**Brillouin scattering microscope for noninvasive 3D microscale mechanical characterization**

*Michael TaylorA, Alan RowanA*

AAustralian Institute for Bioengineering and Nanotechnology, The University of Queensland, Australia

**Overview**

Brillouin microscopy is a new technology which allows noncontact elastography by characterizing light which has scattered from sound waves in the sample. Brillouin microscopy provides optical resolution, non-contact sampling of viscoelasticity, and allows mechanical imaging in otherwise inaccessible regions such as the interior of cells or within the cornea of intact eyes (Meng 2016, Scarcelli 2015). Since sound is always propagating, light which scatters from it has its frequency shifted due to the Doppler effect. Measuring the frequency shift of the scattered light allows measurement of the local speed of sound in the material, thereby achieving diffraction limited 3D elastography. However, sound scatters very few photons, which makes it challenging to collect a sufficient signal. Most instruments therefore require both high power and long acquisition time. In addition, it is difficult to isolate these few photons from the much larger background of stray light, and most instruments cannot work in scattering samples.

Here we are currently constructing a Brillouin microscope that uses a different technology to measure the signal. While most use spectrometers, we are introducing heterodyne detection which is able to extract all of the available information in the light field, and should permit far higher sensitivity while also being insensitivity to stray light. Once completed this will be used in cell biomechanics experiments to provide localized information about the mechanics within and around cells as they either migrate or differentiate.

We will report progress towards this new technology and present preliminary results. We will explain and the capabilities of the instrument, and discuss plans for its use in cell biomechanics experiments.

**References**

1. Meng Z *et al.*, (2016). Seeing cells in a new light: a renaissance of Brillouin spectroscopy, Adv. Opt. Photonics 8, 300.
2. Scarcelli G *et al.*, (2015). Noncontact three-dimensional mapping of intracellular hydromechanical properties by Brillouin microscopy, Nat. Methods 12, 1132.