

LATEST DEVELOPMENTS IN CONFOCAL BRILLOUIN MICROSCOPY

Chengze Song¹, Yuchen Xiang¹, Emilio Sánchez Ortega^{1,2}, Andreas Karampatzakis^{1,3},
Matthew Foreman¹, Pei-Jung Wu⁴, Thorsten Wohland³, Irina Kabakova³, Carl Paterson¹,
Darryl Overby⁴, Peter Török¹

¹Department of Physics, Imperial College London, UK

²Department of Optics, University of Valencia, Spain

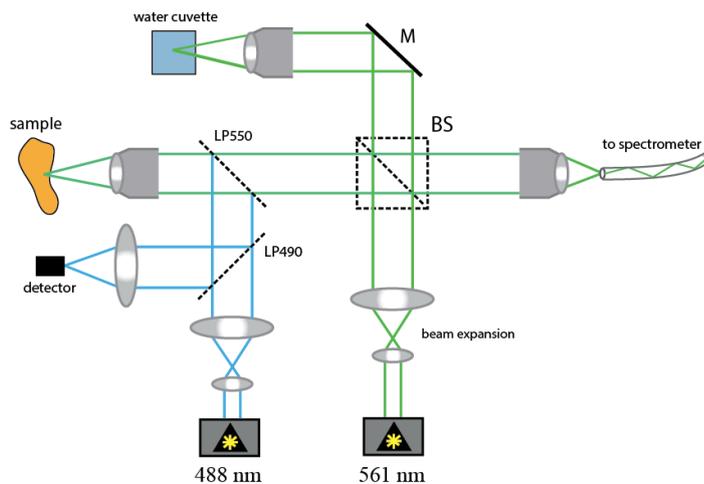
³School of Biological Sciences, National University of Singapore

⁴Department of Bioengineering, Imperial College London, UK

E-mail: peter.torok@imperial.ac.uk

KEY WORDS: Brillouin microscopy, Mechanical imaging, Cell mechanics

Abstract: Brillouin microscopy is a technique used to obtain information on the mechanical properties of samples in a non-contact manner. The sample is illuminated using a microscope objective lens (see Figure [1]) and the scattered light, containing both elastic (Rayleigh signal) and inelastic (Brillouin signal) components, is collected by the same lens and is analysed by a single mode fibre coupled spectrometer. The position, width and height of the Brillouin peak reveals mechanical properties of the specimen, sampled by the tightly focused illumination.



Brillouin spectrometers are required to have much higher spatial resolution than what is required for Raman imaging, so Fabry-Perot etalons had been used before the invention of Virtually Imaged Phase Array (VIPA) spectrometers [2]. Even though the inception of this spectrometer permitted a one and a half order of magnitude drop in data acquisition speed, acquiring spatially resolved Brillouin images is still a very slow process.

In this talk we present the latest developments in Brillouin microscopy instrumentation, also including results

of our Brillouin endoscopy research. We shall discuss design aspects of VIPA based spectrometers, the use of interferometric Rayleigh peak suppression [3], the design of the endoscope especially that of the Raman spectrometer and describe our latest results in biofilm formation, cancer research and also discuss our measurements on investigating the controversial question as to what a Brillouin microscope measures [4].

Reference:

- [1] A. Karampatzakis, PhD Thesis, NUS and Imperial College, 2017
- [2] Shirasaki, M, Virtually Imaged Phased Array, FUJITSU Sci. Tech. J., Vol. 35, 1, pp. 113-125, July 1999.
- [3] Lepert, G, et al. "Assessing corneal biomechanics with Brillouin spectro-microscopy." Faraday discussions 187 (2016): 415-428.
- [4] P-J Wu et al: Brillouin microscopy, what is it really measuring? <http://arxiv.org/abs/1711.03312>