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Heat and mass transfer phenomena in rarefied gas flows

Proposed degrees for this position: MSc and PhD
Starting date: Immediate

Gases flowing in micro-scale devices or at extreme low pressures are named "rarefied". Quantitatively, in gas-flow setups where the characteristic length-scale is of the order of the mean free path of a gas molecule, the continuum hypothesis breaks down and the flow-field cannot be described using traditional continuum (Navier-Stokes) equations.

This situation is common in high-altitude flight (during reentry of space shuttles), where the mean free path is large, or in smallscale electronic devices (MEMS/NEMS), where both length- and time-scales may become very small. In such cases any study of "classical" hydrodynamic phenomena, such as flow stability or heat and mass transfer, must take into account the microscopic (molecular) properties of the fluid.

The proposed work examines the conditions for continuum breakdown in a variety of applications and applies the kinetic theory of gases to study problems such as high-altitude flight; ultra-fast heating processes; and transition to turbulence in rarefied gas flows.

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