Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Improving the sheath model used in plasma fluid transport codes[1]

JOHN CANIK, ORNL, XIANZHU TANG, LANL — Fluid plasma transport codes such as SOLPS treat the sheath at the interface of plasma and material as a boundary conditions on the fluid equations, enforcing standard conditions on the flow speed, electric potential, and the transmission of power to the wall for given plasma parameters. Recent computational studies using the VPIC particle-in-cell code have revealed several inaccuracies in the conventional values used for these, with higher flow speed, lower potential, and higher sheath transmission coefficients found in the first-principle simulations. The impact of the updated values for these boundary conditions on the plasma solution is investigated using SOLPS. For example, kinetic simulation show a substantially higher ion sheath heat transmission coefficient ($\sim$ 5.5-6) than are typically assumed ($\sim$ 2), and modestly lower electron coefficients. SOLPS simulations show that updating these values can significantly alter the plasma state from an initial equilibrium, increasing the electron and decreasing the ion temperatures. Further, the upstream density required to achieve low temperature, detached divertor conditions is increased by $\sim$ 10%. The impact of further improvements to the SOLPS sheath model, including the flow speed and electric potential, will be presented.

[1]Supported by the US DOE under DE-AC05-00ER22725 and DE-AC52-06NA25396, as part of the SciDAC project on Plasma-Surface Interactions.

John Canik
ORNL

Date submitted: 24 Jul 2015 Electronic form version 1.4