Phononics 2013: 2nd International Conference on Phononic Crystals/Metamaterials, Phonon Transport and Optomechanics

June 2-7 2013, Sharm El-Sheikh, Egypt

Sunday: June 2	Detailed Program Information
Registration (Amaraua Foyer)	**4:00 pm - 7:00 pm**
Reception (Amaraua Foyer)	**7:00 pm - 9:00 pm**
Adjourn	**9:00 PM**

Phononics 2013: 2nd International Conference on Phononic Crystals/Metamaterials, Phonon Transport and Optomechanics

June 2-7 2013, Sharm El-Sheikh, Egypt

Monday: June 3 Detailed Program Information

Registration (Amaraua Foyer)	**7:30 am - 12:00 pm**
Opening Ceremony (Amaraua Conf. Hall)	**7:40 am - 8:00 am**
Track 1: Phononic Crystals	
Session: 1 (Amaraua Conference Hall)	**8:00 am - 10:20 pm**
Session Chair: T.T. Wu	
Author: E. N. Economou	**Category: Plenary Talk**
Affiliation: IESL, Foundation for Research and Technology	
Paper #: 0154	**Time:** 8:00 am -8:30 am
Title: Manipulating the Flow of Classical Waves: The Case of Phononic Crystals	
Abstract: *The appearance of frequency gaps for acoustic and elastic wave in inhomogenous media is examined. Strong resonance scattering (geometric or physical) and destructive inter-ference are the key factors. Some characteristic examples will be presented.*	
Author: V. Laude	**Category: Plenary Talk**
Affiliation: Institut FEMTO-ST, Université de Franche-Comté and CNRS	
Paper #: 0098	**Time:** 8:30 am -9:00 am
Title: Phononic Crystal Diffraction Gratings for Surface and Bulk Acoustic Waves	
Abstract: *Phononic crystals built from solid materials and immersed in water make efficient diffraction gratings. In addition to frequency band gaps, phononic crystals of finite thickness support a rich variety of surface acoustic waves and can be optimized for diffraction efficiency, as we illustrate by experiments and calculations.*	
Author: J. H. Page	**Category: Invited Oral**
Affiliation: Department of Physics and Astronomy, University of Manitoba	
Paper #: 0133	**Time:** 9:00 am -9:20 am
Title: Anomalous Ultrasonic Transport through a 2D Phononic Crystal with Competing Bragg and Hybridization Gaps	
Abstract: *In 2D phononic crystals of nylon rods surrounded by water, strikingly unusual dispersion effects have been observed, both experimentally and numerically, when both hybridi-zation and Bragg gaps coincide in frequency. These remarkable characteristics are explained by the competition between two co-existing propagation modes, reflecting strong coupling between scattering resonances of the rods.*	
Author: V. Romero-Garcia	**Category: Invited Oral**
Affiliation: Universitat Politècnica de València	
Paper #: 0109	**Time:** 9:20 am -9:40 am
Title: Unlocked Evanescent Waves in Sonic Crystals	
Abstract: *Unlocked evanescent waves in periodic medium are characterized by Bloch modes which wave vector has real part in between the Brillouin zone and non zero imaginary part. Because of these properties, we report here the relevance of the k-space of unlocked evanescent waves in thin semi-infinite fluid-fluid sonic crystal slabs.*	

Author: G. Fytas	**Category: Invited Oral**
Affiliation: Max Planck Institute for Polymer Research and Department of Materials Science, University of Crete and	
Paper #: 0158	**Time:** 9:40 am -10:00 am

Title: Hypersonic Phononic Band Gap Structures

Abstract: *The study of hypersonic crystals imposes substantial demand on fabrication and characterization techniques. Colloid and polymer science offer methods to create novel materials that possess periodic variations of density and elastic properties at mesoscopic length scales commensurate with the wave length of hypersonic phonons and hence photons of the visible light. Polymer- and colloid-based phononics is an emerging new field at the interface of soft materials science and condensed matter physics with good perspectives ahead. Here, examples from fabricated structures will be highlighted.*

Author: M. M. Sigalas	**Category: Invited Oral**
Affiliation: Department of Materials Science, University of Patras	
Paper #: 0037	**Time:** 10:00 am -10:20 am

Title: Phononic Band Gaps in Graphene-like Materials and Nanotubes

Abstract: *In this work graphene and graphene-like structures in which some of their atoms are replaced by other group IV atoms are examined. Phononic band gaps in these nanoscale phononic crystals, is studied. Nanotubes were also examined and their similarities with the graphene-like materials were found.*

Coffee Break (Amaraua Foyer)	**10:20 am - 10:40 am**
Track 1: Phononic Crystals	
Session: 2 (Amaraua Conference Hall)	**10:40 am - 1:00 pm**
Session Chair: J. Page	
Author: J. O. Vasseur	**Category: Invited Oral**
Affiliation: Institut d'Electronique, de Micro-électronique et de Nanotechnologie	
Paper #: 0047	**Time:** 10:40 am -11:00 am

Title: Two-dimensional Solid/Solid Phononic Crystal with Multiple Functionalities

Abstract: *A two dimensional solid/solid phononic crystal exhibits a passing band of longitudinal polarization with equifrequency contours of quasi-square shape. Due to this property, peculiar refraction phenomena occur and serve as a basis for new and original functionalities.*

Author: A.-C. Hladky-Hennion	**Category: Invited Oral**
Affiliation: IEMN (UMR 8520 CNRS)	
Paper #: 0030	**Time:** 11:00 am -11:20 am

Title: Negative Refraction and Focalization of Acoustic Waves Using a Foam-like Metallic Structure

Abstract: *A phononic crystal (PC) based on a metal structure permeated by air is presented and studied. At low frequency, the structure has water like-density and -longitudinal velocity. At higher frequency, the structure displays a perfect negative index matching with surrounding water and focusing capability. Numerical results and experiments are presented.*

Author: P. H. Otsuka	**Category: Invited Oral**
Affiliation: Division of Applied Physics, Faculty of Engineering, Hokkaido University	
Paper #: 0078	**Time:** 11:20 am -11:40 am

Title: Mapping Surface Phonons in Phononic Crystals in Real- and k-Space

Abstract: *We investigate gigahertz phonon propagation in a triangular-lattice phononic crystal by time-resolved two-dimensional imaging and by finite element simulations. The effects of exciting different points in the crystal lattice in k-space are revealed by spatiotemporal Fourier analysis. Moreover, the effect of conducting the Fourier analysis at different depths in the sample is elucidated in the numerical simulations.*

Author: O. Matsuda	**Category: Invited Oral**
Affiliation: Division of Applied Physics, Faculty of Engineering, Hokkaido University	
Paper #: 0013	**Time:** 11:40 am -12:00 pm
Title: Time-resolved Imaging of the Negative Refraction of GHz Surface Acoustic Waves in Phononic Crystals	
Abstract: *We investigate the negative refraction of surface acoustic waves at an interface between a two-dimensional phononic crystal and a homogeneous medium with a simulation using the finite element method and with a time-resolved two-dimensional imaging experiment. Negative refraction in the GHz frequency region is clearly revealed by spatiotemporal Fourier analysis.*	

Author: B. Bonello	**Category: Invited Oral**
Affiliation: Institut des NanoSciences de Paris (INSP-UMR CNRS 7588)	
Paper #: 0057	**Time:** 12:00 pm -12:20 pm
Title: Observation of Localized Cavity Modes in a 2D Phononic Crystal Slab	
Abstract: *The confinement of anti-symmetric Lamb modes in a single defect inserted in a 2D silicon/air phononic crystal is measured as a function of both position and time. Posi-tions and relative amplitude of the localized modes well agree with FEM calculations. The dynamics of confinement are deduced from the time dependence.*	

Author: T. T. Wu	**Category: Org. Colloquium**
Affiliation: 1Institute of Applied Mechanics, National Taiwan University	
Paper #: 0123	**Time:** 12:20 pm -12:40 pm
Title: Quartz Phononic Lamb Wave Resonator	
Abstract: *In this work, we present results on the design and fabrication of an AT-cut quartz Lamb wave resonator with phononic crystal reflective gratings. The deep reactive ion etching process with a laboratory-made etcher was utilized to fabricate phononic crystal (PC) structures of the AT-cut quartz Lamb wave resonator. The finite element method was adopted to calculate the PC band structure, effective reflective distance from the PC boundary and further the resonant modes and admittance of the phononic Lamb wave resonant cavity. Through the comparison studies between the experimental and simulated results, a design process for the AT-cut quartz phononic Lamb wave resonator was proposed.*	

Author: A. Khelif	**Category: Org. Colloquium**
Affiliation: Institut FEMTO-ST, 32 avenue de l'Observatoire	
Paper #: 0117	**Time:** 12:40 pm -1:00 pm
Title: How Pillar-based Phononic Crystal Controls the Surface Acoustic Waves	
Abstract: *It is well known that pillars have internal modal resonances that can be tuned in frequency by design. When they hybridize with the continuum of surface modes of the supporting substrate, they lead to the formation of Fano-like resonances. Depending on the near-field coupling of neighboring pillars, a phenomenon of band repulsion can further be induced. Thus, in addition to Bragg band gaps, frequency band gaps can appear around the local resonances of the pillars. The guidance and the confinement of surface waves through defects are also affected by these resonances as well as the dispersion.*	

Lunch Break (Kahramana Resturant)	**1:00 pm - 3:30 pm**
Track 1: Phononic Crystals	
Session: 3 (Amaraua Conference Hall)	**3:30 pm - 6:30 pm**
Session Chair: A. Khelif	
Author: Y. S. Wang	**Category: Invited Oral**
Affiliation: Institute of Engineering Mechanics,Beijing Jiaotong University, Beijing	
Paper #: 0025	**Time:** 3:30 pm -3:50 pm
Title: Method Based on Dirichlet-to-Neumann Map for Band Structure Calculation of Two-dimensional Phononic Crys-tals with Consideration of Interface Effects	
Abstract: *A numerical method based on Dirichlet-to-Neumann Map is developed for band structure calculation of two-dimensional phononic crystals. Various interface conditions between the scatterers and host material are considered. Numerical results for a phononic crystal of the nano size are presented; and the interfacial effect is discussed.*	

Author: Y. Pennec	**Category: Invited Oral**
Affiliation: Institut d'Electronique, de Microélectronique et de Nanotechnologie, Université de Lille	
Paper #: 0062	**Time:** 3:50 pm -4:10 pm
Title: Dual Phononic and Photonic Crystal Sensor	
Abstract: *We study theoretically dual phononic-photonic (the so-called phoxonic) crystals for liquid sensing applications. We investigate the existence of well-defined features (peaks or dips) in the transmission spectra of acoustic and optical waves and evaluate their sensitivity to the sound and light velocity of the liquid environment.*	

Author: S. A. Bhave	**Category: Invited Oral**
Affiliation: OxideMEMS Lab, Cornell University	
Paper #: 0132	**Time:** 4:10 pm -4:30 pm
Title: Silicon MEMS + Photonic Systems*	
Abstract: *In this talk, I will introduce a method for actuating an optomechanical resonator using electrostatic forces and sensing of mechanical motion by using the optical intensity modulation at the output of an optomechanical resonator, integrated into a monolithic system fabricated on a silicon-on-insulator (SOI) platform. I will discuss new applications enabled by this hybrid system including Opto-Acoustic Oscillators (OAO) and inertial sensors.*	

Author: N. Z. Swinteck	**Category: Contributed Oral**
Affiliation: Department of Materials Science and Engineering, University of Arizona	
Paper #: 0114	**Time:** 4:30 pm -4:45 pm
Title: Shear-resonance Modes in 2D and 3D Phononic Structures with Ultra-soft-polymer Host Matrices	
Abstract: *In this study we examine the modes of vibration supported by a variety of 2D and 3D elastic phononic crystals (EPCs) comprised of stiff-polymer inclusions and ultra-soft-polymer matrices (matrix materials with transverse speed of sound less-than or equal to 30 m/s). Finite-difference time-domain (FDTD) band structure and displacement field calculations reveal the presence and origin of numerous shear-resonance modes in these types of EPCs. We highlight unique cases of rigid-body rotational resonance as well as hybridization between shear-resonance and bulk transverse modes and attribute these phenomena to the small value of transverse speed of sound for the host matrix material.*	

Author: A. A. Kutsenko	**Category: Contributed Oral**
Affiliation: Universite de Bordeaux, Institut de Mecanique et d'Ingenierie de Bordeaux	
Paper #: 0029	**Time:** 4:45 pm -5:00 pm
Title: Surface Waves in Phononic Crystals	
Abstract: *We study SH surface waves in a 2D-periodic half-space with free surface. An explicit form of the dispersion equation f(ω,k)=0 is found. The surface-wave dispersion branches ω (k) are calculated by the new method based on the projector on the space of evanescent modes. Subsonic and supersonic SH surface waves are observed. The low-frequency asymptotics of the subsonic branch is discussed in detail.*	

Author: N. Aravantinos-Zafiris	**Category: Contributed Oral**
Affiliation: Department of Materials Science, University of Patras	
Paper #: 0046	**Time:** 5:00 pm -5:15 pm
Title: Sonic Strip Waveguide with Phononic Crystal	
Abstract: *Using the Finite Difference Time Domain method, we numerically examine the usage of a sonic strip waveguide having a phononic crystal. This structure could have important applications in acoustic circuits. Different materials, all three polarizations of the input pulse and the effect of all the geometric parameters of the structure were considered for this study. Defected phononic crystal was also included in our calculations.*	

Author: J. F. Zhao	**Category: Contributed Oral**
Affiliation: Institut des NanoSciences de Paris (INSP-UMR CNRS 7588) Université Pierre et Marie Curie	
Paper #: 0086	**Time:** 5:15 pm -5:30 pm
Title: Focalization of the Lowest Order Antisymmetric Lamb Wave with a Gradient-index Phononic Plate	
Abstract: *In this work, we report on a study of the lowest antisymetric A0 Lamb wave in a gradient-index phononic crystal plate with a rectangular lattice. The numerical and experimental results demonstrate very close behaviors of wave propagation inside phononic crystal, and both of them show an efficient focalization of the A0 mode wave.*	

Author: T. J. Isotalo	**Category: Contributed Oral**
Affiliation: Nanoscience Center, Department of Physics, University of Jyväskylä	
Paper #: 0028	**Time:** 5:30 pm -5:45 pm
Title: 3D Phononic Colloidal Crystals: Fabrication and Modeling	
Abstract: *We have investigated the fabrication and characterization of nano-scale polystyrene colloidal crystals as sub-kelvin 3D phononic materials. A method for integrating simple circuit elements onto colloidal crystal surfaces has been developed. To support experiments, we have performed FEM simulations for various close-packed structures.*	

Author: J. H. Park	**Category: Contributed Oral**
Affiliation: WCU Multiscale Design Division, Seoul National University	
Paper #: 0012	**Time:** 5:45 pm -6:00 pm
Title: Engineering of Phononic Crystals by Topology Optimization	
Abstract: *The topology optimization of some unexplored design problems of phononic crystals is presented: self-collimation and periodicity-controlled bandgap maximization. For self-collimation, we aim to design unit cell layouts that propagate non-diffractive waves of narrow beam width. For bandgap maximization, we address the periodicity issue and propose a new formulation.*	

Author: S. R. Sklan	**Category: Contributed Oral**
Affiliation: Department of Physics, MIT	
Paper #: 0034	**Time:** 6:00 pm -6:15 pm
Title: A Magneto-acoustic Approach to Phononic Signal Pro-cessing and Amplification	
Abstract: *We formulate a theoretical means of guiding and manipulating phonons. Magneto-acoustic materials, controlled by a suitably sculpted magnetic field, can produce arbitrary linear operations (e.g. gyrations, beam splitting) on transverse phonon currents. A control mechanism (measurement and post-processing) extends this approach to nonlinear operations (e.g. amplifying arbitrarily polarized inputs).*	

Author: S. Degraeve	**Category: Contributed Oral**
Affiliation: IEMN, Institut d'Electronique, de Microelectronique et de Nanotechnologies	
Paper #: 0148	**Time:** 6:15 pm -6:30 pm
Title: Electric Charge Band Gaps in Phononic Crystals	
Abstract: *Thononic crystals consist of periodic arrangements of inclusions in a matrix, allowing absolute band gaps. Bragg band gaps are produced by wave scattering at periodic impedance mismatch zones, while hybridization band gaps are generated by periodic arrangements of resonators. A third kind of band gaps is presented here in the case of piezoelectric phononic crystals: electric charge band gaps. They have the property to be highly tunable.*	

Adjourn	**6:30 PM**

* Optomechanics Talk

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June 2-7 2013, Sharm El-Sheikh, Egypt

Tuesday: June 4 — Detailed Program Information

Registration (Amaraua Foyer)	**7:30 am - 12:00 pm**
Announcements (Amaraua Conf. Hall)	**7:45 am - 8:00 am**
Track 2: Phononic Metamaterials	
Session: 4 (Amaraua Conference Hall)	**8:00 am - 10:20 pm**
Session Chair: J. Sánchez-Dehesa	
Author: P. Sheng	**Category: Plenary Talk**
Affiliation: Department of Physics and William Mong Institute of Nano Science and Technology	
Paper #: 0127	**Time:** 8:00 am -8:30 am
Title: Dark Acoustic Metamaterials	
Abstract: *The absorption coefficient for low frequency sound is generally small. Hence their attenuation usually requires bulky and/or soft materials. In this talk I show that by using designed acoustic metamaterials comprising thin rubber membranes decorated with metallic platelets, we can achieve not only total reflection, but also very high absorption of the low frequency sound. These effects are made possible, in certain tunable frequency regimes, by the negative dynamic mass of the system and the high concentration of curvature energy density (by several orders of magnitude) at the perimeters of the decorated platelets*	
Author: N. X. Fang	**Category: Plenary Talk**
Affiliation: Massachusetts Institute of Technology	
Paper #: 0153	**Time:** 8:30 am -9:00 am
Title: Bending the Flow of Sound and Elastic Waves in Acoustic Metamaterials	
Abstract: *In this plenary talk, we will present our progress in bending and folding acoustic waves in a flexible acoustic circuitry. Motivated by our recent success in cloaking and beam shaping using coordinate transformation in acoustics, we will discuss its application to an array of acoustic devices and systems that are physically implementable without complex fabrication methods. We will also discuss the potential of MHz acoustic metamaterials.*	
Author: G. K. Hu	**Category: Invited Oral**
Affiliation: Beijing Institute of Technology	
Paper #: 0106	**Time:** 9:00 am -9:20 am
Title: Negative-mass Metamaterials and Superlensing Effect	
Abstract: *Acoustic metamaterials with negative effective mass below a cut-off frequency are analyzed in both mass-spring and continuum material models. Based on the proposed metamaterial model, acoustic superlens is designed to create images beyond the diffraction limit. There are two different mechanisms by which evanescent fields can be maintained. One mechanism is based on the zero effective mass, and the other is based on the resonant tunneling. The imaging performance of the proposed lens is validated by both numerical and experimental methods.*	
Author: Y.-F. Chen	**Category: Invited Oral**
Affiliation: Nanjing University	
Paper #: 0169	**Time:** 9:20 am -9:40 am
Title: Acoustic Metamaterials and Their Abnormal Effects	
Abstract: *Acoustic wave exhibits inherently different nature when propagating in sonic band-gap materials. We demonstrated effects of negative refractions of acoustic wave in two dimen-sional sonic crystals constructed with steel rods embedded in air. Analogous to enhanced opti-cal wave transmission through decorated tiny hole on metal thin, enhanced acoustic wave transmission through narrow slit much smaller than wavelength has been established as well. With deliberately making use of directional bandgap of sonic crystals, we showed a type of acoustic diode by asymmetric sonic crystal, which makes use of the wave momentum jumping from band gap to pass band. Some others progress on the resonators based phononic crystals will also be reported.*	

Author: J. Christensen	**Category: Invited Oral**
Affiliation: Technical University of Denmark	
Paper #: 0001	**Time:** 9:40 am -10:00 am

Title: Tunable Acoustic Metadevices

Abstract: *We demonstrate both by analytical and numerical simulations that structured rigid screens filled with elastic inclusions can be described in the long wavelength limit as an effective medium characterized by a mass density of the plasmon form. This type of metamaterial is thus not only used to control surface waves but also to create them. The combination of this behavior together with gap materials hosting bulk modulus resonances, produces negative dis-persion with simultaneous negative values of peff and 1/κeff, which is a characteristic of nega-tive refractive index materials.*

Author: H.-H. Huang	**Category: Invited Oral**
Affiliation: National Taiwan University	
Paper #: 0008	**Time:** 10:00 am -10:20 am

Title: Transmission of Bianisotropic Elastic Metamaterials

Abstract: *The dynamics characteristics of elastic metamaterials are investigated. Of particular interests are the bi-anisotropic material properties and their implications. Reflection and transmission of the harmonic waves are determined using the effective continuum model. In addition, interesting transient wave motion is presented through numerical simulations based on simplified mass-spring model.*

Coffee Break (Amaraua Foyer)	**10:20 am - 10:40 am**

Track 2: Phononic Metamaterials

Session: 5 (Amaraua Conference Hall)	**10:40 am - 1:00 pm**
Session Chair: P. Sheng	
Author: Y. Xiao	**Category: Invited Oral**
Affiliation: National University of Defense Technology	
Paper #: 0168	**Time:** 10:40 am -11:00 am

Title: Wave Propagation in Locally Resonant Phononic Plates

Abstract: *We study the wave attenuation behavior (inside band gaps) and wave beaming effects (within pass bands) of a locally resonant phononic plate made of a 2D periodic array of local resonators attached to a thin homogeneous plate. The wave attenuation behavior is char-acterized by the imaginary parts of Bloch wavenumbers, while the wave beaming effects are revealed by the iso-frequency contours of dispersion surfaces.*

Author: G. L. Huang	**Category: Invited Oral**
Affiliation: University of Arkansas at Little Rock	
Paper #: 0099	**Time:** 11:00 am -11:20 am

Title: Vibroacoustic Modeling and Analysis of Acoustic Metamaterials with Multiple Resonators

Abstract: *In this study, an analytical structural-acoustic model of the membrane-type acoustic metamaterial with multiple resonators is developed to consider the both translational and rotational motions of the resonators. The local deformation of the membrane is obtained through the point matching approach. The transmission loss and sound absorption are then described with different parameters of the resonators.*

Author: G. Lerosey	**Category: Invited Oral**
Affiliation: ESPCI ParisTech and CNRS	
Paper #: 0161	**Time:** 11:20 am -11:40 am

Title: Steering Waves at the Deep Subwavelength Scale in Locally Resonant Metamaterials

Abstract: *Using a microscopic approach we show that the dispersive properties of some metamaterials based on resonant unit cells are solely governed by interferences and not by near field interactions. This allows us to modify locally those metamaterials in order to create point or line defects, with which we can confine and guide waves on scales much smaller than the wavelength. We give examples in the audible acoustic range as in the microwave domain.*

Author: Y. Y. Kim	**Category: Invited Oral**
Affiliation: Seoul National University	
Paper #: 0160	**Time:** 11:40 am -12:00 pm

Title: Experimental Techniques for Ultrasonic Metamaterials with Guided Waves

Abstract: *This work presents magnetostrictive transducer-based experimental methods suitable for the investigation of intriguing phenomena of ultrasonic elastic waves. We will present the critical advantages of the proposed experimental technique and show interesting experimental results for elastic metamaterials and phononic crystals.*

Author: I.-K. Oh	**Category: Invited Oral**
Affiliation: Korea Advanced Institute of Science and Technology	
Paper #: 0054	**Time:** 12:00 pm -12:20 pm

Title: Vibro-Acoustic Waveguide with Tunable Bandgap

Abstract: *We represent that tunable bandgap on the propagation of acoustic waves can be achieved by using a vibro-acoustic waveguide consists of a series of unit metamaterial cells with shunted piezoelectric structure. Each of unit cells is composed of a shunt circuit and an embedded single crystal PMN-PT structure (SCPPS) which is used as sensing-actuator.*

Author: C. T. Chan	**Category: Org. Colloquium**
Affiliation: Hong Kong University of Science and Technology	
Paper #: 0135	**Time:** 12:20 pm -12:40 pm

Title: Dirac Cone Dispersion and Its Implications in Phononics

Abstract: *Dirac cone like dispersions at k=0 can be obtained in classical wave systems using accidental degeneracy. We will examine the consequences of such a dispersion in two-dimensional (2D) acoustic and elastic wave crystals and we will attempt to extend the concept to 3D.*

Author: J. Sánchez-Dehesa	**Category: Org. Colloquium**
Affiliation: Universitat Politècnica de València	
Paper #: 0137	**Time:** 12:40 pm -1:00 pm

Title: Advances in Acoustic Cloaking and Metamaterials with Negative Paramaters

Abstract: *Acoustic cloaks based on the scattering cancellation of the scattered waves by the object are designed, fabricated and experimentally demonstrated for two and three dimensional objects. In particular, an axisymmetric 3D cloak for sphere is fabricated by a 3D printer. In addition, acoustic metamaterials or metafluids with negative acoustic parameters will be reported. These structures consist of cylindrical cavities drilled in two-dimensional waveguides where the effective parameters can be tailored by changing the parameters of the cavities.*

Lunch Break (Kahramana Resturant)	**1:00 pm - 3:30 pm**

Track 2: Phononic Metamaterials

Session: 6 (Amaraua Conference Hall)	**3:30 pm - 6:30 pm**
Session Chair: C. T. Chan	
Author: Y. Lai	**Category: Invited Oral**
Affiliation: Soochow University	
Paper #: 0144	**Time:** 3:30 pm -3:50 pm

Title: Coherent Perfect Absorbers: From Optics to Acoustics

Abstract: *We extend the concept of coherent perfect absorbers (CPAs) from optics to acoustics, which provides us a new way to absorb sound very efficiently. It is possible to achieve acoustic CPAs by tuning both mass density and modulus of phononic metamaterials.*

Author: Y. A. Urzhumov	**Category: Invited Oral**
Affiliation: Duke University	
Paper #: 0049	**Time:** 3:50 pm -4:10 pm
Title: Structurally Rigid Elastic Binary Composites for Acoustic Imaging Countermeasures	
Abstract: *We explore the possibilities coming from transformation acoustics and beyond for creating rigid elastic composite shells capable of suppressing the total scattering cross-section of acoustically large objects. The reported design methodology is based on generalized shape and topology optimization, and the outcomes are suitable for rapid prototyping techniques.*	

Author: W. Akl	**Category: Invited Oral**
Affiliation: Ain Shams University	
Paper #: 0164	**Time:** 4:10 pm -4:30 pm
Title: Acoustic Metamaterial with Programmable Bulk Modulus for Sector Acoustic Cavities	
Abstract: *A new class of composite shell-type acoustic metamaterials with tunable effective bulk modulus which can be tailored to have controllable variation along the material volume in curvilinear coordinates is developed using a piezoelectric sector element coupled with an acoustic sector cavity to form a homogenized periodically-structured sector-shaped acoustic metamaterial.*	

Author: O. R. Bilal	**Category: Contributed Oral**
Affiliation: University of Colorado Boulder	
Paper #: 0173	**Time:** 4:30 pm -4:45 pm
Title: Trampoline Metamaterials: Local Resonance Enhancement by Springboards	
Abstract: *We investigate the dispersion characteristics of locally resonant metamaterials formed from the erection of pillars on the solid regions in a plate patterned by a periodic array of holes. We show that these solid regions effectively act as springboards leading to an enhanced resonance behavior by the pillars when compared to the nominal case of pillars with no holes. As such, we refer to this band gap enhancement phenomenon as the trampoline effect.*	

Author: M. J. Frazier	**Category: Contributed Oral**
Affiliation: University of Colorado Boulder	
Paper #: 0174	**Time:** 4:45 pm -5:00 pm
Title: Metadamping: An Emergent Phenomenon in Dissipative Metamaterials	
Abstract: *Using a generalized form of Bloch's theorem, we compare two statically equivalent, viscously damped periodic materials – one with local resonators and the other without. We find that with the same level of prescribed damping, the locally resonant metamaterial exhibits higher dissipation throughout the spectrum. This outcome indicates a damping emergence phenomena which we refer to as metadamping.*	

Author: L. Bonanomi	**Category: Contributed Oral**
Affiliation: ETH Zurich	
Paper #: 0093	**Time:** 5:00 pm -5:15 pm
Title: Locally Resonant Granular Crystal	
Abstract: *We study the acoustic response of locally resonant granular crystals, consisting of one-dimensional arrays of hollow spherical particles containing local resonators. The funda-mental unit cell of these periodic systems (i.e., a Mass-in-Mass unit, "MinM") is made of an aluminum outer spherical shell and a steel inner mass connected by a polymeric plastic struc-ture. We characterized the linear spectra of the individual particles and of one-dimensional ar-rays of particles using numerical simulations and experiments. We measure the existence of a band gap due to the presence of local resonances.*	

Author: M. Oudich	**Category: Contributed Oral**
Affiliation: UMR CNRS	
Paper #: 0087	**Time:** 5:15 pm -5:30 pm

Title: Acoustic Metamaterial Plate with Negative Effective Mass Density

Abstract: *A phononic metamaterial plate with low frequency resonators is investigated as an effective dispersive medium for acoustic waves. A numerical based effective medium model is used to calculate the plate's effective dynamic mass density as function of the frequency. Strong anisotropy of the mass density matrix is observed around the resonance frequencies where the gaps are opened.*

Author: M. Farooqui	**Category: Contributed Oral**
Affiliation: Ain Shams University	
Paper #: 0116	**Time:** 5:30 pm -5:45 pm

Title: Sound Attenuation in Ducts using Locally Resonant Periodic Flush Mounted Flexible Silicon Patches

Abstract: *Transmission properties of a Phononic crystal composed of patches of silicon aerogel is studied analytically and numerically in this paper. With the help of mathematical models the difference between the Bragg scattering and the locally resonant mechanism was demonstrated. It is also shown that the periodicity of these local resonators also plays role in determining the width of the acoustic band gap.*

Author: M. Zubtsov	**Category: Contributed Oral**
Affiliation: Otto von Guericke University	
Paper #: 0061	**Time:** 5:45 pm -6:00 pm

Title: On the Nature of Extraordinary Acoustic Transmission through Sub-Wavelength Holes Array.

Abstract: *We present experimental and computational evidences for the existence of structural vibrations in periodic solid-liquid composite that combine vibrations in solid with vibrations in neighboring liquid volumes whose dynamics define anomalous response function determining extraordinary acoustic transmission.*

Author: B. Figeys	**Category: Contributed Oral**
Affiliation: IMEC	
Paper #: 0071	**Time:** 6:00 pm -6:15 pm

Title: Shear Interface Acoustic Wave in Solids Enabled by Acoustic Metamaterials

Abstract: *We present for the first time developments supporting the existence of shear waves propagating at the interface between two solids with shear moduli of opposite signs, condition made possible using metamaterials. We indicate the analogy between this wave and surface plasmon polaritons and present the acoustic analog of metal-insulator-metal and insulator-metal-insulator electromagnetic waveguides.*

Author: L. M. Garcia-Raffi	**Category: Contributed Oral**
Affiliation: Universitat Politècnica de València	
Paper #: 0070	**Time:** 6:15 pm -6:30 pm

Title: Acoustic Fractal Conical Lens Based on Sonic Crystals

Abstract: *This work reports the numerical analysis of an axial symmetric sonic crystal which external shape is based on the Cantor fractal set. In the long wavelength regime the system has an ef-fective refraction index controlled by the filling fraction, so the fractal external shape can control the phases of the transmitted waves. We show here the possibility of multifocal acous-tic lenses as it has been previously observed in optics.*

Adjourn	**6:30 PM**

Phononics 2013: 2nd International Conference on Phononic Crystals/Metamaterials, Phonon Transport and Optomechanics

June 2-7 2013, Sharm El-Sheikh, Egypt

Wednesday: June 5 — Detailed Program Information

Registration (Amaraua Foyer)	**7:30 am - 12:00 pm**
Announcements (Amaraua Conf. Hall)	**7:45 am - 8:00 am**
Track 3: Phonon Transport	
Session: 7 (Amaraua Conference Hall)	**8:00 am - 10:20 pm**
Session Chair: Baowen Li	
Author: C. M. Sotomayor Torres	**Category: Plenary Talk**
Affiliation: Catalan Institute of Nanotechnology	
Paper #: 0156	**Time:** 8:00 am -8:30 am
Title: Acoustic Phonons in Silicon Free-Standing Membranes: From Slow Phonons to Engineering Thermal Conductivity	
Abstract: *Confined acoustic phonons are investigated and their dispersion relations simulated and measured. Based on this we investigate the impact on thermal transport in low dimensional semiconductors and carry out simulations for thermal rectification and storage.*	
Author: D. Donadio	**Category: Plenary Talk**
Affiliation: Max Planck Institute for Polymer Research	
Paper #: 0077	**Time:** 8:30 am -9:00 am
Title: Phonon Transport in Graphene: Effects of Strain and of Finite Temperature Gradients	
Abstract: *We compute phonon transport in suspended graphene by atomistic molecular dynamics simulations. We find that whereas at equilibrium conditions the thermal conductivity of suspended graphene is finite, in the presence of finite temperature gradients it diverges with the size of graphene patches. Thermal conductivity also diverges when graphene is strained.*	
Author: I. J. Maasilta	**Category: Invited Oral**
Affiliation: University of Jyväskylä	
Paper #: 0035	**Time:** 9:00 am -9:20 am
Title: Phononic Crystals for the Control of Thermal Conduct-ance at Sub-Kelvin Temperatures	
Abstract: *I will review recent progress in fabrication, measurement and modeling of two- and three dimensional phononic crystals for controlling thermal transport in the sub-Kelvin temperature regime. Initial measurements for 2D hole-array phononic crystal samples show good agreement with the calculated ballistic thermal conductance of the modified phonon eigenmode spectrum. Somewhat surprisingly, the calculation predicts that thermal conduct-ance is enhanced at the ultralow temperature limit below 0.1 K, as compared to a full, uncut membrane.*	
Author: A. Struck	**Category: Invited Oral**
Affiliation: Hochschule Rhein-Waal	
Paper #: 0090	**Time:** 9:20 am -9:40 am
Title: Minimizing the Thermal Conductivity in Isotopic Superlattices: A Molecular Dynamical Approach	
Abstract: *Superlattice structures can be tailored to manipulate phonon propagation. Modified density of states, multiple back-reflections at interfaces, reduced effective sound velocities and localization lead to strongly altered macroscopic quantities like thermal conductivity. We have investigated to which extent the tailoring of phononic structures can reduce the thermal conductivity in isotopically enriched silicon superlattices. Based on molecular dynamical simulations (MD) we have altered design parameters such as the number of interfaces and the periodicity. In accordance to experimental investigations the thermal conductivity could be engineered in the range from 170 W/(m·K)1 to 50 W/(m·K)2. We also discuss the modified material properties in the context of thermoelectric*	

Author: C. M. Reinke	**Category: Invited Oral**
Affiliation: Sandia National Laboratories	
Paper #: 0155	**Time:** 9:40 am -10:00 am

Title: Modified Nanoscale Phonon Transport in Phononic Crystal Devices

Abstract: *We present an analysis of thermal conductivity reduction in micro-scale PnC devices using a method that combines the phonon dispersion of the atomic material lattice with that of the PnC lattice. The theoretical results are compared with thermal conductivity measurements of fabricated PnC samples, with good agreement observed between the thermal transport model and corresponding experimental data.*

Author: K. Muralidharan	**Category: Invited Oral**
Affiliation: University of Arizona	
Paper #: 0103	**Time:** 10:00 am -10:20 am

Title: Analysis of Phonon Mode Lifetime in 1D and 2D Anharmonic Systems

Abstract: *In nano-composite systems, high frequency thermal phonon modes are subject to multiple different mechanisms of decay. Of particular importance are effects related to the periodicity of the underlying structure (band-folding effects) and scattering effects related to boundaries, surfaces and interfaces as well as anharmonic effects. Thus, characterizing the thermal response of nanoscale composites requires a rigorous examination of these phenomena. In this work, we elucidate the role that band-folding and boundary scattering as well as anharmonicity play in decreasing the lifetime of high-frequency phonon modes using two novel simulation approaches. Specifically, using spectral energy density (SED)1 band structure calculations, a series of non-linear one-dimensional superlattices of*

Coffee Break (Amaraua Foyer)	**10:20 am - 10:40 am**

Track 3: Phonon Transport

Session: 8 (Amaraua Conference Hall)	**10:40 am - 1:00 pm**
Session Chair: C. M. Sotomayor Torres	

Author: Z. C. Leseman	**Category: Invited Oral**
Affiliation: University of New Mexico	
Paper #: 0162	**Time:** 10:40 am -11:00 am

Title: Fabrication and Characterization of 2-D Phononic Crystals

Abstract: *Techniques are described for the fabrication and characterization of nanostructured phononic crystals (PnCs). Fabrication of the PnCs is performed in Si while employing a fo-cused ion beam (FIB) to impart the nanostructure. Characterization is performed using a technique wherein the PnC is suspended between two thermally isolated islands. By raising the temperature with respect to the other the thermal conductivity of the PnC can be deter-mined. Results indicate that coherent scattering of phonons is occurring.*

Author: O. Bourgeois	**Category: Invited Oral**
Affiliation: Centre National de la Recherche Scientifique	
Paper #: 0112	**Time:** 11:00 am -11:20 am

Title: Phonon Thermal Transport in Periodically Structured Nanosystems

Abstract: *We report on the transport of thermal phonons in periodic nano-objects. The thermal conductance of suspended nanosystems (nano-engineered membranes, nanowires) has been measured down to very low temperature. It is shown that the presence of periodic structures (corrugation, lattice of holes) may strongly reduce the heat transfer in these nanosystems.*

Author: S. Sinha	**Category: Invited Oral**
Affiliation: University of Illinois at Urbana-Champaign	
Paper #: 0142	**Time:** 11:20 am -11:40 am

Title: Phonon Transport in Periodic 3-Dimensional Nanostructures

Abstract: *We report measurements and modeling of thermal conductivity in periodic three-dimensional dielectric nanostructures: silicon inverse opals. The periodicities and shell thicknesses are in the range 420-900 nm and 18-38 nm respectively. The material thermal conductivity is in the range 5-12 W/mK at 300 K and has an anomalous ~T1.8 dependence at low temperatures, distinct from the typical ~T3 behavior of bulk polycrystalline silicon. Using phonon scattering theory, we show such dependence arising from coherent phonon reflections in the inter-grain region.*

Author: R. Chen	**Category: Invited Oral**
Affiliation: University of California	
Paper #: 0171	**Time:** 11:40 am -12:00 pm
Title: Thermal and Thermoelectric Transport in Thin Nanowires	
Abstract: *Thermal and thermoelectric transport in small diameter nanowires where both heat and charge carriers (phonons and electrons) are confined have been rarely probed experimentally due to several changes associated with the small size. In this presentation, we will present our recent progress on experimental study of thermal conductivity and thermoelectric power factor in small diameter Ge and Ge-Si nanowires.*	

Author: Baowen Li	**Category: Org. Colloquium**
Affiliation: National University of Singapore	
Paper #: 0128	**Time:** 12:00 pm -12:20 pm
Title: Anomalous Phonon Transport and Anomalous Diffusion	
Abstract: *Heat conduction is an important energy transport process in nature. Phonon is the major energy carrier for heat in semiconductors and dielectric materials. In analogy to Ohm's law of electrical conduction, Fourier's law is the fundamental law of heat conduction in solids. Although Fourier's law has received great success in describing macroscopic heat conduction in the past two hundred years, its validity in low dimensional systems is still an open question. Here we give a brief review of the recent developments in experimental, theoretical and nu-merical studies of heat conduction in low dimensional systems, including lattice models and low dimensional nanostructures such as nanowires, nanotubes and graphene. We will demon-strate that phonons transport in low dimensional systems*	

Author: M. I. Hussein	**Category: Org. Colloquium**
Affiliation: University of Colorado Boulder	
Paper #: 0177	**Time:** 12:20 pm -12:40 pm
Title: Thermal Conductivity Reduction by Nanophononic Metamaterials	
Abstract: *We present the concept of a locally resonant nanophononic metamaterial for the purpose of thermal conductivity reduction and utilization as a thermoelectric material system. The proposed configuration consists of a silicon thin-film with a periodic array of pillars erected on its free surface(s). This configuration qualitatively alters the base thin-film phonon spectrum due to a hybridization mechanism between the pillar local resonances and the underlying lattice dispersion, thus causing a significant reduction in the thermal conductivity.*	

Author: E. Abdel-Rahman	**Category: Guest Lecture on Thermoacoustics**
Affiliation: The American University in Cairo	
Paper #: N/A	**Time:** 12:40 pm -1:00 pm
Title: TBA	
Abstract: *TBA*	

Lunch Break (Kahramana Resturant)	**1:00 pm - 3:30 pm**

Bloch Lecture

Session: 9 (Amaraua Conference Hall)	**3:30 pm - 4:15 pm**
Session Chair: I. El-Kady	
Author: B. Djafari-Rouhani	**Category: Award Lecture**
Affiliation: Université Lille 1 Sciences et Technologies	
Paper #: Bloch-Paper	**Time:** 3:30 pm -4:15 pm

Title: Optomechanical interactions in phoxonic cavities

Abstract: *Phoxonic crystals can exhibit dual phononic/photonic band gaps. Therefore, the confinement of both acoustic and optical waves in a phoxonic cavity can allow the enhancement of their interaction. In this paper, we discuss some of our recent theoretical works on the strength of the optomechanic coupling, based on both photoelastic and moving interfaces mechanisms, in different (2D, slabs, strips) phoxonic crystals cavities.*

Track 3: Phonon Transport

Session: 10 (Amaraua Conference Hall)	**4:15 pm - 6:30 pm**
Session Chair: I. J. Maasilta	
Author: M. Y. Swinkels	**Category: Contributed Oral**
Affiliation: Eindhoven University of Technology	
Paper #: 0072	**Time:** 4:15 pm -4:30 pm

Title: Investigation of Phonon Transport in Nanowires for Thermoelectric Applications

Abstract: *Nanowires could be interesting candidates for future thermoelectric materials thanks to the reduced phonon transport in these wires. A full understanding of phonon transport in these small scales is required to take full advantage of this. In this work we will present an approach for investigations on the thermoelectric properties of nanowires.*

Author: T. A. Puurtinen	**Category: Contributed Oral**
Affiliation: University of Jyväskylä	
Paper #: 0026	**Time:** 4:30 pm -4:45 pm

Title: Ballistic Heat Transfer in Thin-Film Phononic Crystals

Abstract: *We have measured the thermal transport properties of various thin-film phononic crystals in the sub-Kelvin temperature range using sensitive normal-metal-insulator-superconductor (NIS) tunnel junction thermometry. We have also compared the measurements to numerical results of a ballistic phonon radiation model implemented by the finite element method, and found good agreement.*

Author: K. Sääskilahti	**Category: Contributed Oral**
Affiliation: Aalto University	
Paper #: 0066	**Time:** 4:45 pm -5:00 pm

Title: Quantum Heat Transfer in Graphene Nanostructures: Self-Consistent Thermal Bath Calculation

Abstract: *We present an extended Green's function method to study phonon heat transfer and apply the method to graphene point contacts. Phonon damping and dephasing are introduced by coupling all atoms to Langevin heat baths, whose temperatures are determined self-consistently. We calculate temperature profiles for various geometries and discuss the im-portance of quantum effects at different temperatures.*

Author: P. E. Hopkins	**Category: Contributed Oral**
Affiliation: University of Virginia	
Paper #: 0052	**Time:** 5:00 pm -5:15 pm
Title: Einstein Oscillations and Exceptionally Low Thermal Conductivities of Fullerene Derivative PCBM	
Abstract: *We report on the thermal conductivities of microcrystalline [6,6]-phenyl C61-butyric acid methyl ester (PCBM) thin films from 135 to 387 K as measured by time domain thermoreflectance. Thermal conductivities are independent of temperature above 180 K and less than 0:030+/-0:003 W m-1 K-1 at room temperature. The longitudinal sound speed is determined via picosecond acoustics and is found to be 30% lower than that in C60/C70 fullerite compacts. Using Einstein's model of thermal conductivity, we find the Einstein characteristic frequency of microcrystalline PCBM is 2.88x1012 rad s-1. By comparing our data to previous reports on C60/C70 fullerite compacts, we argue that the molecular tails on the fullerene moieties in our PCBM films are responsible for lowering both the apparent sound*	

Author: R. Cheaito	**Category: Contributed Oral**
Affiliation: University of Virginia	
Paper #: 0081	**Time:** 5:15 pm -5:30 pm
Title: Experimental Evidence of Crossover from Incoherent to Coherent phonon Scattering in Epitaxial Oxide Superlattices	
Abstract: *We experimentally demonstrate the theoretically predicted crossover from incoherent to coherent phonon transport in (SrTiO3)m/(CaTiO3)m oxide superlattices by showing a local minimum in phonon thermal conductivity as a function of period spacing in these struc-tures.*	

Author: F. Döring	**Category: Contributed Oral**
Affiliation: University of Göttingen	
Paper #: 0039	**Time:** 5:30 pm -5:45 pm
Title: Interface Design for Minimizing thermal Conductivity by Phonon Blocking in Multilayers	
Abstract: *Different kinds of multilayers with small layer thicknesses and a high number of interfaces were fabricated by pulsed laser deposition. The thermal conductivities of the grown multilayers were studied using fs-pump-probe reflectivity measurements. In this contribution, the phonon spectra are discussed with respect to the possibility to obtain phonon blocking by multilayer design in order to minimize the thermal conductivity.*	

Author: A. K. Kushwaha	**Category: Contributed Oral**
Affiliation: K.N. Govt. P.G. College	
Paper #: 0027	**Time:** 5:45 pm -6:00 pm
Title: Phonon Spectrum of MnTe, HgTe and Their Mixed Semiconductor MnxHg1-xTe	
Abstract: *We have calculated the phonon spectrum of MnTe, HgTe and their mixed semiconductor MnxHg1-xTe in the framework of three-body shell model. This model incorporates the effect of the short-range repulsive interactions up to and including the second nearest neighbours, in addition to the long-range Coulombic interactions in the framework of the rigid-shell model with both the ions are polarizable. The calculated phonon spectrum for MnTe, HgTe and MnxHg1-xTe are plotted along with their available experimental results. We find an overall good agreement with the experimental results.*	

Author: J. S. Reparaz	**Category: Contributed Oral**
Affiliation: Catalan Institute of Nanotechnology	
Paper #: 0048	**Time:** 6:00 pm -6:15 pm
Title: Si and Ge Membranes Investigated through Raman Thermometry: The Role of Phonon Boundary Scattering and Phonon Confinement in 2D Systems	
Abstract: *The unique thermal properties exhibited by free-standing ultra-thin semiconductor membranes, have recently triggered a considerable amount of research in this field. A precise knowledge of the influence of low dimensionality, chemical composition, degree of crystallinity and surface roughness is essential to tailor the thermal properties of membranes. We investigate the thermal conductivity reduction in Si and Ge free-standing membranes at 300 K as function of thickness, ranging from 6 to 700 nm, using Raman thermometry. This contactless technique is extremely convenient for those cases where electrical techniques are not easily applicable. We show that the thermal conductivity systematically decreases as the membranes thickness decrease, which we show to originate from*	

Author: D. Schneider	**Category: Contributed Oral**
Affiliation: Max Planck Institute for Polymer Research	
Paper #: 0040	**Time:** 6:15 pm -6:30 pm
Title: 1D Hybrid Phononic Bragg-Stacks: Propagation of Hypersound in Soft Periodic Structures*	
Abstract: *Soft periodic structures constitute a promising material class to study phononic properties. Here, we focus on 1D hybrid phononic crystals as model system to study fundamentals of elastic wave propagation. Spontaneous Brillouin light scattering (BLS) in combination with theoretical calculations provide full description of phononic band diagrams at hypersonic frequencies.*	
Adjourn	**6:30 PM**

* Phononic Crystals Talk

Phononics 2013: 2nd International Conference on Phononic Crystals/Metamaterials, Phonon Transport and Optomechanics

June 2-7 2013, Sharm El-Sheikh, Egypt

Thursday: June 6 Detailed Program Information

Registration (Amaraua Foyer)	**7:30 am - 12:00 pm**
Announcements (Amaraua Conf. Hall)	**7:45 am - 8:00 am**
Track 4: Optomechanics and Coupled Phenomena	
Session: 11 (Amaraua Conference Hall)	**8:00 am - 10:20 pm**
Session Chair: B. Djafari-Rouhani	
Author: I. E. Psarobas	**Category: Plenary Talk**
Affiliation: University of Athens	
Paper #: 0122	**Time:** 8:00 am -8:30 am
Title: Topology Arguments in Engineering 3D PhoXonic Systems	
Abstract: *Concurrent control of both light and sound through simultaneous photonic-phononic, often called phoxonic, bandgap structures is intended to advance both our understanding as well as our ability to manipulate light with sound and vise versa. Topology arguments set the framework of engineering 3D dual functional phoxonic structures by means of a dual multiple scattering method for classical waves.*	
Author: B. Jusserand	**Category: Plenary Talk**
Affiliation: Institut des Nanosciences de Paris	
Paper #: 0176	**Time:** 8:30 am -9:00 am
Title: Confined Acoustical Phonons and Confined Photons in Semiconductor Nanostructures: A Route Towards Very Large Acousto-optical Interactions	
Abstract: *Photon confinement in microcavities is easily transferred to acoustic phonons. We describe here several achievements based on the combination of acoustic and photonic confinement in GaAs/AlAs multilayers and demonstrate high finesse optical cavities as a very promising device with typical optomechanical couplings two order of magnitudes larger than in available systems.*	
Author: D. Navarro-Urrios	**Category: Invited Oral**
Affiliation: Catalan Institute of Nanotechnology	
Paper #: 0163	**Time:** 9:00 am -9:20 am
Title: Optomechanics in Corrugated Beams with Parabolic Defects	
Abstract: *We report on the optical, mechanical and optomechanical properties of a Silicon based 1D corrugated beam, excited by means of a microlooped tapered optical fiber. The high optical quality factor of the localized photonic modes (Qopt=20000-35000) supported by the structure has allowed the transduction of the thermally activated mechanical motion of the structures. We have observed localized mechanical modes at frequencies up to 7.25 GHz and relatively high mechanical quality factors (Qmec=4700).*	
Author: M. Farhat	**Category: Invited Oral**
Affiliation: King Abdullah University of Science and Technology	
Paper #: 0038	**Time:** 9:20 am -9:40 am
Title: Graphene Acousto-optical Plate for Coupling Sound and Light at THz Frequencies	
Abstract: *We propose a novel device that exploits extra-ordinary properties of graphene to couple elastic vibration to light. The bending biharmonic wave that could be excited on a very thin sheet of graphene forms a quasi-grating that interacts with incident light and permits the excitation of surface plasmons polaritons. Many applications such as sensing and bio-detection could be envisaged.*	

Author: N. Kiesel	**Category: Invited Oral**
Affiliation: University of Vienna	
Paper #: 0136	**Time:** 9:40 am -10:00 am

Title: Towards High-Q Cavity-optomechanics with Levitated Nanospheres

Abstract: *Nanoparticles, optically trapped in ultra-high vacuum and dispersively coupled to a high-finesse Fabry-Perot cavity, have recently been proposed as a new light-mechanics interface. This interface promises, amongst others, to operate optomechanical quantum information protocols in a room-temperature environment and to build novel ultrasensitive force sensors. We present first experiments in this direction.*

Author: N. Piro	**Category: Invited Oral**
Affiliation: École Polytechnique Fédérale de Lausanne	
Paper #: 0183	**Time:** 10:00 am -10:20 am

Title: Quantum-Coherent Coupling of a Mechanical Oscillator to an Optical Cavity Mode

Abstract: *We demonstrate an optomechanical microresonator in which optical and mechanical degrees of freedom exchange energy at a rate exceeding the relevant decoherence rates in the system, enabling quantum control of a mechanical oscillator with light.*

Coffee Break (Amaraua Foyer)	**10:20 am - 10:40 am**

Track 13: Optomechanics and Coupled Phenomena

Session: 12 (Amaraua Conference Hall)	**10:40 am - 1:00 pm**
Session Chair: I. E. Psarobas	
Author: R. M. Camacho	**Category: Invited Oral**
Affiliation: Sandia National Laboratories	
Paper #: 0140	**Time:** 10:40 am -11:00 am

Title: Disorder in Optomechanical Systems

Abstract: *In this talk, I will describe recent investigations into the effects of disorder in optomechanical systems. In particular, I will discuss disorder induced opto-mechanical coupling in photononic/phononic crystal structures, group velocity effects, and connections to Anderson localization.*

Author: S. Ludwig	**Category: Invited Oral**
Affiliation: Ludwig-Maximilians-Universität	
Paper #: 0009	**Time:** 11:00 am -11:20 am

Title: The Quantum Dot Single-Phonon Detector

Abstract: *Recent developments make the idea of electronic-phononic hybrid quantum circuits an interesting prospect. One of the main challenges is the realization of nanoscale single-phonon detectors. We demonstrate single-phonon detection in laterally defined coupled quantum dots in semiconductor quantum circuits.*

Author: P. V. Santos	**Category: Invited Oral**
Affiliation: Paul-Drude-Insitut für Festkörperelektronik	
Paper #: 0004	**Time:** 11:20 am -11:40 am
Title: Exciton Control and Transport by Acoustic Fields	
Abstract: *Surface phonons in the form of surface acoustic waves are used to store and transport excitons over millimeter distances in GaAs quantum well structures. By combining SAW beams along different crystallographic directions it becomes possible to realize novel electro-optic functionalities based on exciton transport such as the routing of photonic signals.*	

Author: S. Benchabane	**Category: Invited Oral**
Affiliation: Université de Franche-Comté	
Paper #: 0089	**Time:** 11:40 am -12:00 pm
Title: Surface Elastic Wave Confinement in Defect-based and Mass-loaded Phononic Waveguides	
Abstract: *Ways to achieve efficient three-dimensional surface acoustic wave guidance and confinement have already been reported in the phononic crystal literature. In this talk, we will discuss two possible means of reaching this objective by using either 2D Bragg-type phononic crystals or by exploiting the mass-loading effect in 1D periodical structure.*	

Author: B. Djafari-Rouhani	**Category: Org. Colloquium**
Affiliation: Le Centre National de la Recherche Scientifique	
Paper #: 0050	**Time:** 12:00 pm -12:20 pm
Title: Optomechanical Interactions in Phoxonic Cavities	
Abstract: *Phoxonic crystals can exhibit dual phononic/photonic band gaps. Therefore, the confinement of both acoustic and optical waves in a phoxonic cavity can allow the enhancement of their interaction. In this paper, we discuss our recent theoretical works on the strength of the optomechanic coupling, based on both photoelastic and moving boundaries effects, in differ-ent cavities in various (2D, slabs, strips) phoxonic crystals.*	

Author: I. El-Kady	**Category: Org. Colloquium**
Affiliation: Sandia National Laboratories	
Paper #: 0178	**Time:** 12:20 pm -12:40 pm
Title: On-Chip Quantum Phonodynamics, the Sound-Based Analogue of Quantum Electrodynamics: Realization of a "Phoniton"	
Abstract: *Phonons, due to their unique nonlinear properties, enable new opportunities for quantum devices and physics. We propose a phonon-based, solid-state analogue of the cavity-polariton QED system. Despite having never been practically realized, qubits based on this half-sound half-matter quasi-particle, or the so called "phoniton", have been predicted to outcompete quantum dot-based qubits and approach circuit QED performance in the MHz frequencies. In this talk we discuss our attempts at the first realization of a "phoniton".*	

Conference Photograph	**12:40 pm - 1:00pm**
Lunch Break (Kahramana Resturant)	**1:00 pm - 3:30 pm**

Brillouin Lecture

Session: 13 (Amaraua Conference Hall)	**3:30 pm - 4:15 pm**
Session Chair: M. I. Hussein	
Author(s): P. Sheng, C. T. Chan, Z. Yang	**Category: Award Lecture**
Affiliation: Hong Kong University of Science and Technology	
Paper #: Brillouin-Paper	**Time:** 3:30 pm -4:15 pm

Title: Acoustic Metamaterials

Abstract: ***We present the basic concept of acoustic metamaterials and their initial realization in the form of locally resonant sonic materials. The development of acoustic metamaterials has led to the realization of many acoustic and elastic functionalities previously thought to be not possible, such as acoustic cloaking and the attenuation of sound in the 100 to 1000 Hz range by using thin membranes.***

Track 3: Optomechanics and Coupled Phenomena

Session: 14 (Amaraua Conference Hall)	**4:15 pm - 6:30 pm**
Session Chair: S. Ludwig	
Author: R. Braive	**Category: Contributed Oral**
Affiliation: Le Centre National de la Recherche Scientifique	
Paper #: 0018	**Time:** 4:15 pm -4:30 pm

Title: Optomechanics with Photonic Crystals Slab Mirrors and Cavities

Abstract: *We investigate optomechanical effects in photonic crystal slab membranes. For slabs embedding a photonic crystal cavity, two families of mechanical modes are identified: drum modes and vibrations localized within the cavity core. For slabs acting as an end mirror in a Fabry-Perot cavity, cold-damping techniques allowed to cool the fundamental drum mode by a factor of two from 300 K.*

Author: S. El-jallal	**Category: Contributed Oral**
Affiliation: Le Centre National de la Recherche Scientifique	
Paper #: 0076	**Time:** 4:30 pm -4:45 pm

Title: Acousto-optic Interactions in 2D Silicon and Gallium Arsenide PhoXonic Cavities

Abstract: *We study the acousto-optic interactions in 2D Si and GaAs phoXonic crystal cavities. We take into account both the moving boundaries and photoelastic effects. The coupling is obtained by calculating the modulation of each optical cavity mode by each acoustic cavity mode. The photoelastic contribution is discussed in view of the strong variations of the photoelastic coefficients near the band gap.*

Author: M. Ismail	**Category: Contributed Oral**
Affiliation: University of Glasgow	
Paper #: 0180	**Time:** 4:45 pm -5:00 pm

Title: Waves Confinement in Piezoelectric Phononic Cavity

Abstract: *The existence of complete band gap has been demonstrated theoretically using Plane Wave Expansion (PWE) method in a two-dimensional triangular lattice piezoelectric phononic crystal consists of cylindrical tungsten pillars deposited over lithium niobate (LiNbO3) slab. Several complete band gaps have been observed for different dimensions of the slab and pillars. It is shown that LiNbO3 stubbed with the tungsten pillars create dual complete band gaps with relative bandwidth of 31.5 % and 26.6 %. The confinement of the waves within a single defect of this piezoelectric phononic crystal structure has also been theoretically demonstrated.*

Session: 15 (Amaraua Conference Hall)	**5:00 pm - 5:15 pm**
Session Chair: I. El-Kady / M. I. Hussein	
Phononics 2015/2017 Announcement	**5:00 pm - 5:15pm**

Poster Session (Amaraua Foyer)	
Session: 16 (Amaraua Conference Hall)	**5:15 pm - 7:15 pm**
Session Chair: C. Reinke	
Author: M. Y. Wang	**Category: Poster #1**
Affiliation: Dept. of Mechanical & Automation Eng., The Chinese University of Hong Kong	
Paper #: 2	**Time:** 5:15 pm - 7:15 pm
Title: Band Gaps in Periodic Flexural Beams With Multi-DOF/Continuum Local Resonators	
Author: Y. Y. Kim	**Category: Poster #2**
Affiliation: WCU Multiscale Mechanical Design Devision, Seoul National University	
Paper #: 0006	**Time:** 5:15 pm - 7:15 pm
Title: Phononic Crystal Tailoring for Single-Mode Ultrasonic Wave Excitation	
Author: M. V. Golub	**Category: Poster #3**
Affiliation: Wave Propagation, Reflection and Filtering in Functionally Graded Phononic Crystals	
Paper #: 0010	**Time:** 5:15 pm - 7:15 pm
Title: Wave Propagation, Reflection and Filtering in Functionally Graded Phononic Crystals	
Author: M. H. Ben Ghozlen	**Category: Poster #4**
Affiliation: Materials Physics Laboratory, Faculty of Sciences, Sfax university	
Paper #: 0015	**Time:** 5:15 pm - 7:15 pm
Title: Combination of PWE and Stiffness Matrix Methods to Study Transmission Properties and Guided Modes in Two Dimensional Phononic Plates	
Author: I. Robert-Philip	**Category: Poster #5**
Affiliation: Laboratoire de Photonique et Nanostructures LPN-CNRS	
Paper #: 0019	**Time:** 5:15 pm - 7:15 pm
Title: Non-linear Mechanical Response of Photonic Crystal Slabs	
Author: J. O. Vasseur	**Category: Poster #6**
Affiliation: Institut d'Electronique, de Microélectronique et de Nanotechnologie	
Paper #: 0022	**Time:** 5:15 pm - 7:15 pm
Title: The layer-multiple-scattering Method as Applied to Two-dimensional Phononic Crystals	
Author: Y.-F. Wang	**Category: Poster #7**
Affiliation: Institute of Engineering Mechanics, Beijing Jiaotong University, Beijing	
Paper #: 0023	**Time:** 5:15 pm - 7:15 pm
Title: Complex Band Structures of Two-Dimensional Viscoelastic Phononic Crystals Obtained by Using Finite Element Method	
Author: T.-X. Ma	**Category: Poster #8**
Affiliation: Institute of Engineering Mechanics, Beijing Jiaotong University	
Paper #: 0024	**Time:** 5:15 pm - 7:15 pm
Title: Engineering Dual Phononic and Photonic Bandgaps of a Two-dimensional Phoxonic Crystal with Veins	
Author: A. A. Kutsenko	**Category: Poster #9**
Affiliation: Universite de Bordeaux, Institut de Mecanique et d'Ingenierie de Bordeaux	
Paper #: 0033	**Time:** 5:15 pm - 7:15 pm
Title: Discrete Periodic Lattice with Defects	
Author: P. Méresse	**Category: Poster #10**
Affiliation: DCNS Research, Le Mourillon Rond point de l'Artillerie de la Marine	
Paper #: 0043	**Time:** 5:15 pm - 7:15 pm
Title: Propagation Number in Periodic Structures Including Losses	
Author: J. Gomis-Bresco	**Category: Poster #11**
Affiliation: Catalan Institute of Nanotechnology	
Paper #: 0056	**Time:** 5:15 pm - 7:15 pm
Title: 1D Phononic Corrugated Cavities in Si Nanobeams: Design of the Confined Modes in a Full Band gap	

Author: I. Boiragi	**Category: Poster #12**
Affiliation: Photonics Department, Society for Applied Microwave Electronics Engineering and Research	
Paper #: 0065	**Time:** 5:15 pm - 7:15 pm
Title: Development of Photoacoustic Gas Cell for Trace Gas Measurement by IR Laser Absorption Technique	

Author: B. Figeys	**Category: Poster #13**
Affiliation: IMEC and KU Leuven, TELEMIC	
Paper #: 0082	**Time:** 5:15 pm - 7:15 pm
Title: Process Tolerant Design of a BAW Resonator via Acoustic Metamaterial Engineering	

Author: A. Cebrecos	**Category: Poster #14**
Affiliation: Instituto de investigación para la Gestión Integrada de Zonas Costeras, Universitat de Valéncia	
Paper #: 0091	**Time:** 5:15 pm - 7:15 pm
Title: Collimation of Ultrasound Beams behind 3D Sonic Crystal	

Author: B. Bonello	**Category: Poster #15**
Affiliation: Institut des NanoSciences de Paris (INSP-UMR CNRS 7588) Université Pierre et Marie Curie	
Paper #: 0095	**Time:** 5:15 pm - 7:15 pm
Title: Scattering of Lamb Waves by Isolated Hole or Pillar: Towards an Acoustic Metamaterial	

Author: P. Anzel	**Category: Poster #16**
Affiliation: Division of Engineering and Applied Science, California Institute of Technology	
Paper #: 0097	**Time:** 5:15 pm - 7:15 pm
Title: Development of a Nonlinear Acoustic Phased Array and its Interaction with Thin Plates	

Author: R. Picó	**Category: Poster #17**
Affiliation: Instituto de investigaciónpara la Gestión Integrada de zonas Costeras, Universitat de València	
Paper #: 0104	**Time:** 5:15 pm - 7:15 pm
Title: AntiBandgaps in Acoustic Periodic Loss Media	

Author: P. H. Otsuka	**Category: Poster #18**
Affiliation: Division of Applied Physics, Faculty of Engineering, Hokkaido University	
Paper #: 0105	**Time:** 5:15 pm - 7:15 pm
Title: k-Space Imaging of Phonon Propagation in Phononic Crystal Waveguides	

Author: S. Degraeve	**Category: Poster #19**
Affiliation: IEMN, Institut d'Electronique, de Microelectronique et de Nanotechnologies	
Paper #: 0110	**Time:** 5:15 pm - 7:15 pm
Title: Tunable One-Dimensional Piezoelectric Phononic Crystals	

Author: Y. Pennec	**Category: Poster #20**
Affiliation: IEMN, UMR CNRS 8520, Université de Lille	
Paper #: 0113	**Time:** 5:15 pm - 7:15 pm
Title: Wide Surface Acoustic Wave Bandgaps for Conical Pillars on a Piezoelectric Substrate	

Author: V. Romero-García	**Category: Poster #21**
Affiliation: Instituto de Investigación para la Gestión Integrada de zonas Costeras, Universitat de València	
Paper #: 0152	**Time:** 5:15 pm - 7:15 pm
Title: Tunable Acoustic Waveguides in Sonic Crystals Made of Square-Rod Scatterers: Experiments and Theory	

Author: A. Mehany	**Category: Poster #22**
Affiliation: XXXXX	
Paper #:	**Time:** 5:15 pm - 7:15 pm
Title: XXX	

Author: R. Khajehtourian	**Category: Poster #23**
Affiliation: Department of Aerospace Engineering Sciences, University of Colorado Boulder	
Paper #: 0175	**Time:** 5:15 pm - 7:15 pm
Title: Nonlinear Locally Resonant Metamaterials: Modeling and Dispersion Characteristics	
Adjourn	**7:15 PM**
Conference Banquet (Bedouin Night)	**7:30 PM**

Phononics 2013: 2nd International Conference on Phononic Crystals/Metamaterials, Phonon Transport and Optomechanics

June 2-7 2013, Sharm El-Sheikh, Egypt

Friday: June 7 — Detailed Program Information

Announcements (Amaraua Conf. Hall)	**7:45 am - 8:00 am**
Track 5: Periodic Structures	
Session: 17 (Amaraua Conference Hall)	**8:00 am - 10:20 pm**
Session Chair: A. Adibi	
Author: A. G. Every	**Category: Plenary Talk**
Affiliation: University of the Witwatersrand	
Paper #: 0058	**Time:** 8:00 am -8:30 am
Title: Guided Waves at Periodically-Structured Surfaces and Interfaces of Solids	
Abstract: *This paper examines the dynamics of 1D planar periodic structures in solids, with particular attention given to a periodic array of thin coplanar cavities in a solid, and surface gratings consisting of parallel metal strips mounted periodically on a solid surface and a supported solid layer.*	
Author: A. Baz	**Category: Plenary Talk**
Affiliation: University of Maryland	
Paper #: 0151	**Time:** 8:30 am -9:00 am
Title: Bio-Inspired Active Acoustic Fluidic Cloak	
Abstract: *A class of bio-inspired fluidic Active Acoustic MetaMaterial (AAMM) is introduced. The AAMM consists of networks of pressurized channels manufactured to form a composite cloak that can render objects acoustically invisible. The theory governing the operation of this class of cloaks is presented and applied to control the propagation of sound inside aircraft fuselages.*	
Author: G. M. Hulbert	**Category: Invited Oral**
Affiliation: University of Michigan	
Paper #: 0146	**Time:** 9:00 am -9:20 am
Title: Wave Propagation in Periodic Microstructured Composite Materials	
Abstract: *Novel composite materials have been developed at the University of Michigan that provide high stiffness and high damping. These materials are considered herein for their wave attenuation characteristics, while maintaining their high stiffness and high damping attributes. Several different designs are presented to illustrate the material applications for vibration and wave mitigation.*	
Author: A. S. Phani	**Category: Invited Oral**
Affiliation: University of British Columbia	
Paper #: 0120	**Time:** 9:20 am -9:40 am
Title: Bandgap Analysis in Generally Damped Periodic Struc-tures and Metamaterials using Receptance Coupling	
Abstract: *Frequency bandgap locations and their widths in the wave response of damped periodic structures and metamaterials are predicted using a receptance coupling technique. A re-ceptance-coupling analysis is developed to infer band edge frequencies from the standing wave frequencies of a symmetric unitcell. Both viscous and nonviscous damping models can be incorporated in the present formulation. Experimental results on a structural beam with pe-riodic resonators are presented.*	

Author: J. S. Jensen	**Category: Invited Oral**
Affiliation: Technical University of Denmark	
Paper #: 0064	**Time:** 9:40 am -10:00 am

Title: Topology Optimization of Bandgap Materials for Loss Factor, Stiffness and Manufacturability

Abstract: *We use topology optimization to design composites for high loss factor and high stiffness. Additionally, we address the issue of manufacturability using additive manufacturing. The optimization is done using an iterative gradient-based procedure based on the solution of complex k(□)-eigenvalue FE problems. The formulation facilitates the design of composites with a low-loss metallic material and a lossy elastic or acoustic medium.*

Author: A. Spadoni	**Category: Invited Oral**
Affiliation: École Polytechnique Fédérale de Lausanne	
Paper #: 0084	**Time:** 10:00 am -10:20 am

Title: Wave Propagation in Cellular Solids

Abstract: *Engineering wave dispersion is elastic media can be achieved by modulation of material properties or by embedding resonators. Both strategies are challenging: in the first case large dimensions are needed to accommodate enough scattering sites (jumps in stiffness and mass), while in the second case manufacturing is a significant hurdle. Both designs lack broad-band effectiveness which is necessary for widespread employment of engineered media. Cellular solids are particularly promising media for design of wave-propagation characteristics in solids since they are two-phase materials with slender internal components. Such microstructure readily resonates for practical frequencies leading to resonant-scattering which is a key phenomenon in the design of metamaterials. Such capabilities may be*

Coffee Break (Amaraua Foyer)	**10:20 am - 10:40 am**

Track 5: Periodic Structures

Session: 18 (Amaraua Conference Hall)	**10:40 am - 1:00 pm**
Session Chair: A. G. Every	
Author: M. V. Golub	**Category: Invited Oral**
Affiliation: Kuban State University	
Paper #: 0003	**Time:** 10:40 am -11:00 am

Title: Propagation of Harmonic Elastic Waves in Layered Phononic Crystals and Wave Diffraction by Damages

Abstract: *The paper investigates the time-harmonic propagation of 2D plane waves in periodically multi-layered elastic composites with strip-like damages. At first band-gaps for non-damaged phononic crystals are analyzed. Then three kinds of damages are considered: single crack, periodic array of cracks and distributed delaminations. The total wave field in the damaged structure is written as a sum of the incident wave field described by the transfer matrix method and the scattered wave field represented as a Fourier integral convolution of the crack-opening-displacements and the Green's matrix of the multi-layered structure. The effects of the incidence angle, crack location and crack size are investigated. The paper focuses on resonance motion and localization phenomena in a stack of elastic layers weakened*

Author: S. Gonella	**Category: Invited Oral**
Affiliation: University of Minnesota	
Paper #: 0101	**Time:** 11:00 am -11:20 am

Title: Spectro-Spatial Features as Detectors and Classifiers of Nonlinearity in Periodic Chains

Abstract: *Wave propagation in monoatomic chains with quadratic nonlinearity is analyzed to determine spatial and spectral phononic characteristics. An inverse problem to determine the nonlinear coefficient is then obtained by using the spectro-spatial features of wave propaga-tion. The application of this inverse problem is demonstrated for a periodic system consisting of monoatomic spheres in contact. Experimental characterization is also considered to demonstrate the applicability of this inverse problem.*

Author: A. Adibi	**Category: Invited Oral**
Affiliation: Georgia Institute of Technology	
Paper #: 0150	**Time:** 11:20 am -11:40 am

Title: Functional Metallic-Pillar-Based Planar Phononic Crystal Structures

Abstract: *We present a new class of planar phononic crystal (PnC) structures based on a two-dimensional array of metallic pillars on a thin substrate and compare it with hole-based PnCs. We will further show the use of the unique properties of these PnC structures for the formation of fundamental devices like single-mode waveguides and resonators and their use in forming more functional PnC structures.*

Author: V. J. Sánchez-Morcillo	**Category: Invited Oral**
Affiliation: Universitat Politècnica de València	
Paper #: 0111	**Time:** 11:40 am -12:00 pm
Title: Enhancement of Sound in Chirped Sonic Crystals	
Abstract: *We report and experimentally demonstrate a mechanism of sound wave concentration based on soft reflections in chirped sonic crystals. The reported controlled field enhancement occurs at around particular (bright) planes in the crystal, and is related to a progressive slowing down of the sound wave as it propagates along the material. At these bright planes, a substantial concentration of the energy was obtained for a linear chirp profile and for frequencies around the first band gap.*	

Author: M. Ouisse	**Category: Invited Oral**
Affiliation: FEMTO-ST Institute	
Paper #: 0115	**Time:** 12:00 pm -12:20 pm
Title: Adaptive Metacomposites: Design Strategy and Experi-mental Validation	
Abstract: *Recent advances in modeling of multiphysics periodic systems allow designers to investigate new concepts for vibroacoustic absorption. In this work, we present a strategy to design adaptive metacomposites, namely host structures with periodic piezoelectric patches shunted with semi-passive electric circuits, together with experimental implementation.*	

Author: J. M. Cooper	**Category: Invited Oral**
Affiliation: University of Glasgow	
Paper #: 0108	**Time:** 12:20 pm -12:40 pm
Title: PhonoFluidics Phononic Tool-box for Microfluidic Circuits	
Abstract: *We present the design, fabrication and experimental validation of 2D phononic crystal lattices to control the propagation of acoustic energy within a plate, and its interaction with liquids on a microfluidic system. Controlled by the actuation frequency, this enables us to build a tool-box of fluidic functions for integrated molecular diagnostics.*	

Author: P. A. Deymier	**Category: Org. Colloquium**
Affiliation: University of Arizona	
Paper #: 0130	**Time:** 12:40 pm -1:00 pm
Title: Non-linear Waves in Phononic Structures	
Abstract: *We examine the propagation of elastic waves in non-linear one-dimensional phononic structures. Multiple-time scale perturbation theory and Molecular Dynamics (MD) simulations combined with Spectral Energy Density (SED) calculations are used to study the effect of non-linearity on the band structure of the phononic structures. We pay particular attention to frequency shift and line width of the modes. These are discussed in terms of multi-phonon scattering processes. Two mass-spring systems are studied and contrasted. The first one is a one-dimensional chain of point masses and non-linear springs with cubic non-linearity. The second system is composed of linear springs connecting spatially extended masses. In addition to translation degrees of freedom, this later systems includes*	

Lunch Break (Kahramana Resturant)	**1:00 pm - 3:30 pm**
Track 5: Periodic Structures	
Session: 19 (Amaraua Conference Hall)	**3:30 pm - 6:30 pm**
Session Chair: A. Baz	

Author: H. Khales	**Category: Contributed Oral**
Affiliation: Centre de Développement des Technologies Avancées	
Paper #: 0083	**Time:** 3:30 pm -3:45 pm
Title: Evidence of Complete Elastic Band Gap in Phononic Strip Waveguides	
Abstract: *We present theoretical work about the parametric effect of phononic strip made with inclusions on band gap formation. The influence of materials contrast and the geometrical forms on 1D phononic crystal is investigated. The geometric dimensions of the PC strip are in the same order of the system periodicity. We focus on the materials commonly used in micro-fabrication as W, Ni, Cu, and Al as inclusions material deposited on silicon substrate material.*	

Author: C. C. Claeys	**Category: Contributed Oral**
Affiliation: Katholieke Universiteit Leuven	
Paper #: 0032	**Time:** 3:45 pm -4:00 pm

Title: Honeycomb Core with Local Resonance Stopband Behaviour

Abstract: *Liu et al. demonstrated that inclusions of high density spheres with a rubber coating in a matrix material result in low frequency stop bands1. These locally resonant sonic materials require a high density of local resonators throughout the matrix material, either spread ran-domly or periodically. In this paper, resonating structures are introduced into the cavities of a honeycomb core, leading to a honeycomb structure with local resonant stop band behaviour. This opens up possibilities to create materials with excellent mechanical properties and strong structural attenuation in a low-frequency region.*

Author: M. Y. Wang	**Category: Contributed Oral**
Affiliation: The Chinese University of Hong Kong	
Paper #: 0005	**Time:** 4:00 pm -4:15 pm

Title: Wide-Band Low Frequency Gaps in Periodic Flexural Beams With Nonlinear Local Resonators

Abstract: *In this work we study flexural wave propagation in a periodic beam with nonlinear local resonators suspended along the span of the beam. We focus on the frequency band structure of flexural wave propagation, especially the effects of a hardening stiffness of the resonators. We use the harmonic balance method with the transfer matrix method and Bloch's theorem to analyze the frequency band structure. Our results show that strong nonlinearity gives rise to a super-wide band-gap starting at a low frequency edge and extending to the first Bragg frequency with band-gap characteristics similar to Bragg scattering type.*

Author: F. Romeo	**Category: Contributed Oral**
Affiliation: Sapienza University of Rome	
Paper #: 0096	**Time:** 4:15 pm -4:30 pm

Title: Localized Solutions against Wave Propagation Regions in Nonlinear Oscillatory Chains

Abstract: *The nonlinear propagation regions of a chain of linearly coupled mechanical oscillators characterized by on site cubic nonlinearity are used to identify the re-gions of existence of localized solutions and to guide their analysis. Through a nonlinear map approach, the role played in the localization context by the propagation regions internal thresholds, governing temporary loss of stability, is also investigated.*

Author: A. Leonard	**Category: Contributed Oral**
Affiliation: California Institute of Technology	
Paper #: 0068	**Time:** 4:30 pm -4:45 pm

Title: Nonlinear Pulse Propagation through Ordered Granular Networks

Abstract: *We present a study of the nonlinear pulse splitting, bending, and combining through ordered 2D and 3D granular networks. Experimental results are in good agreement with both numerical simulations and theoretical predictions in terms of the distribution of leading pulse amplitudes reaching branch ends for variable network sizes.*

Author: M. Ke	**Category: Contributed Oral**
Affiliation: Wuhan University	
Paper #: 0011	**Time:** 4:45 pm -5:00 pm

Title: Asymmetric Transmission of Acoustic Waves by Grating Structures

Abstract: *We demonstrated the asymmetric transmission of acoustic waves by an asymmetric steel grating structure. This physical essence of this phenomenon comes from the one-way dif-fraction effect determined by the different periods on the both surfaces of the structure. The asymmetric transmission has potential applications in ultrasonic devices.*

Author: R. Picó	**Category: Contributed Oral**
Affiliation: Universitat Politécnica de València	
Paper #: 0102	**Time:** 5:00 pm -5:15 pm
Title: Axisymmetric Toroidal System for Beam Focalization	
Abstract: *Experimental evidences of focusing of acoustic waves with axisymmetric systems made of concentric toroidal rigid scatterers are reported in this work. The system behaves in the long wavelength regime as a refractive lens. Several other effects as beam forming, spatial filtering and frequency filtering are observed and discussed in this work. Due to the scalability of the problem, the design proposed in this work can be used in the range of ultrasound waves for medical and industrial applications.*	

Author: H. Zhang	**Category: Contributed Oral**
Affiliation: National University of Defense Technology	
Paper #: 0074	**Time:** 5:15 pm -5:30 pm
Title: Band Gaps Control of Phononic Beam with Hybrid Shunt-ing Circuits	
Abstract: *Periodic arrays of hybrid-shunted piezoelectric patches are used to control the band gaps of phononic beam. In this article, active NC shunting circuits and passive resonant RL shunting circuits are connected to the same piezoelectric patch in parallel to control the location and the extent of the band gaps. A wider band gap will be achieved when the RL shunting band gap and the NC shunting band gap coupled with each other.*	

Adjourn	**5:30 PM**