SS 12: Geometric numerical integration

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Lecture.
Time: Tuesday 08.00-09.30
Place: Room 1C-03
Start: April 17

Tutorial.
Time: Thursday 15.45-17.15
Place: Room 1C-04
Start: April 19

Background.
Numerical methods for ordinary differential equations.

Course description.
Ordinary differential equations often appear in the dynamical description of systems in physics, chemistry, biology, etc. Many differential equations exhibit geometric properties that are preserved by the dynamics. Recently, there has been a trend towards the construction of geometric numerical integrators. Such methods are of particular interest in the simulation of mechanical systems, with the preservation of invariants as the energy, momentum or symplectic form is important, especially in long-term simulations (Figure 1).

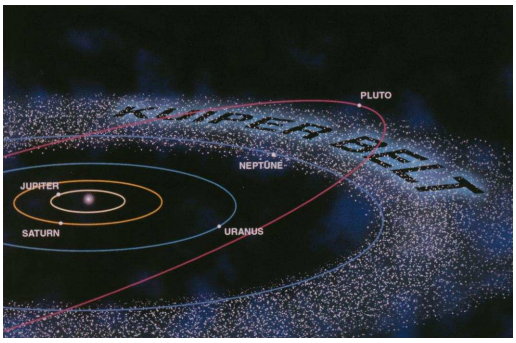

Figure 1: The outer solar system (@ www.cnes.fr).

Topics:

- Numerical methods for ordinary differential equations.
- Hamiltonian problems.
- Structure-preserving numerical integrators.
- Highly oscillatory differential equations.

Target Audience.
Master students, advanced Diploma students, members of the Research Training Group. Students from physics and other sciences with a basic knowledge in ordinary differential equations are welcome.

References.
E. Hairer, C. Lubich, G. Wanner: *Geometric Numerical Integration*, http://www.springerlink.com/content/978-3-540-30666-5#section=49190
B. Leimkuhler, S. Reich: *Simulating Hamiltonian Dynamics*
E. Hairer, C. Lubich, G. Wanner: *Geometric Numerical Integration Illustrated by the Störmer-Verlet Method*, 2003, http://www.unige.ch/~hairer/preprints.html
E. Hairer: *Geometric Numerical Integration*, script: http://www.unige.ch/~hairer/polycop.html