Professor Steven Bryant,

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will visit NTNU Nov. 14-15, 2018.11.08 and will give the following talks:

Wednesday Nov. 14: 10:15 – Room P11:

Three Reasons I No Longer Understand Two-phase Flow.

Abstract:

Navier-Stokes equations and the geometry of the flow paths can account for single phase flow in channels and porous media quite nicely. An example is the successful *a priori* prediction of the absolute permeability of a porous medium, given only a description of the grain scale geometry in a sufficiently large volume. Seventy-five years ago, Muskat and others concerned with two immiscible fluids flowing in porous media extended Darcy's single phase empiricism to include a "relative permeability" for each phase.

More than 10,000 papers subsequently appeared in the petroleum engineering literature examining many aspects and implications of the relative permeability concept. From classical Buckley-Leverett fractional flow theory to the latest reservoir simulation software, the reservoir engineering community has been quite content to treat two-phase flow at the continuum scale with i) partial differential equations for mass conservation, ii) the multiphase extension of Darcy's law, and iii) relative permeability curves. It would appear these days that two-phase flow is well behaved, well understood, mature, established, perhaps even boring.

Or is it?

In this presentation I show three examples of what should be an inconsequential tweak to many classical two-phase flow situations, namely, the addition of nanoparticles into one of the fluids. What we observe in these experiments, however, is not what standard theory would predict.

This raises obvious questions about the physical mechanisms underlying our observations and about how to model these phenomena. These questions are interesting in and of themselves, but there may also be reason to re-evaluate how we think about and model multiphase flow, with or without nanoparticles.

Thursday Nov. 15: 15:15 – Room P10:

White Knights and Dark Knights: Prospects for Climate Stabilization via Negative Emissions

Abstract:

Low- to no-carbon energy generation capacity is being built at a rapid pace. Reducing CO2 emissions from fossil fuel consumption at fixed locations like electricity generation plants is technologically straightforward and urgently needed. A carbon-neutral fuel cycle, wherein CO2 captured from the atmosphere is reduced to hydrocarbons, is technologically feasible and could be integrated into existing energy infrastructure. But none of these addresses the growing consensus that climate stabilization can only be achieved via negative net emissions of CO2.

The candidate "White Knight" technologies that can save us from the atmospheric legacy of our fossil-fuel intensive economy are very few. In this presentation I outline some limitations of the technologies commonly considered in the context of achieving negative emissions, such as direct air capture or bioenergy with carbon capture and storage. I then describe a "Dark Knight" technology which addresses these limitations. Its feasibility has been established by several decades of field observations and by recent demonstrations of capture technology. This leads to a discussion of the prospects for implementing this technology at scale. Implementation will be daunting, but implementing the White Knight alternatives will be even more daunting. We conclude that a serious consideration of climate stabilization demands serious consideration of a Dark Knight technology.