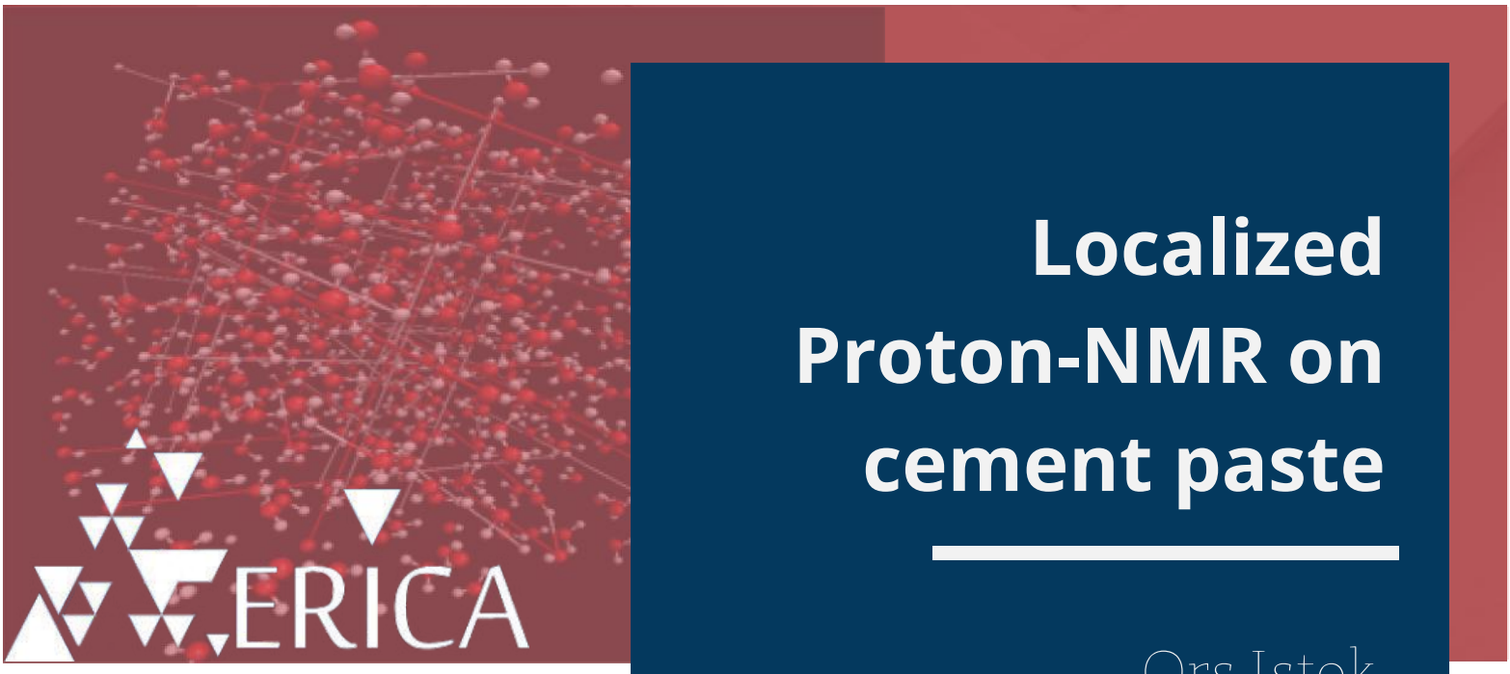

Localized Proton-NMR on cement paste

Ors Istok
University of Surrey, UK

Objectives:
This project aims to link anomalous water sorption and time-dependent microstructure in cement paste using spatially resolved GARfield Proton Nuclear Magnetic Resonance analysis.

Anomalous sorption

Water uptake into the porous network of cement sample is non-linear with the square root of time. This deviation is believed to be due to several reasons: delayed hydration, carbonation, microcracking, swelling, hysteresis, or environmental effects.

GARField Proton NMR

This method operates on using high magnetic gradients which enable localized measurements of the water-filled pores. This method can measure pores at the scale of microns, and detects at depths less than 1 mm below a thin cement paste sample.

Interpreting time-dependent data

A model is developed that considers an effective capillary diffusion coefficient that is dependent on the instantaneous, exponentially relaxing towards a saturation dependent pore size distribution

Time constants for relaxing porosity in de/sorption experiments

Sorption shows at least two time consants for each pore populations at 2 hours and 12 hours.

During drying we only observe one time constant of 10 minutes. Differences arise due to different mechanisms, capillary action vs. vapor transport.