Chapter I: Introduction: Examples and first numerical schemes

The mathematical pendulum. We consider the following Hamiltonian function:

$$H(p,q) = \frac{1}{2}p^2 - \cos(q).$$

Figure 1 shows the energy H along the numerical solutions (exp. Euler, midpoint rule, symp. Euler, Störmer-Verlet) for the stepsize $h = 0.2$.

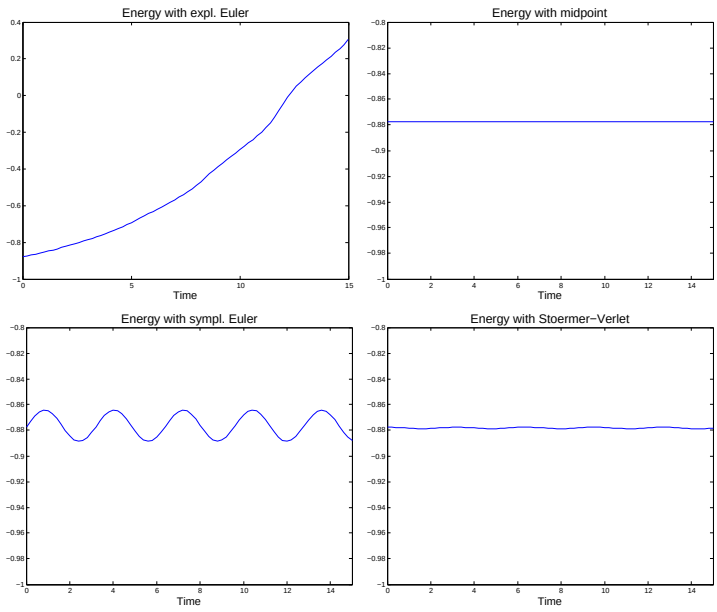

Figure 1: Computed energies for the pendulum problem.

A long time simulation is shown in Figure 2.

The N-body problem. Figure 3 shows the numerical solutions (exp. Euler and symp. Euler) for the outer solar system.

Argon crystal. Figure 5 shows the computed energy and temperature for the argon crystal (Figure 4).

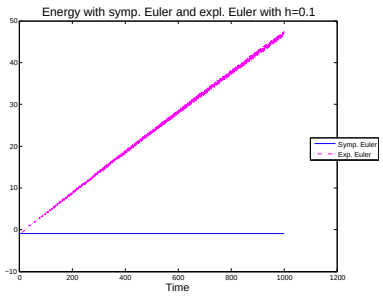

Figure 2: Long time simulation of the pendulum problem.

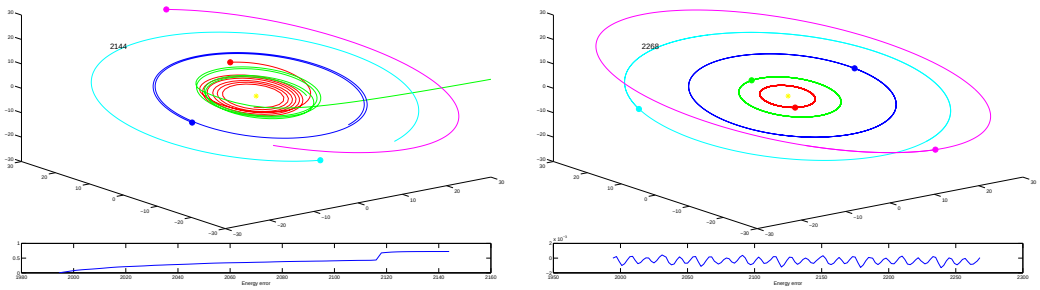

Figure 3: Simulation of the outer solar system and computed energies for the exp. Euler and symp. Euler schemes.

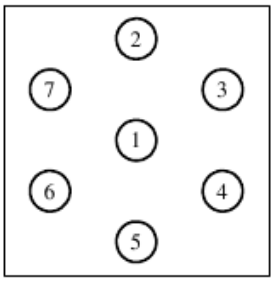

Figure 4: The argon crystal is composed of 7 argon atoms (@ HLW).

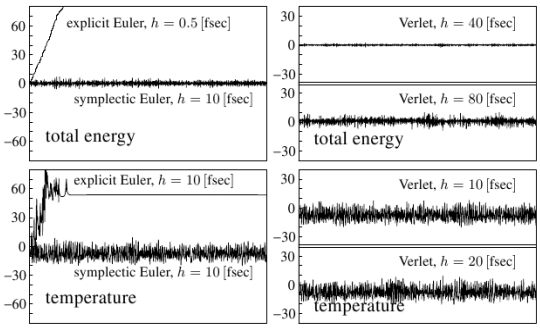

Figure 5: Computed energy and temperature of the argon crystal (@ HLW).