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# Laser-induced breakdown for ignition and related stories in integrated predictive science



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### ABSTRACT:

An overview of a recent and new predictive science centers at Illinois --- The Center for Exascale Simulation of Plasma-coupled Combustion (XPACC) and The Center for Exascale-enabled Scramjet Design (CEESD) --- will provide context for more in-depth research efforts in computational flow physics that related to the simulation challenges and physical mechanisms of engineering. These studies will include the vortex dynamics induced by a laser-induced optical breakdown, how such a breakdown seeds ignition and detonation, and a new embedded approach for using machine-learning to augment simulation models for such multi-physics systems.

### BIOGRAPHY:

Jonathan Freund is the Donald Biggar Willett Professor and Head of Aerospace Engineering at the University of Illinois at Urbana--Champaign. He is a Fellow of the American Physical Society, and a winner of the 2008 Frenkiel Prize from its Division of Fluid Dynamics and has served in division leadership in several capacities. He is past associate editor of Physical Review Fluids and on the editorial board of Annual Review of Fluid Mechanics. Computational science has been central to his research across and beyond fluid mechanics, which has included simulations of turbulent jet noise and its control, the dynamics of molecularly thin liquid films, nanostructure formation by ion-bombardment of semiconductor materials, bubble dynamics in confinement, and the dynamics of red blood cells flowing in the narrow confines of the microcirculation. He is the PI and co-director of the Center for Exascale-enabled Scramjet Design (CEESD).