Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

A self-consistent view on plasma-neutral interaction near a wall: plasma acceleration by momentum removal and heating by cold walls GERARD VAN ROOIJ, NIEK DEN HARDER, TEOFIL MINEA, AMY SHUMACK, H. DE BLANK, FOM Institute DIFFER, PLASMA PHYSICS TEAM — In plasma physics, material walls are generally regarded as perfect sinks for charged particles and their energy. A special case arises when the wall efficiently reflects the neutralized plasma particles (with a significant portion of their kinetic energy) and at the same time the upstream plasma is of sufficiently high density to yield strong neutral-ion coupling (i.e. reflected energy and momentum will not escape from the plasma). Under these conditions, plasma-surface interaction will feedback to the upstream plasma and a self-consistent view on the coupling between plasma and neutrals is required for correct prediction of plasma conditions and plasma-surface interaction. Here, an analytical and numerical study of the fluid equations is combined with experiments (in hydrogen and argon) to construct such a self-consistent view. It shows how plasma momentum removal builds up upstream pressure and causes plasma acceleration towards the wall. It also shows how energy reflection causes plasma heating, which recycles part of the reflected power to the wall and induces additional flow acceleration due to local sound speed increase. The findings are relevant as generic textbook example and are at play in the boundary plasma of fusion devices.

Gerard van Rooij
FOM Institute DIFFER

Date submitted: 12 Jun 2014 Electronic form version 1.4