Type: New

Principal Investigator: William Dorland
Affiliation: University of Maryland
Co-Investigators: Gregory Howes, University of California, Berkeley

Proposal Title: "Fluctuation Spectra and Anomalous Heating in Magnetized Plasma Turbulence"
Scientific Discipline: Solar/Space Physics

INCITE allocation: 4,000,000 Processor Hours
Site: Oak Ridge National Laboratory
Machine: Cray XT4
Allocation: 4,000,000 processor hours

Research Summary:
Plasma is a ubiquitous form of matter in the universe. It is nearly always found to be magnetized and turbulent. If we can understand the turbulence in the solar wind streaming past the Earth, then we can understand similar turbulence in the distant universe, such as is found between the stars and swirling around supermassive black holes. To understand X-ray observational data from Chandra, one must characterize the small-scale, kinetic plasma turbulence. In the solar wind and in the interstellar medium, there are similar unsolved, interesting problems. However, in these cases, there are also direct observations of the small-scale fluctuations, presenting concrete opportunities for testing the insights gained from theory and simulation. Comprehensive, in situ satellite measurements of all aspects of the electromagnetic fluctuations in the solar wind offer particularly exciting possibilities for confronting and testing our understanding of plasma turbulence. This project will investigate the properties of magnetized plasma turbulence, a key problem in space physics and astrophysics. This will be the first program to pursue ab initio simulations of kinetic, low-frequency turbulence in astrophysical plasmas, with the goal of carrying out direct quantitative comparisons with observations.