Project Title: RUI: The Effects of Three-dimensional Fluid Flows on Front Propagation

Principle Investigator: Dr. Thomas Solomon, Professor of Physics

Funding Agency: National Science Foundation (NSF)

Award Amount: $208,673.00

Award Period: 2014-2017

Fluid flows play a crucial role in the behavior of many physical, chemical, geological, astrophysical and biological processes. During the past ten years, Dr. Solomon and his research group have done numerous experiments on the behavior of reaction fronts in simple, two-dimensional (2D) fluid flows. Results from those experiments have led to development of a theory that predicts the existence of "burning invariant manifolds" (BIMs) in the flow that act as invisible barriers that block the motion of reaction fronts. The experiments funded by this NSF grant will extend those studies to three-dimensional (3D) flows. Ultimately, these experiments may lead to a better understanding of blooms of plankton in the oceans; more efficient chemical reactors, especially in micro-scale devices; processes in plasma flows that might lead to economical fusion-based electrical generation; the role of cellular-scale flows in biological processes including morphogenesis in a developing embryo; detonation of supernova explosions; and the effects of moving populations on the spreading of a disease. This award from NSF is a Research at Undergraduate Institutions (RUI) grant; consequently, all of this research will be done with undergraduate students who will play an active role in all aspects of the studies, including experimental design, building and testing of the apparatus, data collection and analysis, and publication and presentation of the results. These will be the first real research experiences for most of these students, and will play an important role in their development as scientists.

Contact: Carol A. Burdsal, Assistant Provost for Research, 570-577-3855, cab066@bucknell.edu

March 4, 2015