Fusion Energy Sciences Introduction

Presented at the 2013 SciDAC PI Meeting

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FES Mission

The mission of the Fusion Energy Sciences (FES) program is to expand the fundamental understanding of matter at very high temperatures and densities and to build the scientific foundations needed to develop a fusion energy source. This is accomplished by studying plasmas under a wide range of temperature and density conditions, developing advanced diagnostics to make detailed measurements of plasma properties, and creating theoretical and computational models to resolve the essential physics ideas and principles.

FES Strategic Goals

Advance the fundamental science of **magnetically confined plasmas** to develop the predictive capability needed for a sustainable fusion energy source

SciDAC-3 partnership & FES SciDAC Centers
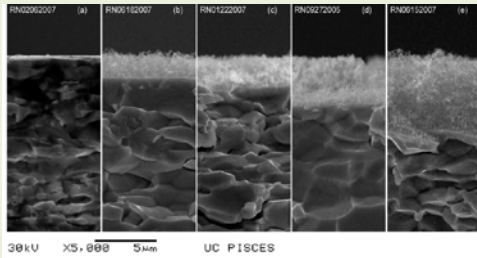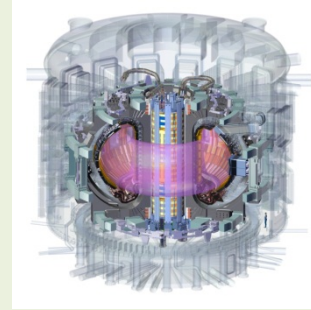
Support the development of the scientific understanding required to design and deploy the **materials** needed to support a burning plasma environment
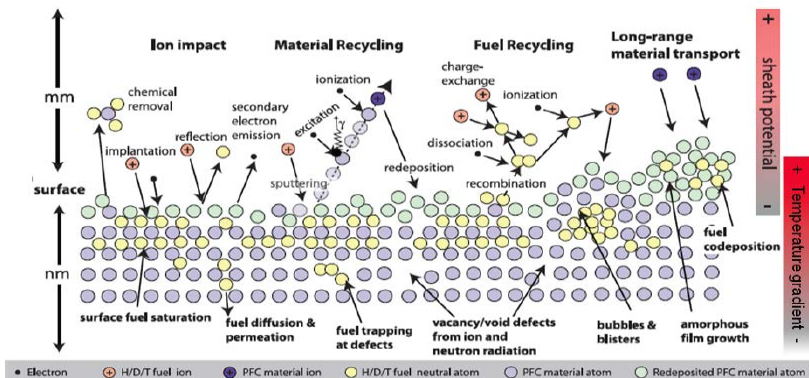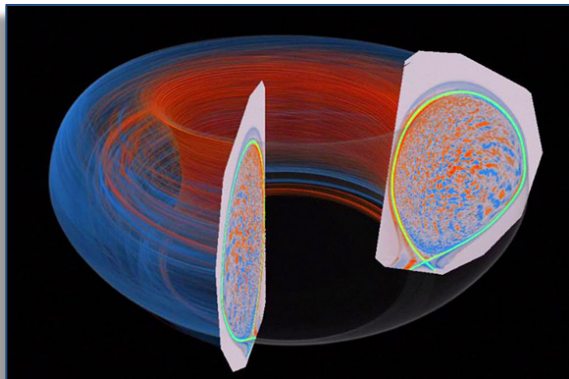
SciDAC-3 partnership

Pursue scientific opportunities and grand challenges in **high energy density plasma science** to explore the feasibility of the inertial confinement approach as a fusion energy source, to better understand our universe, and to enhance national security and economic competitiveness

Increase the fundamental understanding of **basic plasma science**, including both burning plasma and low temperature plasma science and engineering, to enhance economic competiveness and to create opportunities for a broader range of science-based applications
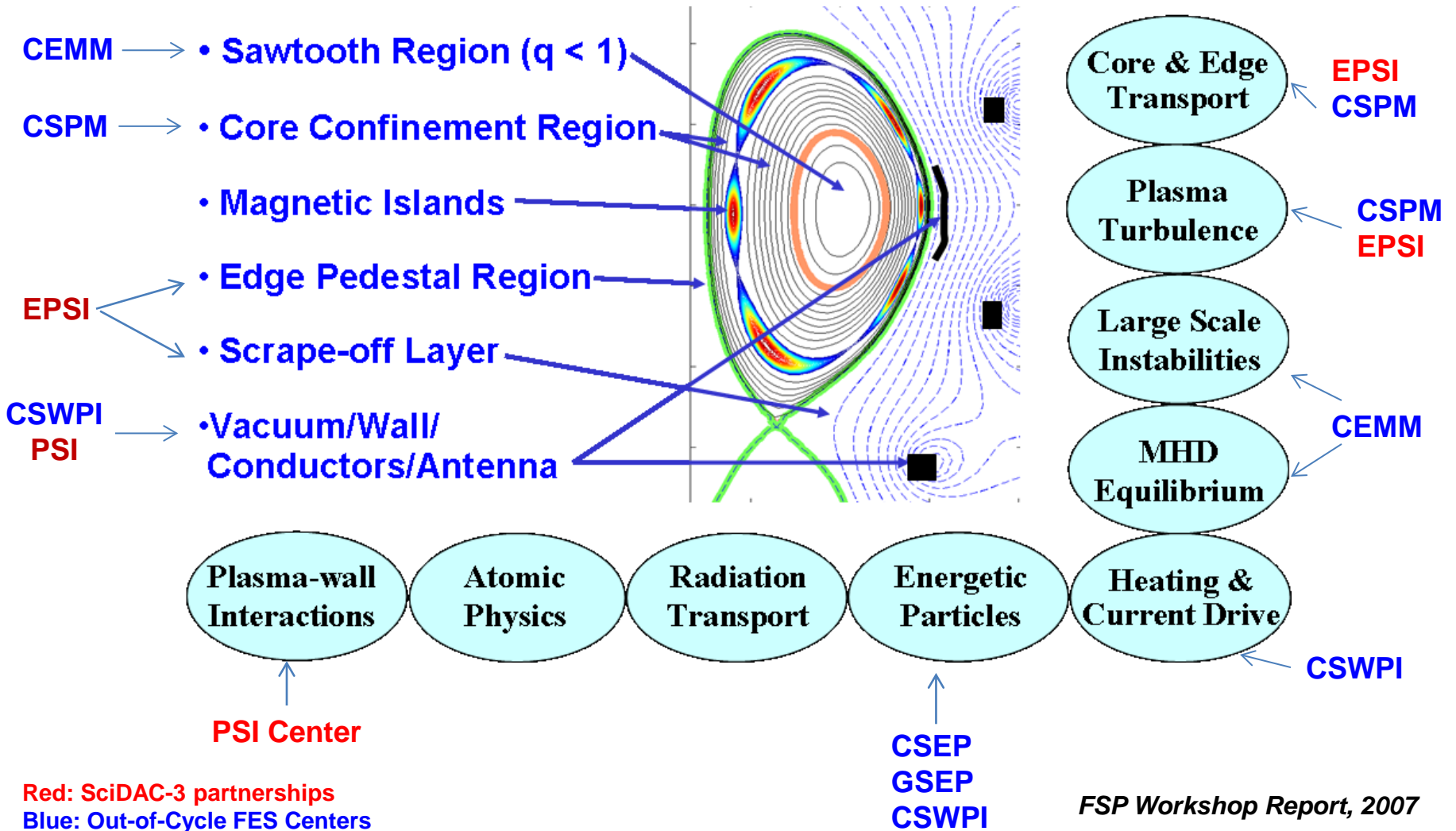
FES SciDAC Program

- The **FES Scientific Discovery through Advanced Computing** (SciDAC) program advances scientific discovery in fusion plasma science by exploiting SC leadership class computing resources and associated advances in computational science
    - *essential component of the FES strategy for developing predictive understanding of magnetically confined plasmas*
- **FES SciDAC portfolio has two parts:**
    - *Two FES / ASCR partnerships (represented at this PI meeting)*
    - *Five "out-of-cycle" FES-funded SciDAC Centers in the areas of RF waves in plasmas, MHD stability, core turbulence & transport, and energetic particle physics*
- The FES SciDAC program's seven multi-institutional, interdisciplinary Centers involve researchers located at 7 national laboratories, 16 universities, and 5 private companies, and support over 20 graduate students and 13 postdocs.

FES SciDAC Portfolio

Project	Lead PI	Collaborators
FES SciDAC-3 Partnerships: FY 2012—FY 2016		
Center for Edge Physics Simulation (EPSI)	CS Chang, PPPL	Brown U, Caltech, LBNL, Lehigh U, MIT, ORNL, RPI, Rutgers U, UCSD, U Colorado, U Texas
Plasma Surface Interactions: Bridging from the Surface to the Micron Frontier through Leadership Class Computing (PSI)	Brian Wirth, ORNL / UTK	ANL, General Atomics, LANL, PNNL, UCSD, UIUC, U Mass
FES SciDAC Centers: FY 2011—FY 2015		
Center for Simulation of Wave-Plasma Interactions (CSWPI)	Paul Bonoli, MIT	CompX, Tech-X, Lodestar, General Atomics, PPPL, ORNL
Center for Extended MHD Modeling (CEMM)	Stephen Jardin, PPPL	General Atomics, HRS Fusion, Tech-X, MIT, U Colorado, Utah State U, RPI, U Washington, U Wisconsin
Center for the Study of Plasma Microturbulence (CSPM)	Jeff Candy, General Atomics	MIT, U Maryland, UCSD, LLNL, PPPL
Center for Simulation of Energetic Particles in Burning Plasmas (CSEP)	Guo-Yong Fu, PPPL	U Colorado, U Texas, ORNL
Center for Gyrokinetic Simulation of Energetic Particle Turbulence & Transport (GSEP)	Zhihong Lin, UC Irvine	General Atomics, LLNL, ORNL