**Hybrid computational and asymptotic modelling for moving fluid-fluid interfaces in porous media**

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Hi, I'm Ellen Luckins, I'm a mathematician here at work and I'm really interested in in modelling fluid flows through porous materials using asymptotic methods and analytical techniques. My name is Radu Cimpeanu, I also work over in the mathematics department and I specialise in developing numerical methods for so-called interfacial flows.

These are situations with droplets, bubbles, liquid films everywhere where there's more than two fluids present in the system. Absolutely, and in this particular project, we're really interested in interfacial flows in a porous material.

So if this is my porous material here we're interested in two fluids within the porous material and an interface between them. Maybe this top pink fluid is moving down through the material.

And what's really interesting and challenging about modelling these sorts of interfacial flows in porous media is the disparity of length scales and the different processes that are happening in different scales.

So we might have pressure or gravity driving this fluid over the the macro scale, but then on the micro scale within the pores of the material, if this is maybe my solid structure, this capillary and surface tension effects that are really important in understanding how that interface moves on the poor scale as well and coupling these two together is something that we're really excited to do in this project.

Exactly. And there's lots of beautiful detail in all of these situations in which on the one hand, we need to understand what happens near the power level with curvature, with all sorts of forces combining together, which we need to understand both analytically and computationally to make sense of the full picture.

But at the same time, how these translate further up is a little bit of a mystery that we hope you can help us with. Absolutely. So these interfacial porous media flow problems are actually really applicable in lots of different situations.

We might be thinking about fluids moving through a philtre or in a manufacturing situation where you've got to inject some kind of fluid into a, into a porous structure to create a composite structure, or perhaps even in decontamination situations, if you want to decontaminate your porous material.

There's lots of really exciting applications of this sort of work and what's what we're, we're really excited about for this project is that bringing together these different techniques.

Both the computational side to really understand how these interfacial flows are, are occurring on the poor scale, but also some analytical or approximation techniques to, to develop rigorous reduced order models for the overall flow through our, through our poorest system.

Exactly. And the good news is because of this wealth of applications and interesting motivations, we do also work very interesting industrial partners as well that will hopefully give us a hand with the interesting data and insight as we evolve into the projects all together.

Absolutely. So we're really excited to to work with you on this project. There's going to be lots of really interesting mathematical modelling to be done, and also lots of really high fidelity simulations to to go along and work together with that.