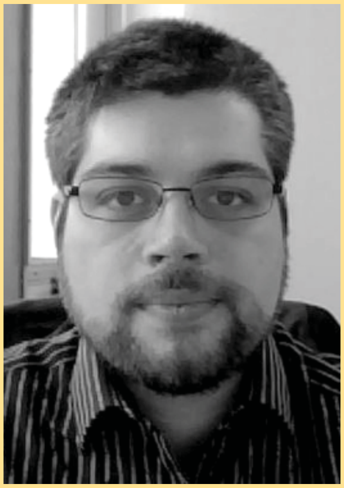
Mathematics Faculty Search
Computational Math

Candidate interview for
assistant professor



James Rossmanith

UW-Madison
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Rossmanith is an assistant professor in the Department of Mathematics at UW-Madison. He received his PhD in applied mathematics from the University of Washington.

Rossmanith's research is focused on developing high-order numerical methods for solving various mathematical models from plasma physics and astrophysics. The equations that must be solved in these applications are characterized by a set of nonlinear evolution equations plus a set of constraint equations. My current work is focused on the development of high-order discontinuous Galerkin for several systems including: (1) Magnetohydrodynamics (MHD), (2) Euler-Maxwell, (3) Vlasov-Poisson, (4) Vlasov-Maxwell, and (5) the Einstein equations of general relativity.

Iowa State University

TEACHING DEMO
401 Carver
Wednesday, February 15 at 9:30 a.m.

HOSPITALITY
404 Carver
Tuesday, February 14 at 3:45 p.m.

COLLOQUIUM
268 Carver
Tuesday, February 14 at 4:10 p.m.

Computational methods for fluid and kinetic models of collisionless plasma

Plasma is a state of matter in which electrons have dissociated from their nuclei, thus resulting in an ionized gas. Such ionized gases appear in variety of applications including in astrophysics, space physics, as well as in laboratory settings such as in magnetically confined fusion. Modeling and understanding the basic phenomenon in plasma has long been a topic in scientific computing, yet many problems remain far too numerically intensive for modern computers. The main difficulty is that plasma phenomena span a wide range of spatial and temporal scales, requiring modeling tools from both fluid and kinetic theory.

In this work I will present an overview of my work on developing high-order discontinuous Galerkin schemes for a variety of models of collisionless plasma. I will begin with fluid models of plasma, and describe numerical discretizations of the ideal magnetohydrodynamic, 5-momemt Euler-Maxwell, and 10-moment Euler-Maxwell systems. In particular, I will discuss the delicate issue of entropy stability and how this influences the finite dimensional approximation spaces in discontinuous Galerkin finite element schemes.

Next I will move to kinetic models of plasma; and in particular, numerical methods for the Vlasov-Poisson system. Important aspects of this work include positivity preservation and high-order accuracy in time.
I will conclude with a brief description of future work, including efforts to develop multiscale numerical discretizations.