

1:00pm-5:00pm | Oct 21, 2015 (Wednesday)

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Title:	Ultrafast Ultrasound Imaging: Basic principles and applications in Doppler, Elastography, Contrast and Super resolution Imaging
Lecturer:	Mickaël Tanter & Mathias Fink; French National Institute for Health and Medical Research, Institute Langevin, ESPCI, Paris France
Abstract:	The advent of ultrafast ultrasonic scanners is paving today the way to tremendous applications in medical Ultrasound. This course will present the basic principles of Ultrafast Imaging (plane wave imaging, synthetic aperture imaging, parallel receive beamforming, plane wave compounding, ...) and their implications in terms of resolution, contrast and frame rates. It will also explain the analogy such concept with optical holography. For our purposes, theoretical aspects and experimental validations will be highlighted. The course will also emphasize technological issues and system architecture constraints. Far beyond breaking technological barriers, this concept of ultrafast imaging is currently changing the paradigm of ultrasound imaging. The course will illustrate how this concept leads to breakthrough innovations in the field by revisiting Bmode, Doppler, tissue strain and nonlinear imaging. Many examples (Shear Wave Imaging, Ultrafast Doppler, fUltrasound, Ultrafast Contrast Imaging, ultrafast Ultrasound Localization Microscopy,...) will illustrate the potential of this new concept and technology.

Biography



Mickaël Tanter is the director of Inserm laboratory “Wave Physics for Medicine” and Deputy Director of Langevin Institute at ESPCI, Paris, France. He is a world renowned expert in biomedical ultrasound and wave physics. He is the recipient of 35 patents and the author of more than 200 peer-reviewed papers and book chapters. In 2006, he co-founded Supersonic Imagine with M. Fink, J. Souquet and C. Cohen-Bacrie. Supersonic Imagine is an innovative French company positioned in the field of medical ultrasound imaging and therapy that launched in 2009 a revolutionary Ultrafast Ultrasound imaging platform called Aixplorer™ with a unique real time shear wave imaging modality for cancer diagnosis (>140 employees, 152 M€ venture capital, and more than 1000 ultrafast scanners already sold worldwide). He co-invented several innovations in Biomedical Ultrasound (Transient Elastography, Ultrafast Ultrasound, functional Ultrasound imaging of brain activity, deep Ultrasound Localization Microscopy). He received many national and international awards (among them the Honored Lecture of the Radiology Society of North America in 2012 and the Grand Prize of Medicine and Medical Research of Paris city). He was recently awarded a European Research Council (ERC) Advanced Grant to introduce fUltrasound imaging (functional imaging of brain activity) as a new full-fledged neuroimaging modality.



Mathias Fink is a professor of physics at the Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI ParisTech), Paris, France. In 1990 he founded the Laboratory Ondes et Acoustique at ESPCI that became in 2009 the Langevin Institute. In 2002, he was elected at the French Academy of Engineering, in 2003 at the French Academy of Science and in 2008 at the Collège de France on the Chair of Technological Innovation. He has received many scientific awards as recently the Ian Donald Medal of the International Society of Ultrasound in Obstetrics and Gynecology (2012), the Rayleigh Award of the IEEE UFFC Society (2012) and the prestigious ERC SYNERGY Grant (European Research Council) for the HELMHOLTZ project (2013).

Mathias Fink's area of research is concerned with the propagation of waves in complex media and the development of numerous instruments based on this basic research. His current research interests include time-reversal in physics, wave control in complex media, super-resolution, metamaterials, medical ultrasonic imaging, ultrasonic therapy, multiwave imaging, acoustic smart objects, underwater acoustics, geophysics and telecommunications. With his colleagues, he has developed different techniques in medical imaging (ultrafast ultrasonic imaging, transient elastography, supersonic shear imaging), wave control and focusing in complex media with time-reversal mirrors. He holds more than 65 patents, and he has published more than 350 peer reviewed papers and book chapters. 4 start-up companies with close to 300 employees have been created from his research (Echosens, Sensitive Object, Supersonic Imagine and Time Reversal Communications).

Awards

- Outstanding Paper Award of IEEE Transactions in Ultrasonics, 1992
- Senior Member of the Institut Universitaire de France, promotion 1994.
- Grand Prix de la créativité SNECMA - 1994
- Prix FOUCAULT, Société Française de Physique, 1995
- Silver Medal of CNRS, 1995
- The research team of the year 1996, Award from New Economist and CNRS
- Distinguished Lecturer at the ASA Meeting in June 1997, Penn State University
- Chevalier de la Légion d'Honneur, May 1998
- The Science Writing Award of the Acoustical Society of America, 1998
- Fellow of the Acoustical Society of America, 2001
- Grand Prix de l'Académie des Sciences (Gaz de France), 2002
- **Elected Member of the Académie des Technologies**, 2002 (National Academy of Engineering of France)
- Médaille Française de la Société Française d'Acoustique, 2003
- **Elected Member of the French Academy of Science**, 2003
- Prix de l'Innovation de la Ville de Paris (Mention Spécial), 2003 for the start-up Sensitive Object
- Helmholtz-Rayleigh Award of ASA (Acoustical Society of America), 2005
- Officier de la Légion d'Honneur, 2007
- Prix de l'Innovation Denis Diderot, 2007 for the start-up Time-reversal communications

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| | <ul style="list-style-type: none">• Grand Prix Louis Néel de la Société Française de Physique, 2008• Elected Professor at College de France : Chaire d'Innovation Technologique Liliane Bettencourt, 2008-2009• Lauréat du Prix ARRI du Rayonnement Français, 2010• Outstanding Paper Award of IEEE Transactions in Ultrasonics, 2010• Prix Yves Rocard de la Société Française de Physique 2011• The CNRS Medal of Innovation, 2011• Ian Donald Medal of the International Society of Ultrasound in Obstetrics and Gynecology, 2012• Rayleigh Award of the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society, 2012 |
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