

# Report on the First meeting of SIG Acoustofluidics

Submitted by: Dr. Richard Fu, Northumbria University



SIG of Acoustofluidics is focused on phenomena and physics of acoustic waves interacting with liquid (either in droplet format or in micro-channels), and on engineering and applications of acoustofluidics in diagnostic systems, biotechnology and biomedicine. It will include topics of microfluidics induced by ultrasonic, surface acoustic waves, bulk acoustic waves and flexural waves, and use of these for bio-sampling, microanalysis, and microfluidic diagnosis.

**First SIG Meeting:** 10.30am-3.00pm, Friday 26<sup>th</sup> May 2017  
 Northumbria University, Newcastle Upon Tyne, UK

**Meeting Place:** “The Zone”, Ellison Building C/D/E Entrance  
 (Location 37 on the [City Campus map](#))

**The aim of this first SIG meeting is for members of the SIG and other researchers**

- To meet and understand each other’s interests and capabilities,
- To update the latest research work on ultrasonic and acoustic wave based fluidics.

- To discuss about the funding opportunities, collaborations, student/research staff exchanges/visiting.

**Agenda**

- 9.30-10.30 Arrival and Tea/Coffee, networking  
(The Zone, Ellison Building C/D/E Entrance)
- 10:30-10:40 Official meeting starts at **Ellison Building A111**.  
Brief Introduction/talk from Chairmen of SIG.
- 10:40-11:00 Prof. Glen McHale: General talks on subject, Northumbria work on fluidics and collaborations among different SIGs in UKFN.
- 11:00-11.30 Cell manipulation in ultrasonic standing waves  
Invites talk from Professor Martyn Hills, Southampton University
- 11.30-12.00 Overview of acoustic wave based microfluidics and integrated with new fluidic and sensing techniques and beyond  
Invites talk from Dr. Julien Reboud, Glasgow University
- 12:00-12:30 Discussions on the recent progress on the research topics.  
**Group photo-taken at entrance of Ellison Building.**
- 12:30-13:30 Buffet Lunch + Networking and exchange ideas (The Zone)
- 13:30-14:00 (Room Ellison Building A111)  
Overview of thin film based acoustofluidics and lab-on-chip  
Talk from Professor Jack Luo, Bolton University.
- 13:30-14:00 Title + a few slide presentations from participant groups from different universities (based on university names, depending on attendance).

University of Bath
University of Bolton
University of Bristol
University of Cambridge
University of Durham
University of Edinburgh
University of Exeter
University of Glasgow
University of Heriot-Watt
University of Leeds
University of Loughborough
University of Manchester
University of Northumbria
University of Nottingham Trent
University of Southampton
University of Strathclyde
University of Warwick

- 14:00-15:00 “Consortium building time”  
Discussions on possible focus areas.  
Promoting collaborations,  
Training and exchange of PGR and Early Career Researchers (ECRs),  
Public and industrial engagement, KTP funding  
Future meetings and workshops  
Summer school
- 15.00-15.30 Tea/Coffee, networking (The Zone)  
Optional tours of facilities

### **Travel and Maps**

Northumbria City Campus is in the heart of Newcastle about a 15-20 minutes’ walk from the mainline railway station or can be accessed by taking the metro to Haymarket Station and then walking down Northumberland Road. The University’s standard travel instructions are [here](#) and a Campus map is [here](#). We will have the arrival at “The Zone” which is marked 37 on the map and is the entrance to Ellison Building C/D/E blocks.

### **Activities**

Pre-organiser chairmen meeting was held in the evening before the official group meeting. Dr. Richard Fu, Dr. Julien Reboud, Dr. Jeremy Hawkes, Prof. Jack Luo attended (with an invited guest Dr. Alex Yue from Univ West England).

In the morning, we planned one-hour welcome tea/coffee time, and people introduced each other when they arrived and exchanged their research interests and areas. We started the meeting at 10:30am to provide people with enough time for traveling to Newcastle.

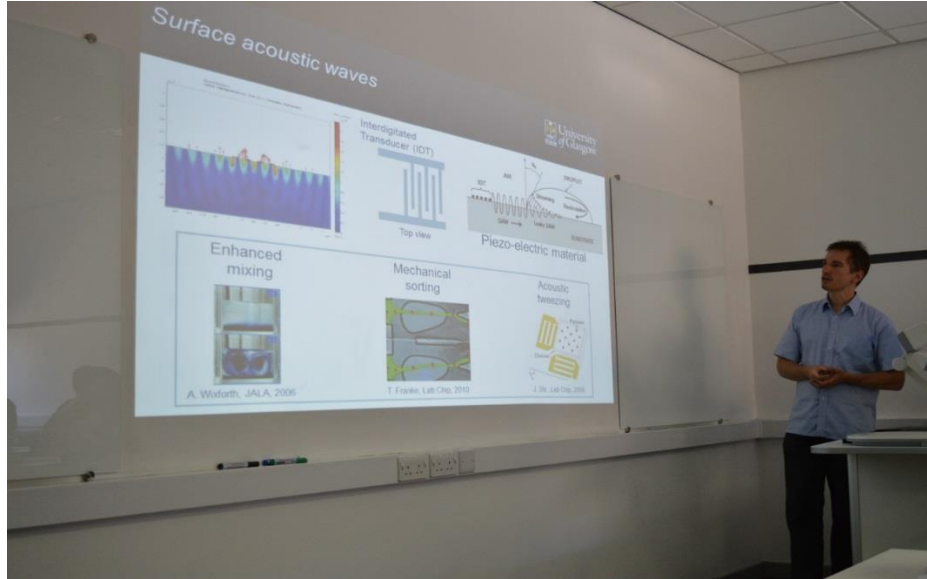


Prof. Glen McHale firstly introduced Northumbria University's research work , mainly focusing on fluidics and acoustofluidics using smart materials and smart surfaces structures. He also introduced themes of other three SIGs which are closely related to the SIG on Acoustofluidics, and discussed potential collaboration, exchange, student joint meeting, etc.

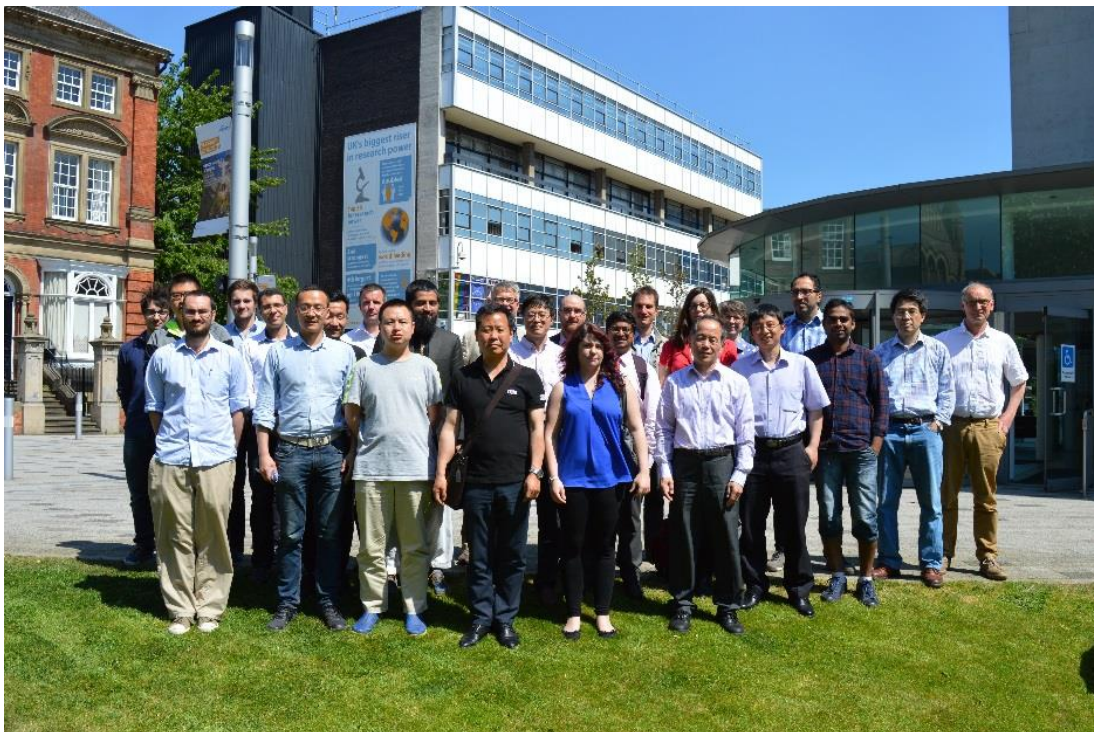
The invited speaker, Prof. Martyn Hills from Southampton University, gave a review talk on ultrasonic microfluidics manipulation using standing waves, focusing on manipulation of biological cells and particles.



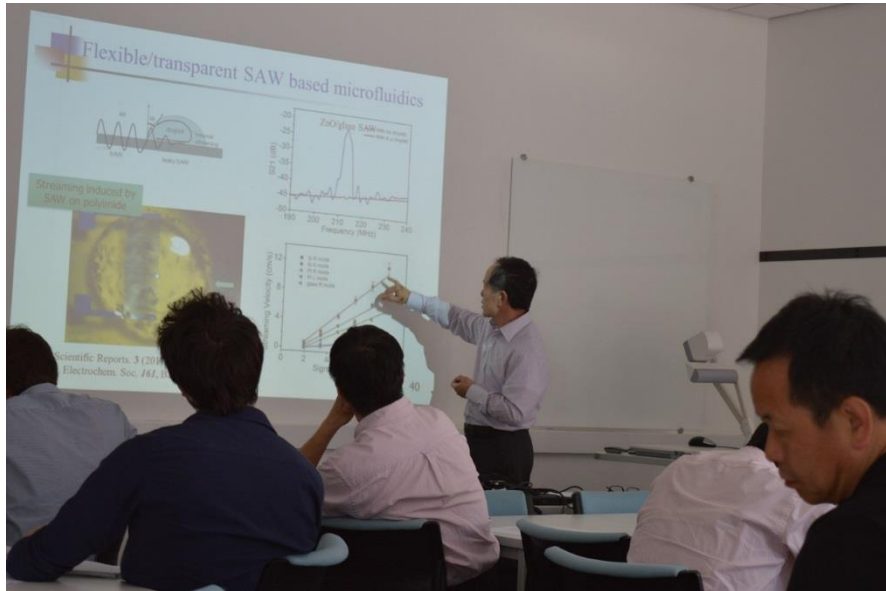
This followed by the talk from invited speaker, Dr. Julien Reboud from Glasgow University, who gave a review on acoustofluidics based on surface acoustic waves (with all different biosampling functions which can be achieved) as well as integration with other technologies and methods for manipulation of particles and cells, PCR, lab-on-chip multiple functions.



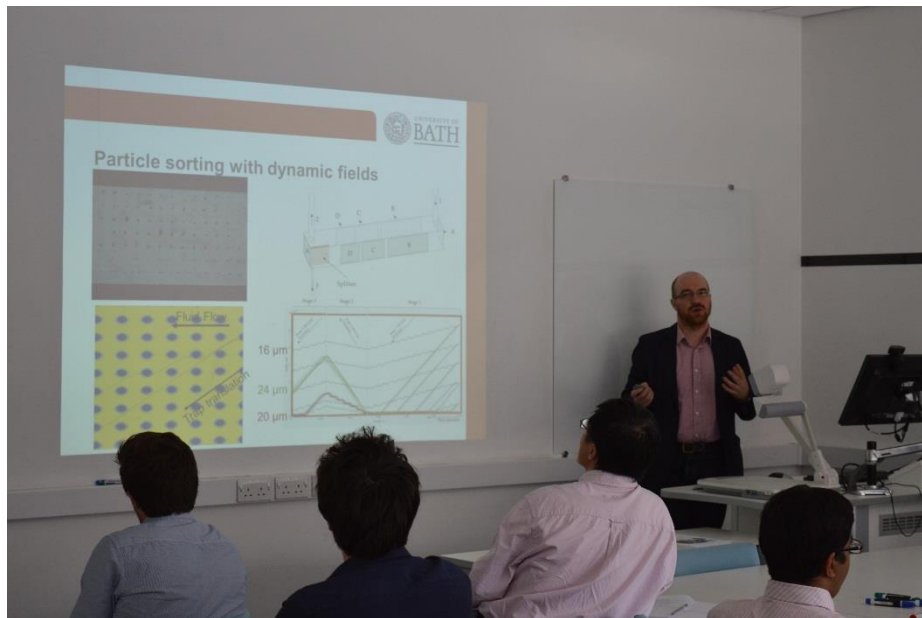
After a short discussion on the collaboration opportunities and organisation of future meetings, the group members went downstairs to take photos. The following photo includes only part of the attendants (as some of the others are still in the meeting room for discussions).



After lunch, Prof. Jack Luo from Bolton University gave a talk on thin film based acoustofluidics and sensing system. He has explained the advantages using thin films instead of bulk materials and focused more on designs of biosensing platform, lab-on-chip and integrated systems.



The representatives of about 12 group universities presented their research areas, facilities and capabilities, research groups, funding supports and recent developments, which are very useful for seeking the potential collaborations and funding. Here are a few selected photos from the presenters.











**Lists of all attendance of Partners:**

Attendance	Title	Full name (first,last)	Institution	Email	Research area(s)	Theory/ Experiment
✓	Dr.	Candace Adams	QuantuMDx Group Ltd	Candace.Adams@quantumdx.com	Drug Susceptibility test, disease testing, flexible malaria assay, HPV diagnostics	E
×	Dr	Anne Bernassau	Heriot-Watt University	A.Bernassau@hw.ac.uk	Ultrasonic sensors, ultrasonic transducers fabrication, micro-fabrication, transducer arrays, acoustofluidics, acoustic particle manipulation and piezoelectric materials	T/E
×	Dr	Dario Carugo	Southampton University	D.Carugo@soton.ac.uk	Ultrasound-mediated therapies, Acoustically responsive agents, Biophysical effects of ultrasound, Controlled drug delivery vehicles, Acoustofluidic manipulation/stimulation, Biomicrofluidics, Bio-fluid dynamics, Vascular networks, Medical devices	E
✓	Dr.	Baixin Chen	Heriot Watt University	<a href="mailto:B.Chen@hw.ac.uk">B.Chen@hw.ac.uk</a>	Computational Fluid Dynamics (CFD) and Lattice Boltzmann method (LBM); Biofuel combustion and Fuel cell, Microfluidics.	T
×	Prof.	Sandy Cochran	University of Glasgow	<a href="mailto:Sandy.Cochran@glasgow.ac.uk">Sandy.Cochran@glasgow.ac.uk</a>	Miniature devices for clinical applications of high resolution ultrasound imaging; Focused ultrasound surgery and ultrasound-	T/E

					targeted drug delivery; Ultrasound for transmission beamforming and manipulation of cells and particles; - Miniature and microscale ultrasound systems for biomedical applications	
×	Dr.	Marina Cole	University of Warwick	Marina.Cole@warwick.ac.uk	Resonant sensors based on piezoelectric materials and instrumentation. Integrated silicon-based sensors, analogue, digital and mixed signal devices, smart sensors, actuators and microsystems	T/E
√	Prof.	Jon Cooper	Glasgow University	<a href="mailto:Jon.cooper@glasgow.ac.uk">Jon.cooper@glasgow.ac.uk</a>	Microfluidics, surface acoustic waves (design, fabrication, applications), phononics, cell-based assays, cell manipulation, diagnostics, synthetic biology	T/E
√	Dr.	Charles Courtney	University of Bath	<a href="mailto:C.R.P.Courtney@bath.ac.uk">C.R.P.Courtney@bath.ac.uk</a>	Ultrasonic non-destructive testing and acoustic particle manipulation	E
×	Prof	John Cunningham	University of Leeds	J.E.Cunningham@leeds.ac.uk	high frequency electronics and photonics; terahertz electronics and photonics	T/E
×	Prof.	Marc Desmulliez	Heriot-Watt University	m.desmulliez@hw.ac.uk	Microwave sensing and sensors for metrology, food industry and biomedical applications Bio-inspired manufacturing, Signals, sensors and systems. Smart Systems Integration.	E
√	Dr	Africa Smith De Diego	University of Leeds	<a href="mailto:mnasdd@leeds.ac.uk">mnasdd@leeds.ac.uk</a>	High-frequency (GHz-THz) biosensors; fluidic systems; lab-on-a-chip; remote dielectrophoresis; surface acoustic waves; on-chip THz devices; THz time-domain spectroscopy	E
×	Prof.	Bruce Drinkwater	University of Bristol	B.Drinkwater@bristol.ac.uk	Ultrasonics; Non-Destructive Testing (NDT); Ultrasonic arrays; Ultrasonic particle manipulation.	E
×	Prof.	Andrew Flewitt	University of Cambridge	<a href="mailto:aif@eng.cam.ac.uk">aif@eng.cam.ac.uk</a>	Acoustic Wave Sensors, and microfluidics, Metal Oxides, Tactile Surfaces, Large-Area Electronics, Metal Oxides for Thin Film Transistors	E
×	Prof.	Thomas Franke	Glasgow University	<a href="mailto:Thomas.franke@glasgow.ac.uk">Thomas.franke@glasgow.ac.uk</a>	Microfluidics, Soft Matter Physics, Lab on a Chip, Red Blood Cells, Vesicles, Droplet fluidics, Surface Acoustic Wave, Acoustofluidics, Mechanobiology	T/E
√	Dr.	Richard Fu	Northumbria University	<a href="mailto:Richard.fu@northumbria.ac.uk">Richard.fu@northumbria.ac.uk</a>	Thin film surface acoustic waves, acoustofluidics, smart materials, lab-on-chip, MEMS, functional nanowires.	E

×	Prof.	Julien Gardner	Warwick University	J.W.Gardner@warwick.ac.uk	CMOS sensors; Biomimetics; Electronic Noses; Chemical microsensors; Chemical Microsystems; Electronic Tongues; Biomedical Engineering; Pattern recognition	T/E
×	Dr.	Yifan Li	Northumbria University	yifan.li@northumbria.ac.uk	Microsystems technology and electrowetting.	E
√	Dr	Mehdi Jangi	Northumbria University	<a href="mailto:mehdi.jangi@northumbria.ac.uk">mehdi.jangi@northumbria.ac.uk</a>	Physics of liquid/solid interactions at extreme conditions, e.g., high-pressure and high-temperature environment using high fidelity computational fluid dynamics (CFD) methods and tools	T
√	Dr	Akshay Kale	University of Leeds	<a href="mailto:A.Kale@leeds.ac.uk">A.Kale@leeds.ac.uk</a>	High-frequency (GHz-THz) biosensors; fluidic systems; lab-on-a-chip; remote dielectrophoresis; surface acoustic waves; on-chip THz devices; THz time-domain spectroscopy	E
×	Dr.	Peter Glynn Jones	University of Southampton	P.Glynn-Jones@soton.ac.uk	Ultrasound in tissue engineering and bio-detection, manipulation of microscopic particles using the forces generated by ultrasonic waves.	T/E
√	Prof.	Jack Luo	Bolton University	<a href="mailto:J.Luo@bolton.ac.uk">J.Luo@bolton.ac.uk</a>	Biosensors, Microfluidics and Lab-on-chip, Flexible and transparent electronics, Thin film surface acoustic waves, smart materials, lab-on-chip.	E
√	Dr.	Jeremy Hawkes	University of Manchester	<a href="mailto:jeremyhawkes@gmail.com">jeremyhawkes@gmail.com</a>	Ultrasound standing waves; Microfluidics, ultrasonic separation to filtration.	T/E
√	Prof.	Martyn Hill	Southampton University	M.Hill@soton.ac.uk	Ultrasonics & underwater acoustics acoustic radiation forces, particularly in MEMS instrumentation	T/E
√	Prof.	Glen McHale	Northumbria University	<a href="mailto:Glen.mchale@northumbria.ac.uk">Glen.mchale@northumbria.ac.uk</a>	Superhydrophobic surfaces, dynamic wetting, drag reduction	T/E
×	Dr.	Rob Morris	Nottingham Trent University	rob.morris@ntu.ac.uk	Magnetic resonance imaging and ultrasound imaging, Surface acoustic wave devices for fluid manipulation.	E
×	Dr.	Michael Newton	Nottingham Trent University	michael.newton@ntu.ac.uk	Superhydrophobic surfaces, drag reduction and electrowetting, acoustic waves,	T/E
×	Prof	Geoffrey Nash	University of Exeter	G.R.Nash@exeter.ac.uk	Surface acoustic wave attenuation by quantum wire, quantum dot and anti-dot arrays, device physics, photonics, plasmonics, quantum	T/E

					devices	
√	Dr.	Valerie J Pinfield	Loughborough University	v.pinfield@lboro.ac.uk	Ultrasonic characterization; Computational modelling of ultrasonic scattering processes; Ultrasonic monitoring of crystallisation processes; Ultrasonic promotion of crystal nucleation, interaction of acoustic waves with particles. Multiple scattering and corrected particle systems.	T/E
×	Dr.	Zoltán Rácz	Durham University	zoltan.racz@durham.ac.uk	Surface acoustic, sensor design, electronic sensor	E/T
√	Dr.	Julien Reboud	Glasgow University	<a href="mailto:julien.reboud@glasgow.ac.uk">julien.reboud@glasgow.ac.uk</a>	Microfluidics, surface acoustic waves (design, fabrication, applications), phononics, cell-based assays, cell manipulation, diagnostics, synthetic biology	E
×	Dr.	Will Shu	University of Strathclyde	will.shu@strath.ac.uk	3D biofabrication, biosensors, microsystems and their applications for regenerative medicine	E
√	Dr	Jonathan Terry	Edinburgh University	Jon.Terry@ed.ac.uk	Integration of novel fabrication processes and materials with foundry CMOS to create smart microsystems.	E
×	Prof.	Anthony Walton	Edinburgh University	Anthony.Walton@ed.ac.uk	Microfluidics, IC technology, microsystem/MEMS, sensors and interconnect technology	E
×	Dr.	Robert Wilson	University of Glasgow	Rab.Wilson@glasgow.ac.uk	Phononics, surface acoustic waves, microfluidics, biosensor	E
×	Dr.	Chris Wood	University of Leeds	C.D.Wood@leeds.ac.uk	High-frequency (GHz-THz) biosensors; fluidic systems; lab-on-a-chip; remote dielectrophoresis; surface acoustic waves; on-chip THz devices; THz time-domain spectroscopy	E
×	Prof.	David Wood	Durham University	david.wood@durham.ac.uk	IC fabrication, Microsystems Technology, Optoelectronics, microscale chips	T/E
√	Dr	Alex Yue	University of West of England	Alex.Yue@uwe.ac.uk	Active electrode for physiological measurements, calibration-free pH sensor, bioinstrumentation design in both component and transistor levels, digital signal processing and pattern recognition, low-power mixed-signal IC design, and zero-power communication for wireless sensor networks (WSN) /Internet of things (IoT).	E/T
√	Prof	Krishna Busawon	Northumbria University	krishna.busawon@northumbria.ac.uk	Modelling, nonlinear control, parameter identification, model-based fault detection and diagnosis,	T

					and chaotic communication systems	
√	Dr	Qiang Wu	Northumbria University	Qiang.wu@northumbria.ac.uk	Fiber Bragg grating devices for sensing and optical communications; Novel fiber optical couplers and sensors; surface plasmon resonant for highly integrated nanophotonics sensors	E/T
√	Mr	Jonathan Saussereau	Northumbria University	<a href="mailto:jonathan.saussereau@etu.u-bordeaux.fr">jonathan.saussereau@etu.u-bordeaux.fr</a>	Acoustic wave sensors and microfluidics	E
√	Mr	Nageswara.lalam	Northumbria University	<a href="mailto:nageswara.lalam@northumbria.ac.uk">nageswara.lalam@northumbria.ac.uk</a>	Distributed optical fiber sensors for strain and temperature monitoring	E/T
√	Mr	Dejun Liu	Northumbria University	<a href="mailto:dejun.liu@northumbria.ac.uk">dejun.liu@northumbria.ac.uk</a>	Optical fibre sensing	E
√	Mr	Sameer Hasan	Northumbria University	<a href="mailto:sameer.hasan@northumbria.ac.uk">sameer.hasan@northumbria.ac.uk</a>	Flexible surface acoustic wave biosensing	E
√	Mr	Bethany Orme	Northumbria University	<a href="mailto:bethany.orme@unn.ac.uk">bethany.orme@unn.ac.uk</a>	SLIP coatings, wetting and droplets	E
√	Mr	Jian.guan	Northumbria University	<a href="mailto:jian.guan@unn.ac.uk">jian.guan@unn.ac.uk</a>	wetting, fluids, materials	E
√	Dr	Pep Canyelles-Pericas	Northumbria University	<a href="mailto:josep.canyelles-pericas@unn.ac.uk">josep.canyelles-pericas@unn.ac.uk</a>	Electronics integration, instrumentation and control	E
√	Mr	Zhefeng Lei	Northumbria University	<a href="mailto:zhefeng.lei@northumbria.ac.uk">zhefeng.lei@northumbria.ac.uk</a>	Coatings, thin films, and microstructures	E
√	Mr	Cong Wang	Northumbria University	<a href="mailto:cong2.wang@northumbria.ac.uk">cong2.wang@northumbria.ac.uk</a>		E
√	Dr	Fei Chen	Northumbria University	<a href="mailto:fei2.chen@northumbria.ac.uk">fei2.chen@northumbria.ac.uk</a>		E
√	Mr	Rahul Kumar	Northumbria University	<a href="mailto:rahul.kumar@northumbria.ac.uk">rahul.kumar@northumbria.ac.uk</a>	Optical fiber sensors for biodetection, strain and temperature monitoring	E
√	Mr	Elfego Ruiz Gutierrez	Northumbria University	<a href="mailto:elfego.gutierrez@northumbria.ac.uk">elfego.gutierrez@northumbria.ac.uk</a>	Wetting, droplet dynamics, mechanics of interfaces, evaporation, bioinspired smart materials, lattice-Boltzmann simulations	E

### Company Supports in this SIG:

The following companies have attended the SIG meetings. The other companies would be later consulted to be involved in funding applications, technical support, finance support, and student project/placement supports.

- SAW-DX, Glasgow
- QuantumDX, Newcastle.

## The main topics for funding identified from the first SIG meeting:

- Ultrasonic induced streaming and agitation, mixing, cell/particle separation, cell lysis, heating.
- Cell interacting with acoustic waves.
- Acoustic wave nebulisation, nanoparticle formation and drug/chemical analysis
- Acoustic wave induced printing and patterning, tissue engineering.

## Decision for the next Meeting:

After discussions, the next SIG meeting is planned to be held between 16-19<sup>th</sup> Jan 2018, together with [Anglo-French Physical Acoustics Conference 2018](#), in Selsdon Park Hotel, 126 Addington Rd, South Croydon CR2 8YA, UK.

<http://www.iop.org/activity/groups/subject/pa/calendar/index.html>

