Group 3 Physical Acoustics

PGP – General Physical Acoustics

Phenomena and theory of physical acoustics.

- Novel experimental methods and theory
- New computational methods and visualizations

PAT – Acoustic Tweezers and Particle Manipulation

Understanding and exploiting acoustic radiation force on objects.

- Forces on particles, fluids and suspensions
- Analytical and numerical force calculations
- Experimental field and force measurements
- Acoustic streaming
- Devices exploiting the acoustic radiation force, including: resonant devices, surface acoustic wave devices, and acoustic beam and array tweezers
- Particle manipulation (sorting, trapping, patterning, filtering, manufacturing and tissue engineering)
- Acoustic levitation and manipulation in air
- Acousto-fluidics / acoustic microfluidics for lab-on-a-chip applications

PNL – Nonlinear Acoustics

Nonlinear effects related to acoustic waves (bulk or guided) in the ultrasonics frequency regime, as well as applications of such effects or countermeasures to reduce them.

- Nonlinear generation effects like harmonic or sub-harmonic generation, intermodulations, etc.
- Nonlinear effects in oscillators / resonators, non-destructive evaluation, acousto-fluidics, biological tissue, etc.
- Acoustic imaging of nonlinear effects (e.g. nonlinear bubble dynamics)
- Nonlinear reflection / transmission, contact nonlinearities
- Nonlinear material properties with relation to ultrasound, and their physical origin (classical or non-classical nonlinearities)
- Nonlinear coupling of ultrasound to other degrees of freedom
- Nonlinear waves (shock waves, solitons, etc.)
- Experimental techniques and theoretical methods for investigating and modelling nonlinear effects

PTE – High Power and Temperature effects

Acoustic effects in materials and devices at high excitation levels and/or at different temperatures or temperature profiles, and the interaction of thermal and acoustic effects.

- Analysis of heat dissipation
- Thermo-elastic interaction
- Effects of high excitation levels
- Design for high power operation
- Thermal modelling and measurements
- Temperature dependence of material parameters

POA – Opto-Acoustics

Physical studies regarding the interaction of sound with electromagnetic waves (e.g. light).

- Acousto-optics (diffraction of light by sound)
- Optomechanics
- phoxonics (simultaneous photonic and phononic crystals and structures)
- Brillouin light scattering
- Interaction of photons and phonons
- Picosecond acoustics and laser ultrasound
- Generation of sound by light (electrostriction, photo-acoustics)
- Optical interferometry for ultrasound metrology
- Interactions of ultrasound with electromagnetic waves

PMI – Modelling and Inversion

Numerical methods to simulate propagation of acoustic and elastic waves in heterogeneous media and structures, or to perform imaging and inversion on measured wave fields.

- Model tailoring
- Coupled acoustic effects
- Parameter extraction
- Compact modelling
- Model validation
- Imaging
- Inverse problems

PPN – Phononics

Harnessing elastic and acoustic waves by engineering the structure of propagation media.

- Phononic crystals, sonic crystals, and generally wave propagation in periodic media and structures
- Acoustic metamaterials, elastic metasolids, and metasurfaces
- Micro- and nanoresonators
- Bulk, surface, and guided waves in the above media or structures
- Topological phononic insulators, non-reciprocal devices, acoustic diodes
- Applications of phononics to waveguides, filters, resonators, imaging, acoustic or vibration insulation, energy harvesting, and other functions
- Theory and numerical methods for phononics

PTF – Thin Films

- Deposition techniques for piezoelectric, dielectric, and metallic films
- Measurement of extrinsic (thickness, roughness, strain) and intrinsic properties (material parameters)
- Novel materials in thin film form
- Fabricating acoustic devices in thin film form

PUM – Ultrasonic Motors & Actuators

- Novel ultrasonic motors and actuation mechanisms
- Performance test and measurement
- Analysis of mechanism
- Modelling for simulation
- Characterization
- Applications
- Design methodology

PNR – Non-Reciprocal Acoustics

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