Title: Efficient solvers for high-order explicit and implicit time finite element methods for the wave equation with discontinuous coefficients

Abstract: The wave equation is a fundamental equation in mathematical physics describing the phenomena of wave propagation. In order to deal with an arbitrarily shaped material interface where the coefficients of the wave equation are discontinuous, we extend the high order unfitted finite element method developed for elliptic equations to propose a semi-discrete DG method which adds a penalty term with time derivative so that an optimal error estimate can be obtained. The focus of the talk is to develop efficient solvers for the resultant ODE system after space discretization. We propose a novel high order explicit time finite element method for which the strong stability and optimal hp-version error estimates can be proved. We also introduce efficient and parallel algorithms for the implicit high order continuous time Galerkin method for solving the ODE system. The implicit time methods avoid the restriction of time step sizes of the explicit methods and thus are especially attractive when the mesh is locally refined to resolve the geometry of the material interfaces. This talk is based on joint works with Yong Liu and Xueshuang Xiang.