solutions can serve to verify computational methods for modeling wave propagation phenomena such as resonance and bandgap formation in periodic media.*	

Author: Y. Achaoui	**Category: Contrib. Oral**
Paper #: 0116	**Time:** 6:10 pm -6:25 pm
Title: Locally resonant and Bragg band gaps for surface acoustic waves	
Abstract: *We investigate the propagation of surface acoustic waves in a square lattice phononic crystal of cylindrical pillars on an anisotropic substrate. It is shown that the propagation of surface acoustic phonons is prohibited in two distinct frequency ranges. We identify two mechanisms responsible for band gaps, i.e. local resonances and Bragg diffraction, and point out the difference between them.*	

Author: P. H. Otsuka	**Category: Contrib. Oral**
Paper #: 0085	**Time:** 6:25 pm -6:40 pm
Title: Observation and Simulation of Surface Acoustic Waves in Phononic Crystals	
Abstract: *We present an analysis of surface acoustic waves propagating in a microscopic phononic crystal waveguide consisting of a silicon crystal containing a square array of holes. Experiments are performed using an ultrafast optical method and the results are compared with an FEM simulation.*	

Author: N. -K. Kuo	**Category: Contrib. Oral**
Paper #: 0106	**Time:** 6:40 pm -6:55 pm
Title: Demonstration of Ultra High Frequency Fractal Air/Aluminum Phononic Crystalsl	
Abstract: *This work presents, for the first time, the design and the experimental demonstration of an air/aluminum nitride (AlN) phononic band gap (PBG) structure patterned in a fractal fashion which exhibits two frequency stop bands for symmetric lamb waves respectively at 900 MHz (bandwidth of 11%) and 1.075 GHz (bandwidth of 13.5%) with a maximum acoustic attenuation of 45 dB.*	

Author: R. Lucklum	**Category: Contrib. Oral**
Paper #: 0065	**Time:** 6:55 pm -7:10 pm
Title: Liquid Sensor Utilizing Phononic Crystals	
Abstract: *A phononic crystal device is investigated as a sensor platform combining bandgap engineering with resonant transmission. We compare several approaches: a one-dimensional arrangement with a thin liquid analyte layer, two-dimensional phononic crystals with and without symmetry reduction and incidence directions normal and perpendicular to the plate.*	

Track 2: Phononic Metamaterials

Session: 5 (Mesa Ballroom C)	**5:30 pm - 7:10 pm**
Session Chair: J. Sanchez-Dehesa	
Author: A. Krokhin	**Category: Invited Oral**
Paper #: 0021	**Time:** 5:30 pm -5:50 pm
Title: Narrow Fluid Channel as a Metamaterial Sound Absorber	
Abstract: *Abnormally high level of absorption has been observed for sound waves propagating through a narrow water channel clad between two metal plates. Absorption is due to resonant excitation of Rayleigh waves on the both metal surfaces. These waves may either produce strong turbulent motion in a viscous fluid or radiate its energy into the metal, giving rise to deep minima in the transmission spectrum.*	

Author: D. Torrent	**Category: Invited Oral**
Paper #: 0026	**Time:** 5:50 pm -6:10 pm
Title: Fabrication and Experimental Characterization of Anisotropic Fluid-Like Materials	
Abstract: *We report a method to obtain acoustic metamaterials or metafluids with cylindrically anisotropic mass density. The method uses a periodically corrugated structure embedded in a two dimensional waveguide. This structure represents a periodic multilayered fluid-fluid composite that, in the low frequency limit, behaves as a fluid-like metamaterial with mass anisotropy. Also, an experimental method to characterize these structures is presented, showing that the resonances in these closed structures can be used to derive the acoustic parameters of these metafluids.*	

Author: A. Spadoni	**Category: Contrib. Oral**
Paper #: 0091	**Time:** 6:10 pm -6:25 pm
Title: Phononic Transport in Structural Networks with Internal Resonances and Dissipation	
Abstract: *The transport of mechanical energy can be controlled with phononic crystals and acoustic meta-materials. The latter can designed to control wave fields with wavelengths much larger than the meta-material's inner structure. This presentation proposes the employ-ment of structural lattices and dissipation to improve the performance of meta-materials.*	
Author: R. Pourabolghasem	**Category: Contrib. Oral**
Paper #: 0150	**Time:** 6:25 pm -6:40 pm
Title: Phononic Band Structure of a Silicon Plate with Periodic Array of Cylindrical Metallic Pillars	
Abstract: *We investigate theoretically the phononic band structure in a 2D array of cylindrical pillars on the surface of a slab. Simulations are based on the finite element method (FEM) using tungsten pillars on silicon as the structure of interest. We show that the phononic structure supports band gaps and study the behavior of band structure with respect to lattice symmetry and geometrical parameters.*	
Author: B. Assouar	**Category: Contrib. Oral**
Paper #: 0063	**Time:** 6:40 pm -6:55 pm
Title: Elastic Waves Propagation in a Locally Resonant Phononic Stubbed Plates	
Abstract: *We report in this study on the phonon transport in a locally resonant (LR) phononic stubbed plate. First, we will discuss the opening of LR band gap (BG) as function as the nature of the stubs and geometrical parameters to figure out the evolution of the BG. Second, we will discuss the waveguiding in such structures based on the calculation of the band structures and the transmission coefficient.*	
Author: Y. Wang	**Category: Contrib. Oral**
Paper #: 0115	**Time:** 6:55 pm -7:10 pm
Title: A wide band underwater strong acoustic absorbing material	
Abstract: *To meet the demand of underwater acoustic absorbing material for wide band strong acoustic absorption, we introduced network structure into locally resonant phononic crystal and fabricated a new kind of metal-polymer composites. Experimental and theoretical results showed that excellent underwater acoustic absorption capability and strong mechanical strength could be obtained simultaneously.*	
Adjourn	**7:10 PM**

Tuesday: May 30 Detailed Program Information

Registration (Promenade)	**7:30 am - 12:00 pm**
Announcements (Mesa BR)	**8:15 am - 8:30 am**
Track 3: Periodic Structures	
Session: 6 (Mesa Ballroom)	**8:30 am - 10:20 pm**
Session Chair: A. Norris	
Author: P. Deymier	**Category: Plenary Talk**
Paper #: 0073	**Time:** 8:30 am -9:00 am
Title: Phononic crystals with complete phase space properties	
Abstract: *We review and demonstrate properties of phononic crystals over their complete phase space, namely, spectral (ω-space), wave vector (k-space) and phase (φ-space) properties. The later two properties are applied to acoustic imaging with a phononic crystal flat lens and to inter-ference-driven acoustic Boolean logic.*	
Author: G.M. Hulbert	**Category: Plenary Talk**
Paper #: 0137	**Time:** 9:00 am -9:30 am
Title: Structurally-Inspired Phononic Metamaterials	
Abstract: *The distinction between materials and structures has blurred. The development of phononic metamaterials based upon novel structural systems is considered in this work. In particular, a Negative-Poisson Ratio (NPR) structure is used as the foundation for developing phononic metamaterials comprising a 'structural' framework of stiff material and a more compliant material that can dissipate energy.*	
Author: J. S. Jensen	**Category: Keynote Talk**
Paper #: 0055	**Time:** 9:30 am -9:55 am
Title: Optimal Design of Nonlinear Wave Devices	
Abstract: *The method of topology optimization is applied to wave propagation problems with nonlinearities. In the general case the iterative design procedure should be based on transient simulation of the wave propagation, but in the special case of non-instantaneous nonlinearities a steady-state optimization formulation can be applied. The latter case is exemplified by the design of a 1D optical diode.*	

Author: J. Wen	**Category: Keynote Talk**
Paper #: 0117	**Time:** 9:55 am -10:20 am

Title: Phononic Crystals with Applications to Sound and Vibration Control

Abstract: *A two dimensional binary locally resonant phononic crystal (PCs) has been fabricated and thoroughly analyzed. A lumped-mass method has been proposed as an efficient tool to calculate the band structure of PCs. The concept of PCs is introduced into the design of beam and plate structures, and the acoustic materials to improve their vibration and sound performance.*

Coffee Break (Promenade)	**10:20 am - 10:45 am**

Track 3: Periodic Structures

Session: 7 (Mesa Ballroom)	**10:45 am - 12:25 pm**
Session Chair: G. Hulbert	
Author: M.J. Leamy	**Category: Keynote Talk**
Paper #: 0071	**Time:** 10:45 am -11:10 am

Title: New Directions in the Analysis of Nano-Scale Phononic and Nonlinear Metamaterial Systems

Abstract: *This talk will focus on two directions being pursued by the author and his coworkers in the areas of (i) multi-scale modeling of phonon spectra and dispersion in reduced dimensional nano-scale systems (e.g., carbon nanotubes), and (ii) analysis of phononic wave propagation in nonlinear metamaterials using asymptotic techniques.*

Author: A. S. Phani	**Category: Keynote Talk**
Paper #: 0107	**Time:** 10:10 am -11:35 am

Title: Lattice Materials: A Unified Structural Mechanics Perspective

Abstract: *Lattice materials with a periodic microstructure are suitable for multifunctional structures with high specific stiffness, favourable acoustic and thermal properties. Their mechanical response under static and dynamic loads is considered from a unified structural mechanics perspective combining Bloch wave theory with Finite Element Method.*

Author: V. Romero-Garcia	**Category: Keynote Talk**
Paper #: 0101	**Time:** 11:35 am -12:00 pm
Title: Theoretical and Experimental Evidence of Evanescent Modes in Finite Sonic Crystals	
Abstract: *Evanescent modes in complete sonic crystals (SC) and SC with point defects are both theoretically and experimentally reported in this paper. Finite element method and an extension of the plane wave expansion with supercell approximation to solve the invers problem k(ω) is used to predict the evanescent modes. Experimental data and numerical results are in good agreement with the predictions.*	

Author: C. Daraio	**Category: Org. Colloquium**
Paper #: 0155	**Time:** 12:00 am -12:25 pm
Title: From Newton's Cradle to New Acoustic Crystals	
Abstract: *The bouncing beads of Newton's cradle fascinate children and executives alike, but their symmetric dance hides a complex dynamic behavior. By assembling grains in crystals we are developing new materials and devices with unique properties. We have constructed twodimensional systems that can redirect mechanical waves, and have developed new materials for absorbing vibrations and explosive blasts.*	

Lunch Break (Chamisa)	**12:25 pm - 2:00 pm**
Track 4: Phonon Transport	
Session: 8 (Mesa Ballroom)	**2:00 pm - 5:05 pm**
Session Chair: P. Deymier	
Author: Baowen Li	**Category: Plenary Talk**
Paper #: 0042	**Time:** 2:00 pm -2:30 pm
Title: Phononics: a new science and technology in processing information and controlling heat flow by phonons	
Abstract: *Heat due to lattice vibration is usually regarded as harmful for information processing. However, studies in recent years have changed this mindset. I will demonstrate via numerical simulation, theoretical analysis and experiments that, phonons, can be manipulated like electrons. They can be used to carry and process information. Basic phononic devices such as thermal diode, thermal transistor, thermal logic gate and thermal memory can be worked via nonlinear lattice and/or low dimensional nanostructures such as nanowire, nanotube, graphen nanoribbon etc. .*	
Author: A. Balandin	**Category: Plenary Talk**
Paper #: 0133	**Time:** 2:30 pm -3:00 pm
Title: Nanoscale Phonon Engineering: From Quantum Dots and Nanowires to Graphene and Topological Insulators	
Abstract: *I describe the nanoscale phonon engineering concept and its possible applications. Nanostructures offer new ways for controlling phonon transport via tuning phonon dispersion. Engineering the phonon spectrum can become as powerful a technique as the electron bandgap engineering, which revolutionized electronics. I outline recent examples of phonon engineering in quantum dot superlattices, nanowires, graphene ribbons and topological insulators. Particular attention is given to the phonon thermal transport in graphene and graphene's applications in thermal management.*	
Author: A. J. H. McGaughey	**Category: Keynote Talk**
Paper #: 0047	**Time:** 3:00 pm -3:25 pm
Title: Predicting Phonon Properties Using the Spectral Energy Density	
Abstract: *The spectral energy density technique for predicting phonon dispersion relations and relaxation times is presented. This technique, which uses atomic velocities obtained from a molecular dynamics simulation, incorporates the full anharmonicity of the atomic interactions. Results for a Lennard-Jones face centered cubic crystal are provided.*	

Author: K. P. Pipe	**Category: Keynote Talk**
Paper #: 0108	**Time:** 3:25 pm -3:50 pm
Title: Effect of Interface Roughness on Phonon Transport in Superlattices	
Abstract: *We present a boundary perturbation method to analyze phonon reflection, transmission, and mode conversion at a rough interface, and extend these calculations using a transfer matrix approach to examine the effects of interface roughness on phonon transport in multilayer thin films.*	

Author: P. E. Hopkins	**Category: Keynote Talk**
Paper #: 0080	**Time:** 3:50 pm -4:15 pm
Title: Phonon scattering at structurally variant boundaries	
Abstract: *Phonon scattering at boundaries drives the thermal transport in nanosystems. In this work, I will discuss various projects in which solid boundaries and interfaces are used to reduce the thermal conductance in nanosystems. These studies include cross plane thermal conductivity in periodic, porous silicon films and thermal boundary conductance across ran-dom and quantum dot roughened Si interfaces.*	

Author: I. Maasilta	**Category: Keynote Talk**
Paper #: 051	**Time:** 4:15 Pm -4:40 Pm
Title: Phononic Thermal Transport in Thin Nanoscale Membranes	
Abstract: *We have studied experimentally the thermal conductance of thin free-standing sili-con nitride membranes at sub-Kelvin temperatures as a function of membrane thickness be-tween 40 nm and 750 nm, using normal metal-insulator-superconductor (NIS) thermometry. Effects of dimensionality cross-over from 3D to 2D phonons are seen, however not all obser-vations follow the simplest theory.*	

Author: I. El-Kady	**Category: Org. Colloquium**
Paper #: 0183	**Time:** 4:40 pm -5:05 pm
Title: Thermal Conductivity Reduction in Phononic Crystals: Interplay of Coherent versus Incoherent Scattering	
Abstract: *In this talk we pose the question: Can the coherent scattering events brought by the periodicity of the Phononic Crystal (PnC) lattice affect the high frequency THz phonons that dominate heat transfer process? In other words, can PnC patterning be used to manipulate the thermal conductivity of a material? We report both theoretically and experimentally on the role of coherent versus incoherent scattering of phonons by a 2D PnC structure and the efficacy of each process in both the cross plane and in plane directions of the PnC lattice.*	

Coffee Break (Promenade)	**5:05 pm - 5:30 pm**

Parallel Sessions	
Track 3: Periodic Structures	
Session: 9 (Mesa Ballroom A)	**5:30 pm - 7:10 pm**
Session Chair: C. Daraio	
Author: M. M. Neves	**Category: Invited Oral**
Paper #: 0121	**Time:** 5:30 pm -5:50 pm
Title: Using classical FEM to predict the dynamical response of periodic devices in acoustic and vibration applications	
Abstract: *The task of predicting the dynamical response and tailoring wave propagation filters for practical frequency ranges is here presented. Finite element steady-state analysis is performed on periodic devices of finite length considering periodic distribution of materials, addition of masses to a tube and periodic curvatures. Validation obtained with prototypes, one for attenuation of axial vibration and other for sound propagation, is also mentioned.*	
Author: O. Umnova	**Category: Invited Oral**
Paper #: 0076	**Time:** 5:50 pm -6:10 pm
Title: An Effective Medium Model for Sonic Crystals with Composite Resonant Elements	
Abstract: *Using a self-consistent method, analytical expressions are derived for the parameters of an effective medium of composite scattering elements in air. The scatterers consist of concentrically arranged thin elastic shells and 4-slit cylinders. Predictions and data confirm that the use of coupled resonators results in a substantial insertion loss peak related to the modified resonance of the shell.*	

Author: N. Swinteck	**Category: Contrib. Oral**
Paper #: 0069	**Time:** 6:10 pm -6:25 pm
Title: Phase-controlling properties in phononic crystals	
Abstract: *We deliver a complete phase-space analysis of two well-studied PC systems to reveal the mechanisms behind phase-manipulation of propagating elastic waves in these composite structures. A triangular-array of steel cylinders embedded in a host matrix of methanol and a square-array of Polyvinylchloride cylinders embedded in a host matrix of air show band structures and equi-frequency contours (EFCs) with very different features, yet phase-control is possible in both systems. We find that phase-control depends on (1) whether or not the wave and group velocity vectors in the PC are collinear and (2) whether or not the excited Bloch waves in the PC have the same phase velocity. The results gathered in this study can be used to draw general conclusions about the reality of phase-control in many other types*	
Author: V. Tournat	**Category: Contrib. Oral**
Paper #: 0009	**Time:** 6:25 pm -6:40 pm
Title: Elastic waves in a three-dimensional hexagonal close-packed granular crystal: observation of rotational modes and nonlinear effects	
Abstract: *Noncohesive granular phononic crystals show peculiar features related to the elastic nonlinearities at the contacts and the rotational degrees of freedom of the grains. Evidence of rotational mode propagation and non reciprocity for nonlinear acoustic effects is found in a hexagonal close-packed crystal layer with a gravityinduced elasticity gradient.*	
Author: H. Estrada	**Category: Contrib. Oral**
Paper #: 0041	**Time:** 6:40 pm -6:55 pm
Title: The Role of Array Symmetry in the Transmission of Ultrasound through Periodically Perforated Plates	
Abstract: *We present angle-resolved experimental results on the role of array symmetry in the transmission features of periodically perforated plates. A very rich interplay between Fabry-Perot single-hole resonances, coherent scattering and plate vibration is found. By comparing several spatial hole arrangements, the effects of the geometry are disentangled from the contribution of plate vibrations.B.*	
Author: M. Zubtsov	**Category: Contrib. Oral**
Paper #: 0057	**Time:** 6:55 pm -7:10 pm
Title: EFIT Simulation of Ultrasonic Wave Propagation in Complex Microfluidic Structures	
Abstract: *The Elastodynamic Finite Integration Technique (EFIT) is used to simulate ultrasonic wave propagation in complex microfluidic structures comprising fluidic channels, phononic crystal structures and piezoelectric transducers. An EFIT computational math is combined with MATLAB coding. The viability of the approach is demonstrated.*	

Track 4: Phonon Transport	
Session: 10 (Mesa Ballroom C)	**5:30 pm - 7:10 pm**
Session Chair: B. Li	
Author: M. Maldovan	**Category: Invited Oral**
Paper #: 0156	**Time:** 5:30 pm -5:50 pm
Title: Understanding and Controlling High-Frequency Phonon Thermal Energy Transport in Nanostructures	
Abstract: *We present a novel theoretical approach based on the kinetic theory of transport processes to understand and accurately describe the transport of high-frequency phonon thermal energy in nanostructures over a broad range of temperatures and across multiple length scales, i.e. from nano to micro. Good agreement with experiments is obtained.*	
Author: H. Elsayed-Ali	**Category: Invited Oral**
Paper #: 0078	**Time:** 5:50 pm -6:10 pm
Title: Coherent phonons in polycrystalline bismuth film monitored by ultrafast electron diffraction	
Abstract: *The generation of coherent phonons in polycrystalline bismuth film is observed by ultrafast time-resolved electron diffraction. The dynamics of the diffracted intensities from the (110), (202), and (024) lattice planes show pronounced oscillations at 130□150 GHz. The anisotropy in the energy transfer rate of coherent optical phonons is discussed.*	

Author: K. Muralidharan	**Category: Contrib. Oral**
Paper #: 0104	**Time:** 6:10 pm -6:25 pm

Title: Nanostructured two-dimensional phononic materials

Abstract: *Phononic properties of nanostructured two-dimensional materials such as graphene and boron nitride (BN) sheets are calculated using the method of molecular dynamics. Nanophononic crystals composed of periodic array of holes in graphene exhibit Bragg scattering at non-cryogenic temperatures leading to reduction in thermal conductivity. The transport of phonons across non-periodic arrays of asymmetric holes in BN sheets is discussed in the context of scattering and non-linear effects that may lead to thermal rectification.*

Author: B. L. Davis	**Category: Contrib. Oral**
Paper #: 0174	**Time:** 6:25 pm -6:40 pm

Title: Reduction of Thermal Conductivity in Silicon Slabs by Unit Cell Nanostructuring

Abstract: *Just like unit cell structuring has seen much interest in phononic crystals for the control of sound and vibration, the same can be done at the nanoscale for the control of thermal properties. Here we present ideas for unit cell nanostructuring within thin silicon slabs for the purpose of reducing the thermal conductivity.*

Author: E. Chavez	**Category: Contrib. Oral**
Paper #: 0111	**Time:** 6:40 pm -6:55 pm

Title: Acoustic phonon relaxation rates in nanometer-scale membranes

Abstract: *The elastic continuum model is applied to analyse the acoustic phonon modes for single and threelayer membranes. The dispersion relations are computed using a numerical approach and are compared with experimental and theoretical results. These values are used to compute the rate of relaxation, considering a three-phonon Umklapp process.*

Author: M. C. George	**Category: Contrib. Oral**
Paper #: 0081	**Time:** 6:55 pm -7:10 pm

Title: Thermal conductance behavior of self-assembled lamellar block copolymer thin films

Abstract: *We measure the thermal conductance of both disordered and self-assembled lamellar polystyrene-block-poly(methyl methacrylate) copolymer films and compare the results to literature reports on thin homopolymer films and polymer brushes. We see a 150% increase in thermal conductivity for a single self-assembled PS-b-PMMA layer.*

Adjourn **7:10 PM**

Wednesday: June 1 Detailed Program Information

Registration (Promenade)	**7:30 am - 12:00 pm**
Announcements (Mesa BR)	**8:15 am - 8:30 am**
Track 5: Optomechanics	
Session: 11 (Mesa Ballroom)	**8:30 am - 10:20 pm**
Session Chair: S. Cummer	
Author: O. Painter	**Category: Plenary Talk**
Paper #: 0180	**Time:** 8:30 am -9:00 am
Title: Optomechanical Crystals	
Abstract: *Rapid advances have been made in the field of cavity optomechanics, in which the usually feeble radiation pressure force of light is used to manipulate (and precisely monitor) mechanical motion. These advances have moved the field from the multi-km interferometer of a gravitational wave observatory, to the optical table top, and now all the way down to a silicon microchip. In this talk I will describe these advances, and discuss our own work to realize radiation pressure within nanoscale structures in the form of photonic-phononic crystals (optomechanical crystals).*	
Author: H. Tang	**Category: Plenary Talk**
Paper #: 0138	**Time:** 9:00 am -9:30 am
Title: Integrated Transduction and Active Manipulation Methods for Nanoelectromechanical Systems	
Abstract: *This talk will discuss integrated NEMS transduction schemes that have been devel-oped by my research group. Methods for achieving active control and manipulation of nano-mechanical motion will be also presented.*	
Author: T. Carmon	**Category: Keynote Talk**
Paper #: 0181	**Time:** 9:30 am -9:55 am
Title: Mechanical Whispering-Gallery Modes	
Abstract: *We experimentally excite mechanical Whispering-Gallery resonances that are vibrating from 50 MHz to 12 GHz rates.*	

Author: T. Kippenberg	**Category: Keynote Talk**
Paper #: 0178	**Time:** 9:55 am -10:20 am
Title: Cooling of a Micromechanical Oscillator into the Quantum Regime	
Abstract: *Using optical sideband cooling, a micromechanical oscillator is cooled to a phonon occupancy below 10 phonons, corresponding to a probability of finding it in its quantum ground state more than 10% of the time.*	

Coffee Break (Promenade)	**10:20 am - 10:45 am**

Track 5: Optomechanics

Session: 12 (Mesa Ballroom)	**10:45 am - 12:25 pm**
Session Chair: O. Painter	
Author: S. Benchebane	**Category: Keynote Talk**
Paper #: 0086	**Time:** 10:45 am -11:10 am
Title: Phoxonic Crystals: a Review	
Abstract: *Periodically structured materials exhibiting simultaneous photonic and phononic band gaps offer unprecedented ways to tailor photon–phonon interactions. A review of the works reported on these materials, sometimes termed "phoxonic crystals", is presented before highlighting theoretical and experimental results demonstrating phoxonic band gaps in structures relying on guided elastic waves.*	
Author: G. D. Cole	**Category: Keynote Talk**
Paper #: 0157	**Time:** 10:10 am -11:35 am
Title: Cavity Quantum Optomechanics	
Abstract: *The overarching research objective of cavity quantum optomechanics is to investigate quantum effects of micro- and nanoscale systems and their implications for the foundations and applications of quantum physics. Our ultimate goal is to gain access to a completely new parameter regime for experimental physics with respect to both size and complexit.*	
Author: P. Rakich	**Category: Org. Colloquium**
Paper #: 0128	**Time:** 11:35 am -12:00 pm
Title: Fundamental Limits of Transduction Efficiency and Bandwidth in Nano-Optomechanics	
Abstract: *Through systematic examination of material and topological degrees of freedom in nano-optomechanical systems, we identify the fundamental barriers and opportunities for the creation of large photon-phonon coupling.*	

Author: R. Camacho	**Category: Org. Colloquium**
Paper #: 0130	**Time:** 12:00 pm -12:25 pm
Title: Mechanical Transduction in Periodic Media	
Abstract: *The possibility of increasing mechanical transduction efficiencies via periodic patterning of the material density is investigated. A 2D simulation suggesting low mechanical impedance over a relatively large bandwidths is presented.*	
Lunch Break (Chamisa)	**12:25 pm - 2:00 pm**
Parallel Sessions	
Track 5: Optomechanics	
Session: 13 (Mesa Ballroom A)	**2:00 pm - 3:00 pm**
Session Chair: P. Rakich	
Author: C. W. Wong	**Category: Invited Oral**
Paper #: 0146	**Time:** 2:00 pm -2:20 pm
Title: Strong Optomechanical Coupling in Slot-type Photonic Crystal Cavities	
Abstract: *Strong dispersive optomechanical coupling of an air-slot mode-gap photonic crystal cavity is demonstrated. The zero-point motion coupling rate can be as high as 2.56MHz. Optical and 10s of MHz mechanical frequency spectra are shown experimentally, supported by theory and numerical models.*	
Author: M. S. Kang	**Category: Invited Oral**
Paper #: 0093	**Time:** 2:20 pm -2:40 pm
Title: Forward Stimulated Light Scattering by Acoustic Resonances in Photonic Crystal Fiber	
Abstract: *Forward stimulated light scattering by transverse acoustic resonances tightly trapped in a photonic crystal fiber core is a recently reported nonlinear-optical optoacoustic phenomenon. The principles and characteristics of the scattering are described. Some potential applications are also discussed*	
Author: C. M. Reinke	**Category: Invited Oral**
Paper #: 0170	**Time:** 2:40 pm -3:00 pm
Title: Analysis of Optomechanical Forces in Nano-Photonic Waveguides	
Abstract: *We present a theoretical analysis of optomechanical forces in nano-scale photonic waveguides. In particular, we show that significant forces due to radiation pressure can be generated in dielectric slab and photonic crystal waveguides having sub-micron dimensions. We also investigate how such forces can be optimized for optomechanical transduction.*	

Track 6&7: Fabrication Characterization & Applications	
Session: 14 (Mesa Ballroom C)	**2:00 pm - 3:00 pm**
Session Chair: G. R. Bogart	
Author: B. Kim	**Category: Invited Oral**
Paper #: 0113	**Time:** 2:00 pm -2:20 pm
Title: Thermal Conductivity Reduction in Lithographically Patterned Single Crystal Silicon Phononic Crystal Structures	
Abstract: *In-plane thermal conductivity of lithography-based phononic crystals has been investigated. Sub-micron holes were lithographically patterned in a 500nm-thick single crystal silicon thin-film and the thermal conductivity was measured as low as 30 W/mK (at and slightly above room temperature, 20~80^{o}C), which is a 50% reduction even after accounting for the effect of volume reduction of the holes.*	
Author: M. Ziaei-Moayyed	**Category: Invited Oral**
Paper #: 0126	**Time:** 2:20 pm -2:40 pm
Title: Silicon Carbide Phononic Crystals for Communication, Sensing, and Energy Management	
Abstract: *We demonstrate design, fabrication, and characterization of silicon carbide phononic crystals used to confine energy in lateral overtone cavities in 2-3GHz range with high f.Q products in air. The SiC cavities are fabricated in a CMOS-compatible process with applications in communication systems, sensing, and thermal energy management*	
Author: M. Su	**Category: Invited Oral**
Paper #: 0169	**Time:** 2:40 pm -3:00 pm
Title: Designing High-Q Compact Phononic Crystal Resonators	
Abstract: *Phononic crystals provide a promising method of producing resonators with very high quality factors up to the theoretical limit possible in the host material. In this study we consider Silicon based solid-solid phononic crystal resonator designs with different lattices (simple cubic, hexagonal/triangular and honeycomb), number of inclusions and cavity shapes.*	

Poster Session (Chapel)	**3:00 pm - 5:05 pm**
Session Chair: I. El-Kady & M. I. Hussein	
Author: S. Alaie	**Category: Poster 1**
Paper #: 165	**Time:** 3:00 pm -5:05 pm
Title: Device Level Harmonic Finite Element Analysis of Phononic Crystals Operating at GHz Frequencies	
Author: G. Bastian	**Category: Poster 2**
Paper #: 0185	**Time:** 3:00 pm -5:05 pm
Title: Isotopically Enriched Semiconductor Superlattices for Thermoelectric Applications	
Author: O. R. Bilal	**Category: Poster 3**
Paper #: 0173	**Time:** 3:00 pm -5:05 pm
Title: Phononic Band Gap Optimization for Combined In-Plane and Out-of-Plane Waves	
Author: S. Bringuier	**Category: Poster 4**
Paper #: 0163	**Time:** 3:00 pm -5:05 pm
Title: Acoustic Logic Gates Implemented using a Phase Controlling Phononic Crystal	
Author: C.-T. Bui	**Category: Poster 5**
Paper #: 0050	**Time:** 3:00 pm -5:05 pm
Title: Temperature and Size Dependence of Thermal Conductivity in Single Crystal ZnO Nanowires	
Author: A.L. Chen	**Category: Poster 6**
Paper #: 0082	**Time:** 3:00 pm -5:05 pm
Title: Propagation of the Elastic Wave in One-dimensional Randomly Disordered Solid-liquid Phononic Crystals	
Author: W.S. Chang	**Category: Poster 7**
Paper #: 0038	**Time:** 3:00 pm -5:05 pm
Title: Nanoscale Tip Fabrication for Plasmon Induced Field- Enhancement	
Author: M. Frazier	**Category: Poster 8**
Paper #: 172	**Time:** 3:00 pm -5:05 pm
Title: Dissipative Effects in Acoustic Metamaterials	
Author: D.F. Goettler	**Category: Poster 9**
Paper #: 164	**Time:** 3:00 pm -5:05 pm
Title: nanoFIBrication of Phononic Crystals in Freestanding Membranes	
Author: M.V. Golub	**Category: Poster 10**
Paper #: 0018	**Time:** 3:00 pm -5:05 pm
Title: 2D Wave Propagation in Periodically Layered Composite Structures with Damages	
Author: Q. Guo	**Category: Poster 11**
Paper #: 0176	**Time:** 3:00 pm -5:05 pm
Title: Convergence of the Reduced Bloch Mode Expansion Method for Electronic Band Structure Calculations	
Author: T.J. Isotalo	**Category: Poster 12**
Paper #: 0088	**Time:** 3:00 pm -5:05 pm
Title: Low-Temperature Thermal Conductance of Periodically Perforated Silicon Nitride Membranes	

Author: H. Ketata	**Category: Poster 13**
Paper #: 0099	**Time:** 3:00 pm -5:05 pm
Title: Influence of Filling Fraction and Constituent Materials on Acoustic Waves in Phononic Lattice	
Author: Kevin L. Manktelow	**Category: Poster 14**
Paper #: 166	**Time:** 3:00 pm -5:05 pm
Title: Intensity-Dependent Dispersion in Nonlinear Phononic and Photonic Layered Systems	
Author: Y. Pennec	**Category: Poster 15**
Paper #: 0090	**Time:** 3:00 pm -5:05 pm
Title: Band-gap operating in the gigahertz frequencies for a bi-layer phononic crystal slab	
Author: O. Poncelet	**Category: Poster 16**
Paper #: 123	**Time:** 3:00 pm -5:05 pm
Title: Dynamical effective properties of elastic multilayers	
Author: V. Romero-Garcia	**Category: Poster 17**
Paper #: 0102	**Time:** 3:00 pm -5:05 pm
Title: Interaction between Periodic Arrays and Finite Impedance Surface: Analytical Results and Experimental Data	
Author: V. Romero-Garcia	**Category: Poster 18**
Paper #: 0058	**Time:** 3:00 pm -5:05 pm
Title: Acoustic Beams in Finite Sonic Crystals	
Author: Matteo Senesi	**Category: Poster 19**
Paper #: 0184	**Time:** 3:00 pm -5:05 pm
Title: Multi-field Internally Resonating Metamaterials	
Author: A. Tomchek	**Category: Poster 20**
Paper #: 177	**Time:** 3:00 pm -5:05 pm
Title: Characterization of Band Gap Resonances in Finite Periodic Structures	

Author: V. Tournat	**Category: Poster 21**
Paper #: 0011	**Time:** 3:00 pm -5:05 pm
Title: Out-of-plane acoustic modes in monolayer phononic granular membranes	
Author: Y.-S. Wang	**Category: Poster 22**
Paper #: 0060	**Time:** 3:00 pm -5:05 pm
Title: Surface/Interface Effects on Band Structures of Nanosized Phononic Crystals	
Author: A. Young	**Category: Poster 23**
Paper #: 0167	**Time:** 3:00 pm -5:05 pm
Title: Strain Based Tuning of Ring Resonators Via Hydrostatic Pressure Actuation of Membranes	
Author: X.-Z. Zhou	**Category: Poster 24**
Paper #: 0040	**Time:** 3:00 pm -5:05 pm
Title: Band Gap Calculation for 2D Solid-Fluid Phononic Crystals by the Method Based on Dirichlet-to-Neumann Map	
Author: G. Zhu	**Category: Poster 25**
Paper #: 0044	**Time:** 3:00 pm -5:05 pm
Title: Phonons on Complex Networks	
Coffee Break (Promenade)	**5:05 pm - 5:25 pm**
Felix Bloch Lecture (Mesa Ballroom)	**5:30 pm - 6:30 pm**
Free Time	6:30 pm - 7:00 pm
Banquet (Ortiz Ballroom) & Phononics 2013 Announcement	**7:00 pm - 10:00 pm**

Thursday: June 2 Detailed Program Information

Registration (Chamisa)	**7:30 am - 12:00 pm**
Announcements (Mesa BR)	**8:15 am - 8:30 am**
Track 6: Fabrication and Characterization for Phononics	
Session: 14 (Ortez Ballroom)	**8:30 am - 10:15 am**
Session Chair: F. McCormick	
Author: G. Bogart	**Category: Plenary Talk**
Paper #: 0075	**Time:** 8:30 am -9:00 am
Title: Larger Scale Fabrication of Nanometer to Micron Sized Periodic Structures in 2D and 3D: Approaches and Trends	
Abstract: *Fabrication of periodic structures for photonic or phononic wavelength interaction and manipulation at the small scale (<100um x 100 um) in planar dimensions using a variety of materials and techniques has been documented in the literature. Often structures are conceived and built with only a single device needing to be made. Some applications require that structures be fabricated in three dimensions or with multiple layers placing additional constraints on the fabricator.*	
Author: G. Piazza	**Category: Keynote Talk**
Paper #: 0105	**Time:** 9:00 am -9:25 am
Title: Microfabricated GHz Phononic Band Gap Structures	
Abstract: *This paper reports the latest development on the synthesis of phononic band gaps (PBG) in AlN/Air and SiC/Air structures operating in the GHz range by means of inverted cylindrical geometries or fractal-based designs. Finite element methods used to design and confirm the PBG dispersion curve and amplitude-frequency response are also presented.*	
Author: D. Schneider	**Category: Keynote Talk**
Paper #: 0131	**Time:** 9:25 am -9:50 am
Title: High Frequency Soft Phononics	
Abstract: *Propagation of hypersonic elastic/acoustic waves in polymer- and colloid-based nanostructures emerges as a powerful characterization tool of thermo- mechanical properties and reveals new structure related collective phenomena .Particle vibration spectroscopy and engineering of the phonon dispersion band diagram are highlighted in this presentation.*	

Author: Z. C. Leseman	**Category: Org. Colloquium**
Paper #: 0125	**Time:** 9:50 am -10:15 am

Title: Fabrication of 2-D Phononic Crystals via Focused Ion Beam

Abstract: *A technique for the fabrication of 2-D Phononic Crystals (PnCs) is described that utilizes a focused ion beam (FIB) instrument. In particular, the details of the microfabrication procedure are discussed which creates the main structure from which the PnC is created. Following the microfabrication is the nanoFIBrication of the microstructure to create a PnC with nanoscale features. Results will be presented for the fabrication of a 33 GHz PnC.*

Coffee Break (Chamisa)	**10:15 am - 10:40 am**

Track 7: Phononic MEMS and RF Applications

Session: 15 (Ortez Ballroom)	**10:40 am - 12:50 pm**
Session Chair: A. Khelif	
Author: A. Adibi	**Category: Plenary Talk**
Paper #: 0179	**Time:** 10:40 am -11:10 am

Title: A Waveguide-based Phononic Crystal Micro/Nano-mechanical High-Q Resonator

Abstract: *In this paper, we report the design, analysis, fabrication, and characterization of a very high frequency (VHF) phononic crystal (PnC) micro/nano mechanical resonator architecture based on silicon (Si) PnC slab waveguides. The PnC structure completely surrounds the resonant area and the resonator is excited by a thin aluminum nitride-based piezoelectric transducer stack directly fabricated on top of the resonator. This architecture highly suppresses the support loss of the resonator to the surroundings while providing mechanical support and electrical signal delivery to the resonator.*

Author: Y. Pennec	**Category: Keynote Talk**
Paper #: 0054	**Time:** 11:10 am -11:35 am

Title: Band Gaps and Defect Modes in Phononic Strip Waveguides

Abstract: *We study the elastic wave propagation in different geometries of strip waveguides obtained by extracting a row out of a phononic crystal slab made up of a square array of air holes in a silicon plate. We show that the existence of band gaps is strongly dependent on the cutting direction. We also study the existence of localized modes in cavities inserted inside the perfect strip waveguides.*

Author: J. Vasseur	**Category: Keynote Talk**
Paper #: 0053	**Time:** 11:35 am -12:00 pm
Title: Tunable magnetoelastic phononic crystals	
Abstract: *The feasibility of contactless tunability of the band structure of two dimensional phononic crystals is demonstrated by employing magnetostrictive materials and applying an external magnetic field. The influence of the amplitude and of the orientation with respect to the inclusion axis of the applied magnetic field are studied in details. Applications to tunable selective frequency filters are discussed.*	

Author: I. E. Psarobas	**Category: Keynote Talk**
Paper #: 0070	**Time:** 12:00 pm -12:25 pm
Title: Multi-phonon Processes in PhoXonic Cavities	
Abstract: *Long lifetime photons and phonons, confined in the same region of space, inside a phoXonic cavity, can interface with each other via strong nonlinear acousto-optic interactions. We unveil physics of distinct importance as the hypersonic modulation of light is substantially enhanced through multi-phonon exchange mechanisms.*	

Author: R. H. Olsson	**Category: Org. Colloquium**
Paper #: 0122	**Time:** 12:25 pm -12:50 pm
Title: Micromachined Phononic Band-Gap Crystals and Devices	
Abstract: *Micromachined phononic crystals are an emerging technology with applications in radio frequency communications, sensors and thermal energy harvesting. This paper presents work at Sandia National Laboratories in the realization of micromachined phononic crystal devices across a broad frequency range and in a number of material systems.*	

Lunch Break (Chamisa)	**12:50 pm - 2:00 pm**

Parallel Sessions	
Track 1 & 4: Phononic Crystals & Phonon Transport	
Session: 17 (Ortez Ballroom A)	**2:00 pm - 3:30 pm**
Session Chair: A. Adibi	
Author: S. Alaie	**Category: Contrib. Oral**
Paper #: 0152	**Time:** 2:00 pm -2:15 pm
Title: On the Validity of 2D Numerical Simulation of Bandgap for Slab of Phononic Crystals	
Abstract: *This work suggests a criterion for verification of Phononic bandpaps simulated by two dimensional elastodynamic models. The bandgap of a phononic crystals (PnCs) was studied using both 2D and 3D finite element analyses. Comparing the numerical results with experiment, this study indicates that validity of 2D models depends on the ratio of the thickness to the excitation wavelength.*	
Author: R. A. Wildman	**Category: Contrib. Oral**
Paper #: 0147	**Time:** 2:15 pm -2:30 pm
Title: Multi-Objective Optimization of Phononic Bandgap Materials for Wide Band, Low Frequency Operation	
Abstract: *Phononic bandgap materials are optimized for maximization of bandgap size and minimization of center frequency using a genetic programming method for inclusion shape design and material choice. Maximizing the bandgap size allows for a material design that can block a wide range of frequencies. Minimizing the center frequency will give designs that are small compared to the effective wavelength.*	
Author: M. V. Golub	**Category: Contrib. Oral**
Paper #: 0072	**Time:** 2:30 pm -2:45 pm
Title: Propagation and Transmission of Elastic SH-Waves in Functionally Graded Phononic Crystals	
Abstract: *The boundary value problem of elastic SH-wave propagation in one-dimensional phononic crystals composed of functionally graded interlayers arisen from the solid diffusion of homogeneous isotropic material of the crystal is considered. The localization phenomena, transmission and band gaps due to the material gradation are investigated.*	

Author: F. Scarpa	**Category: Contrib. Oral**
Paper #: 0022	**Time:** 2:45 pm -3:00 pm
Title: Band-gap Acoustic States in 1D and 2D Single Layer Graphene Sheet Systems	
Abstract: *We evaluate the pass-stop band characteristics of mechanical wave propagating in periodic nanostructures made with nanoribbons or graphene sheets with non-reconstructed defects..*	

Author: R. J. Magyar	**Category: Contrib. Oral**
Paper #: 0046	**Time:** 3:00 pm -3:15 pm
Title: Divide and Conquer Quantum Mechanical Methods for Phononic Applications	
Abstract: *Density functional theory is a highly efficient computational framework that describes structural properties of materials such as phonon frequencies and densities of states. In this talk, we suggest how the divide and conquer scheme may be well suited to determine phononic response in materials with supermolecular scale features.*	

Author: M. W. Blair	**Category: Contrib. Oral**
Paper #: 0145	**Time:** 3:15 pm -3:30 pm
Title: Improved Lattice-Bath Phonon Relaxation in Nanoscale Oxides	
Abstract: *Electron paramagnetic resonance (EPR) spectroscopy has been used to study energy transport properties of bulk and nanophosphor oxyorthosilicate samples. The bulk samples displayed a slight phonon bottleneck while energy relaxation in the nanophosphor samples was not influenced by the lattice-bath relaxation time and was more rapid.*	

Coffee Break (Chamisa)	**3:30 pm - 3:55 pm**

Track 4: Phonon Transport

Session: 18 (Ortez Ballroom A)	3:55 pm - 4:40 pm
Session Chair: Z. C. Leseman	
Author: P.-O. Chapuis	**Category: Contrib. Oral**
Paper #: 0049	**Time:** 3:55 pm -4:10 pm

Title: Heat dissipation in silicon and quartz nanoridges

Abstract: *We have investigated experimentally the effect of confinement of thermal acoustic phonons in 100 nm large ridges of silicon and quartz. We quantify the deviation to Fourier and ballistic predictions as a function of two characteristic numbers, the constriction Knudsen number describing the transmission of the phonons and a dimensionless number based on the nanoridges volume/surface ratio.*

Author: F. Alzina	**Category: Contrib. Oral**
Paper #: 0094	**Time:** 4:10 pm -4:25 pm

Title: Dispersion of Confined Acoustic Phonons in Ultra-Thin Si Membranes

Abstract: *The dispersion curves of confined acoustic phonons in ~10 and ~30 nm Si membranes were measured using Brillouin Light Scattering (BLS) spectroscopy. The dispersion relations of the confined phonons were calculated from a semi-analytical model based on continuum elasticity theory. Green's function simulations were used to simulate the Brillouin spectra.*

Author: M. Prunnila	**Category: Contrib. Oral**
Paper #: 0103	**Time:** 4:25 pm -4:40 pm

Title: Acoustic Phonon Transmission and Heat Conduction Through Vacuum

Abstract: *We describe theoretically how acoustic phonons can directly transmit energy and conduct heat between bodies that are separated by a vacuum gap. This effect is enabled by introducing a coupling mechanism, such as piezoelectricity, that strongly couples electric field and lattice deformation.*

Track 2: Periodic Structures	
Session: 19 (Ortez Ballroom B)	**2:00 pm - 3:30 pm**
Session Chair: R. H. Olsson III	
Author: A. Leonard	**Category: Contrib. Oral**
Paper #: 0030	**Time:** 2:00 pm -2:15 pm
Title: Tailoring Stress Waves in 2-D Highly Nonlinear Granular Crystals: Simulations and Experiments	
Abstract: *We study the propagation of elastic stress waves in two-dimensional highly nonlinear granular crystals composed of square packings of spheres with and without cylindrical intruders, via experiments and numerical simulations. By varying the intruder material, we show the ability to alter the propagating wave front characteristics. Experiments agree well with discrete particle simulations.*	
Author: G. Theocharis	**Category: Contrib. Oral**
Paper #: 0079	**Time:** 2:15 pm -2:30 pm
Title: Control of Vibrational Energy in Nonlinear Granular Crystals	
Abstract: *We describe recent work on nonlinear granular crystals. We explore phenomena related to vibrational energy localization, re-distribution, and rectification enabled by the spatial discreteness, disorder, and nonlinearity of granular crystals. In addition, we note how an understanding of dynamic phenomena in granular crystals can enable the design of novel engineering devices.*	
Author: V. J. Sánchez-Morcillo	**Category: Contrib. Oral**
Paper #: 0098	**Time:** 2:30 pm -2:45 pm
Title: Second harmonics, instabilities and hole solitons in 1D phononic granular chains	
Abstract: *The propagation of nonlinear compressional waves in a 1D compressed granular chain driven at one end by a harmonic excitation is theoretically studied. The chain is described by a FPU lattice model with quadratic nonlinearity. We predict and describe different nonlinear phenomena, as the generation of second harmonics, modulational instabilities and the existence of hole (or dark) solitons.*	

Author: G. Wang	**Category: Contrib. Oral**
Paper #: 0067	**Time:** 2:45 pm -3:00 pm
Title: Broadband Vibration Attenuation Induced by Periodic Arrays of Feedback Shunted Piezoelectric Patches on Beams	
Abstract: *The effect of periodic arrays of feedback shunted piezoelectric patches in vibration attenuation of flexible beams is analyzed theoretically and experimentally. Broadband vibration attenuations are observed no mater in or out of the band gaps. The proposed concept is validated experimentally on a suspended epoxy beam.*	
Author: Y. Xiao	**Category: Contrib. Oral**
Paper #: 0148	**Time:** 3:00 pm -3:15 pm
Title: Longitudinal Vibration Band Gaps in Rods with Periodically Attached Multi-Degree-of-Freedom Vibration Absorbers	
Abstract: *Band gap behavior in rods with periodically mounted multi-degree-of-freedom resonators (vibration absorbers) is concerned. Explicit expressions are derived for the calculation of complex band structures. The effects of absorber parameters on the band gap properties are studied. The band gap formation mechanisms of the system are explained by analytical models with explicit formulations.*	
Author: S. Chen	**Category: Contrib. Oral**
Paper #: 0031	**Time:** 3:15 pm -3:30 pm
Title: Active Control of Band Gaps by Periodically Distributed Piezo-shunts	
Abstract: *Periodic arrays of inductive or negative capacitive shunted piezoelectric patches are employed to control the band gaps of phononic beams. An epoxy beam with periodically surface- bonded piezoelectric patches is designed. The band gaps, when each piezo-patch is connected to a single inductive or negative capacitive circuit, are investigated in detail.*	
Coffee Break (Chamisa)	**3:30 pm - 3:55 pm**

Track 6: Fabrication and Characterization for Phononics	
Session: 20 (Ortez Ballroom B)	**3:55 pm - 4:40 pm**
Session Chair: M. F. Su	
Author: T. J. Isotalo	**Category: Contrib. Oral**
Paper #: 0143	**Time:** 3:55 pm -4:10 pm
Title: Techniques for Self-Assembled Phononic Crystals	
Abstract: *In this project, we study the assembly of periodic arrays of nanospheres and their crystalline properties. The vertical deposition technique is investigated along with the effects of substrate surface modifications for improvement of order and directed self-assembly. Dipping speed and PS sphere concentration are taken as the primary parameters affecting crystalline quality.*	
Author: D. F. Goettler	**Category: Contrib. Oral**
Paper #: 0151	**Time:** 4:10 pm -4:25 pm
Title: The Effect of Phononic Crystal Lattice Type and Lattice Spacing on the Reduction of Bulk Thermal Conductivity in Silicon and Silicon Nitride	
Abstract: *Phononic crystals are a promising method of reducing a material's bulk thermal conductivity. Changing a phononic crystal's lattice type or its lattice spacing are two ways of reducing a material's thermal conductivity. Results of different lattice types and lattice spacings on the reduction of bulk thermal conductivity in silicon and silicon nitride at room temperature will be presented.*	
Author: D. Lanzillotti-Kimura	**Category: Contrib. Oral**
Paper #: 0158	**Time:** 4:25 pm -4:40 pm
Title: Nanophononics using Acoustic and Optical Cavities	
Abstract: *We report pump-probe time experiments in acoustic and optical cavities. We demonstrate that the generated coherent acoustic phonon spectra can be inhibited or enhanced in the cavity. Simulations highlight the role of the phonon density of states in the coherent phonon generation, extending concepts at the base of the Purcell effect to the field of phononics.*	
Adjourn	**4:40 PM**