Sunday, November 8th, 9:00 am - 9:45 am, Invited Talk

Telescoping UQ Method for Extreme Scale Kinetic Simulation of Magnetic Fusion Plasma

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Abstract
Uncertainty quantification of extreme scale simulation codes is a challenging research topic, since the traditional statistical method relying on a large number of simulations cannot be used. Fortunately, the extreme scale codes that use the so-called "firstprinciples" equations tend not to have a large number of input parameters and could provide a means for simplification to this insurmountable task. This talk will be focused on motivating the UQ research for this class of problems. The fusion gyrokinetic code XGC1 will be introduced as a basis for the discussion. A new trial method called "telescoping" UQ will be introduced in which the more conventional UQ will be studied in a reduced-size problem, scale up the results in size, calibrate the UQ scalability on the realistic present-day experimental problems by comparing with the experimental results, and use the calibrated UQ to make predictions for future problems (ITER in the fusion case).

Biography
C.S. Chang is the head of the SciDAC-3 Center for Edge Plasma Simulation (EPSI), actively leading extreme scale computing research on multiscale self-organization physics in magnetic confinement plasma. He is a Fellow of the American Physical Society and a member of numerous national and international advisory and executive committees. He has given a few dozen invited and plenary talks, keynote speeches, and tutorial lectures at major international conferences. Prior to joining Princeton Plasma Physics Laboratory, C.S. Chang was a Professor of Physics at Korea Advanced Institute of Science and Technology, and at the same time a research faculty member at Courant Institute of Mathematical Sciences, NYU with rolling tenure. The XGC particle-in-cell code developed in his group utilizes peta scale homogeneous and heterogeneous leadership class computers for physics research. His close collaborators include not only fusion scientists, but also applied mathematicians and computer scientists. He has produced over 15 PhDs and a similar number of postdoctoral scientists, and has published over 150 scientific papers in refereed journals.