Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Numerical simulation of quantum systems using the Particle-In-Cell method[1] SVEN DIRKMANN, ZIAD YOUSSEF, TORBEN HEMKE, THOMAS MUSSENBROCK, Ruhr University Bochum — The Particle-In-Cell (PIC) method is a very powerful method for studying the dynamics of plasmas. It has been primarily developed for tracking the charged particle trajectories subject to selfconsistent and external electromagnetic fields. Exploiting the power of modern computers, one is able to track the classical paths of tens of millions of particles at the same time. In the late 1980th, it was Dawson (and later Dauger) who had the idea to apply the PIC method to the classical part in the semiclassical approach to quantum systems via path integral methods. One could estimate that if a thousands of classical paths are sufficient to describe the dynamics of one quantum particle, then millions classical paths could describe the dynamics of a quantum particle system. A PIC code in the frame of a semiclassical approach would therefore enable the investigation of a number of quantum phenomena, e.g., optical properties, electrical properties, and, ultimately, chemical reactions. In this contribution we explain the use of the PIC code *yapic* (developed by the authors) in the frame of the path integral method and discuss the numerical results for simple quantum phenomena, i.e., the quantum harmonic oscillator and quantum tunneling.

[1]This work is supported by the German Research Foundation in the frame of FOR 2093.

Thomas Mussenbrock
Ruhr University Bochum

Date submitted: 16 Jun 2014 Electronic form version 1.4