Department of Physics and Astronomy
College of Science

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Seminar

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11 am - Room 701

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Bio-medical X-ray Imaging With Spectroscopic Pixel Detectors

The aim of this presentation is to review the clinical potential of spectroscopic X-ray detectors. Images of surgical specimens obtained with a Medipix-2 detector will be presented. A new breed of X-ray detectors is being developed that individually processes photons interacting with a sensor. These are either known as quantum detectors, photon counting detectors, or for the more advanced systems, photon processing detectors. Many of these detectors, such as Medipix-2, allow thresholds to be selected so that only photons within a specified energy range are recorded. New detectors in development, such as Medipix-3, have multiple thresholds within each pixel. These new detectors will allow for routine use of spectroscopic X-ray systems for bio-medical imaging. The significance of spectroscopic X-ray detectors is difficult to predict but insights can be gained by examining both image reconstruction artefacts caused by beam hardening, and the current uses of dual energy techniques in biomedical imaging. Beam hardening artefact is a CT reconstruction artefact that arises due to the approximation that the spectrum of transmitted X-rays is constant regardless of the material being imaged. This artefact poses significant clinical problems in diverse areas including CT pulmonary angiography and muskuloskeletal imaging around metallic implants. It is hoped that with spectroscopic detectors the artefact can be reduced, thus improving diagnostic capabilities. Dual energy angiography is a technique where an infused angiographic contrast agent is identified by its k-edge. Within bio-medical imaging iodine and gadolinium contrast are routinely used for vascular studies and tumour characterisation. Both iodine and gadolinium have k-edges within the energy range of diagnostic X-rays making them easily identifiable with spectroscopic detectors. Potential clinical applications include pre- and post-contrast CT imaging and retention of contrast in tumours such as breast cancer. Different tissues and tumours have different attenuation coefficients over a range of energies. Spectral imaging will translate to better identification and delineation of tumours compared to conventional imaging. While dual energy techniques are well established for bone diseases, for practical reasons they are rarely used elsewhere.

Despite this, spectral information is known to be of benefit for many diseases. Published examples of the use of energy information in mammography include:

1) lower energies provide better soft tissue contrast.
2) ductal carcinoma has a different attenuation spectrum than fibrous tissue.
3) micro-calcification can be better identified for early detection of cancer.

In conclusion, spectroscopic X-ray pixel detectors have potential for a wide range of clinical benefits.

All Welcome

Contact Details

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