Plasma Surface Interactions 2

Predicting the Performance and Impact of Dynamic PFC Surfaces

Project Summary

The objective of this project is to develop, and integrate, high-performance simulation tools capable of predicting plasma facing component (PFC) operating lifetime and the impact of the evolving surface morphology and composition of tungsten-based PFCs on plasma contamination, including the dynamic recycling of fuel species and tritium retention, in future magnetic fusion devices. This project will enable discovery of phenomena controlling critical PFC performance issues, and quantitatively predict their impact on both steady-state and transient plasma conditions. The outcome of this project will be a suite of coupled plasma and materials modeling tools, and a leadership class PFC simulator to predict PFC evolution and feedback to the boundary plasma. Success in the proposed research tasks will enable the prediction of both plasma fueling and the sources of impurity contamination that impact core plasma performance, and will lay the foundation for understanding, designing and developing the materials required to meet the performance objectives of future fusion reactors.

This project builds upon our SciDAC-3 project: Plasma Surface Interactions: Bridging from the Surface to the Micron Frontier through Leadership Computing

Publications and Presentations

Team

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Sponsor

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Key Partners

Program	Project	Joint Participants (Primary Liaison)
SciDAC Fusion Projects	AToM - Advanced Tokamak Modeling Environment	David E. Bernholdt (ORNL), Mikhail Dorf (LLNL), Milo Dorr (LLNL), David L. Green (ORNL), Phil Snyder (GA), Maxim Umansky (LLNL)
	Center for Integrated Simulation of Fusion Relevant RF Actuators	Davide Curreli (UIUC), David L. Green (ORNL), Ilon Joseph (LLNL), Maxim Umansky (LLNL)
	Partnership Center for High-fidelity Boundary Plasma Simulations (HBPS)	Davide Curreli (UIUC), Mark Shephard (RPI)
FES Theory and ASCR Math Programs	Edge Simulation Laboratory (ESL)	Mikhail Dorf (LLNL), Milo Dorr (LLNL), Sergei Krasheninnikov (UCSD), Phil Snyder (GA)
SciDAC Nuclear Energy Projects	Advancing Understanding of Fission Gas Behavior in Nuclear Fuel through Leadership Class Computing	David E. Bernholdt (ORNL), Sophie Blondel (UTK), James Kress (ORNL), Rick Kurtz (PNNL), David Pugmire (ORNL), Kenny Roche (PNNL), Philip C. Roth (ORNL), Barry Smith (ANL), Blas Uberaga (LANL), Brian Wirth (UTK/ORNL)
	Simulation of Fission Gas in Uranium Oxide Nuclear Fuel	David E. Bernholdt (ORNL), Sophie Blondel (UTK), James Kress (ORNL), Habib Najm (SNL), David Pugmire (ORNL), Philip C. Roth (ORNL), Barry Smith (ANL), Blas Uberaga (LANL), Brian Wirth (UTK/ORNL)
SciDAC Institutes	FASTMath – Frameworks, Algorithms, and Scalable Technologies for Mathematics	Sham Bhat (LANL), Habib Najm (SNL), Khachik Sargsyan (SNL), Onkar Sahni (RPI), Mark Shephard (RPI), Barry Smith (ANL)
	RAPIDS - Resource and Application Productivity through computing, Information, and Data Science	David Bernholdt (ORNL), James Kress (ORNL), David Pugmire (ORNL), Phil Roth (ORNL)

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