Scaleabe Semiclassical Calculation of Strong Field Tunneling Dynamics

Michael Spanner (michael.spanner@nrc.ca)
Steacie Institute for Molecular Sciences
NRC Canada
100 Sussex Drive
Ottawa, ON K1A 0R6, Canada and
University of Waterloo
Department of Physics
Guelph-Waterloo Physics Institute
ON N2L 3G1, Canada

Abstract. Standard fully quantum simulations of multi-dimensional systems quickly become prohibitive with increasing dimensionality due to the exponential scaling of the storage requirements. Semiclassical initial value representation (SC-IVR) methods offer a possible alternative for approximating multi-dimensional quantum dynamics due to polynomial scaling of the computational workload. Unfortunately, standard SC-IVR methods fail to give accurate results for tunneling effects which are crucial for accurate description of many strong field interactions. This work will present an extension of the standard SC-IVR methodology which efficiently incorporates tunneling effects in the case of strong field laser-matter interactions. Calculations of strong field tunnel ionization rates for a model 1D soft-core hydrogen atom will be presented which demonstrate the accuracy of the new method. Issues of scaleability to systems of larger dimensionality will be briefly discussed.