Speaker: **Béatrice Rivière, Rice University**

Title: **High Order Methods for Multiphase Flows in Porous Media**

Abstract:

Numerical simulation of multiphase flows in porous media is of critical importance in many engineering applications such as groundwater flows, hydrocarbons production, and carbon dioxide sequestration. Thanks to the increase in computational power, scientists are able to model multicomponent multiphase problems in more complex media with interesting geological features. One characteristic of porous media is the permeability field that represents the ability of the medium to allow fluid phases to flow through the set of connected pores. Due to the nature of the medium, permeability is piecewise constant and varies in space over several orders of magnitude. Low order methods, such as cell-centered finite volume methods, are known to be numerically diffusive and to produce accurate solutions in isotropic media only if the mesh resolution is sufficiently large. When anisotropy is introduced, there is a significant loss in accuracy. Recently, high order numerical methods using polynomial approximation greater than or equal to three, are shown to be competitive methods in modeling porous media. These methods exhibit high accuracy on coarse meshes, they easily handle isotropic and anisotropic media, and the fronts of the components propagating through the porous medium are sharp. In this talk, we review the development of the class of interior penalty discontinuous Galerkin methods for miscible displacement, two-phase and three-phase in heterogeneous media. We also present the application of hybridizable discontinuous Galerkin methods to porous media flow and transport, which have the advantage of yielding smaller global linear systems.