# Magnetic Resonance Physics

## Porous Media Analysis

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Laby Building - Level 3 Rooms 304, 307 & 308

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

## Hardware

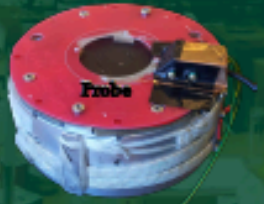
### Rock Core Analyzer


Magnet - 0.0470 T

Gradient Stack

Radiofrequency Probe

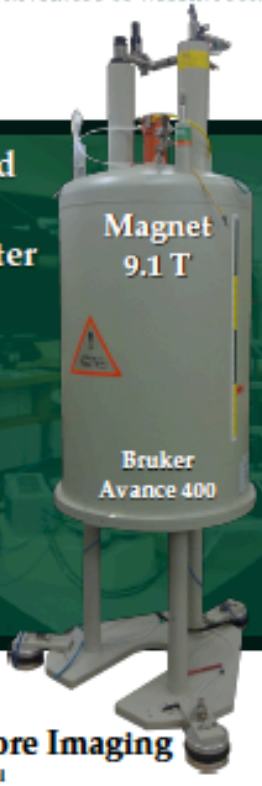
### Mobile Lateral Explorer MOLE NMR




Magnet - 0.1175 T

### High Field NMR Spectrometer

Probe

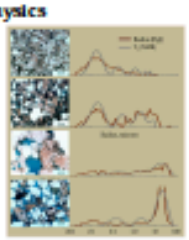



## Applications and Results

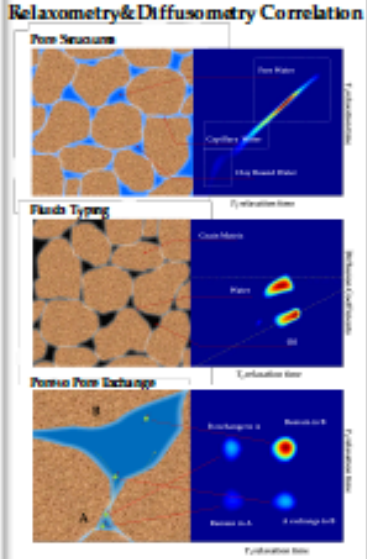
### Rock Core Analysis

Huabing Liu

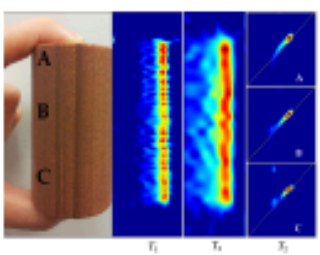
#### NMR in Petrophysics



#### Relaxometry&Diffusometry Correlation




#### Pore Structure Spatially-Resolved

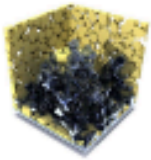



### Real-Time Fluid Transport Measurement

Wilfred Kittler & Mark Hunter

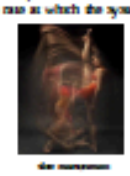
#### Fluid Transport

- Relevant to chemical engineering, the petroleum industry, and environmental sciences.
- The boundaries of the pore space influence the transport properties of the fluid. In turn, characterization of fluid transport yields information about the pore structure.



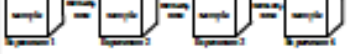
#### Measurement Speed

For the state of a system to be resolved, the measurement time must be short compared to the rate at which the system evolving in time.

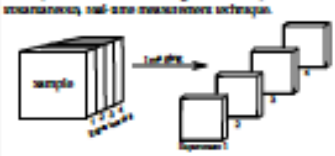


#### Parallel Data Acquisition

NMR is a powerful method of characterizing fluid transport properties, but conventionally requires a series of experiments including recovery times, resulting in an extended total experimental time.

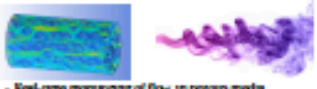


Using novel magnetic fields, the sample is divided into slices, with each representing a single experiment. By spatially resolving the total NMR signal, the entire data set is acquired in a single experiment. This transforms the slow, serial process of characterizing fluid transport into an instantaneous, real-time measurement technique.




One instantaneous measurement yields all required data !

#### Real-Time Flow Characterisation

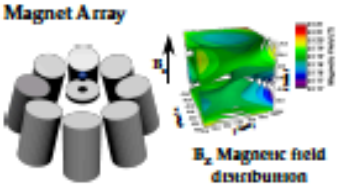


- Real-time monitoring of flow in porous media
- Characterizing transient and short lived processes

### One Sided NMR

Marcel N. & Eurydice & Petrik Galvosas

#### Magnet Array

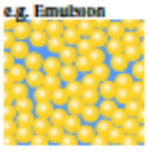


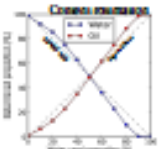
$B_z$ Magnetic field distribution

#### Water and Fat content

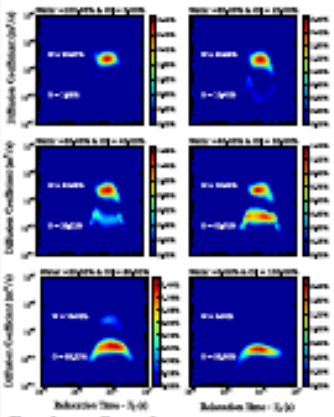
- Using the natural magnetic field gradient
- Pulsed field gradients are not necessary

#### e.g. Emulsion

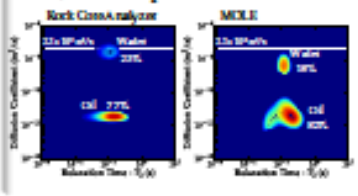




#### Simulated Results



#### Emulsion Sample




### MR Pore Imaging

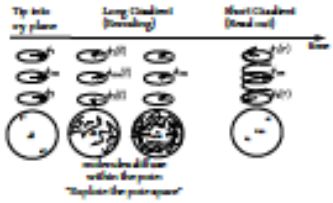
Stefan Hertel

#### The Experiment

- Set of capillaries
  - 20um diameter
- Saturating Fluid
  - Pentane

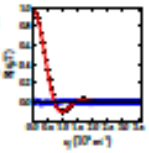
NMR Magnet and magnetic field gradient system

#### How does it work?

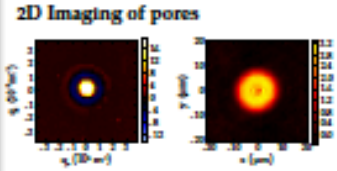


#### The Acquired Signal

Signal obtained contains full information about the average pore shape

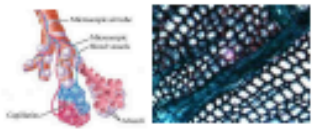


#### 2D Imaging of pores



2D Signal — Average Pore Image

#### Potential Applications



Lung Alveoli — Epithelial Cells (Pine Tree)