



Fully-funded PhD studentship in:

Multiscale modelling of shale gas flows

Project overview

The University of Edinburgh is seeking an excellent student to award a prestigious PhD scholarship to investigate the behaviour of methane gas inside porous rock media. The student will be using molecular dynamics simulations and develop new multiscale models to predict unconventional gas flows in underground reservoirs. This is part of a \$2.8M joint research project between Edinburgh University, Strathclyde University, and King Fahd University of Petroleum & Minerals (KFUPM).

This scholarship is to work with Dr Matthew Borg and Dr Livio Gibelli in their research team in the School of Engineering, which in REF2014 came first in the UK for “research power”, with 94% of our research rated as ‘world-leading’ or ‘internationally excellent’. The University of Edinburgh is one of the world’s top 25 universities.

The start date is October 2019 (or another date, by arrangement), and is for 3½ years. As this is a joint project with KFUPM, there will be some visits to Saudi Arabia for knowledge exchange and research interactions, with research staff and engineers from industry.

The **principal objectives** of this PhD research project are as follows:

- to use molecular dynamics simulations to investigate the interactions of natural gas with the inner surfaces of geological gas reservoirs down to the nanoscale;
- to use these molecular results to develop boundary conditions that are suitable for a hybrid multiscale technique for simulating the flow of gas in real porous rock samples (see **Figure 1**). This problem is directly relevant to reservoir simulations for the oil and gas industry.

Research and Training: The successful applicant will join a consortium of internationally-leading UK research institutions (Daresbury Laboratory, Warwick University, Strathclyde University, and Glasgow University) working on molecular and multiscale modelling of fluid dynamics problems (see www.micronanoflows.ac.uk). This consortium collaborates with several industrial partners, with the core partner in this research project being King Fahd University of Petroleum & Minerals (KFUPM).

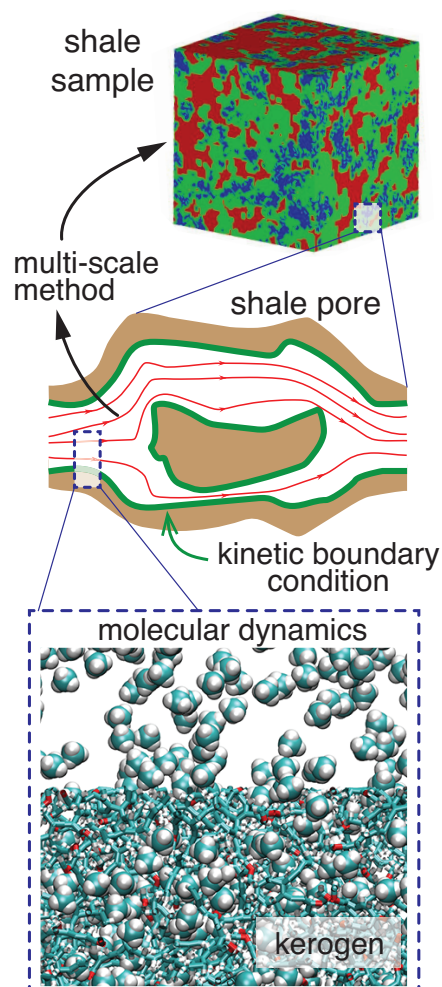


Figure 1: The multiscale method to be developed in this PhD.



This PhD project will be based in the School of Engineering, University of Edinburgh. The supervisors, Dr Matthew Borg and Dr Livio Gibelli, will provide the successful applicant with exceptional research and training opportunities, including:

- regular weekly meetings to discuss the research and software progress;
- collaborating with a large interdisciplinary network of researchers;
- regular opportunities for travel to international conferences to present new results;
- training and experience in state-of-the-art engineering research, including usage and advanced software development in LAMMPS and OpenFOAM;
- integral industrial involvement, including secondments into leading multi-national companies;
- close mentoring from other programme investigators and experienced postdoctoral researchers;
- exceptional career development opportunities with strong institutional support of early career researchers.

Environment: Edinburgh University is ranked in the top 25 universities in the world, and in the top 6 in the UK (source: QS World University Rankings). In the School of Engineering's submission to the last Research Excellence Framework (REF2014), 94% of our activity was rated as '*world-leading*' or '*internationally excellent*', and we are 1st in the UK for *Research Power* – making Edinburgh the largest concentration of leading engineering research in the UK (source: THE). This project is led by Dr Matthew Borg (matthew.borg@ed.ac.uk), and the successful applicant will join a very active, friendly and collaborative research group, comprising 3 lecturers, 4 postdocs and 5 PhD students. Our group makes extensive use of ARCHER – the UK's national supercomputer, which is based in Edinburgh. This PhD will give the successful applicant the skills and experience to become a future leader in either academia, business, or industry.

Applicant Requirements: This is a scientifically and technically challenging project, so it is absolutely essential that the applicant is a dedicated and diligent individual with a 1st (or 2:1) honours engineering degree (or with a degree in a relevant subject area, such as in applied maths or physics), have a strong background in mathematics and physics, and have a good knowledge of (or willing to learn) C++ computer programming and Linux OS. Students already with knowledge of running LAMMPS simulations are desired.

Stipend and Fees: The annual stipend will be £16,813 (tax free), for 3½ years, with all university fees paid. This scholarship is fully-funded for UK or EU students. An international scholarship is also available, which will be awarded to an outstanding international candidate.

To Apply: In the first instance, please email a full Curriculum Vitae and cover letter, explaining why you are interested in pursuing a PhD in this research programme, with the names and contact details of two referees, to matthew.borg@ed.ac.uk with 'PhD Application in multiscale modelling of shale gas flow' in the subject line. Applications can be made [here](#).

The studentship will be offered to **the first applicant with the appropriate set of skills and attainment**. Successful applicants will then complete the formal enrolment process.

Start Date: By arrangement after 1st October 2019.