Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

**QED-PIC Codes for 10PW Laser-Plasma Simulation** CHRISTOPHER RIDGERS, University of Oxford, CHRISTOPHER BRADY, University of Warwick, ROLAND DUCLOUS, Commissariat a l'Energie Atomique, JOHN KIRK, Max-Planck Institut fur Kernphysik, KEITH BENNETT, TONY ARBER, University of Warwick, ANTHONY BELL, University of Oxford — As lasers push to ever higher intensities an exciting new frontier will soon be reached in laser-plasma physics. 10PW lasers will create strong enough electromagnetic fields to access non-linear quantum electrodynamics (QED) processes. In contrast to other scenarios where such effects are typically seen, the fields in a 10PW laser's focus will directly access the non-linear QED processes to create a QED-plasma. Here the microscopic QED processes are inherently entwined with the full complexity of a macroscopic laser-plasma interaction and so neither the QED nor the classical plasma physics may be considered in isolation. As a result the standard particle-in-cell (PIC) simulation approach is inadequate for describing QED-plasmas and a new approach (QED-PIC) must be adopted. We will show that the inclusion of QED emission processes in a PIC code is considerably simplified if the electromagnetic fields in the plasma do not very significantly during the emission and are much less than the Schwinger field. In this case the relevant quantum processes can be included in a standard PIC code. We predict that the resulting QED-PIC algorithm will be essential to the future development of the field of high-intensity laser-matter interactions.

Christopher Ridgers
University of Oxford

Date submitted: 10 Jul 2012 Electronic form version 1.4