**NSF REU Program Seminar**

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**“Applications of Mesoscale Models: Porosity Evolution in Nuclear Materials and Energy Storage in Nanoparticles.”**

**Abstract:**

Certain material phenomena is dominated by the behaviour of interfaces, which have the capability to change the overall ‘bulk’ material behaviour in complex ways. In nuclear materials this impacts the way fission gas, produced inside the solid matrix during irradiation, accumulates on grain boundaries and eventually forms labyrinthine interconnected tunnels towards a vent. In nanoparticles for energy storage, interfacial effects change the charge/discharge behaviour, offering a new way to ‘design’ storage materials with superior performance.

The phase-field model has emerged as a robust and versatile modelling technique to simulate interfacial effects in a thermodynamically self-consistent fashion. It also readily fits into multiphysics models (e.g.: coupled heat transport, diffusion, and elasticity). This benefit comes at a substantial computational cost which is mitigated by advances in high performance computing. This talk will focus on the applications of this model, enabled by HPC, to the nuclear and energy industries.

**Bio:** Dr. Mike Welland graduated with a PhD in Nuclear Engineering from the Royal Military College of Canada, and completed research fellowships at Argonne National Laboratory (USA) and the Institute for Transuranium Elements (Germany). He is currently the head of Mesoscale and Transport Methods in the Computational Techniques Branch at the Canadian Nuclear Laboratories.

His work includes applying mesoscale models to processes in the nuclear and energy industry to enhance the understanding, safety, and efficiency of related technologies. His research interests include thermodynamics, transport processes, and mesoscopic phenomena in nuclear fuels, structural materials, and nanoparticles for energy storage.

**Speaker Name: Dr. Mike Welland**

**Title: Head of Mesoscale and Transport Methods**

**Affiliation: Canadian Nuclear Laboratories**

**CAMP 194**

**July 8, 2019 (Monday)**

**9AM – 11AM** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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