Light-matter interaction with strong fields by using the Schrödinger-Floquet theory

Interactions of atoms or molecules with strong laser fields have a great interest for the applications of quantum mechanics (quantum control, quantum computing, laser cooling, etc). But the modelization and the solving of the induced quantum dynamics problems are not easy ; especially with ultrashort laser pulses (time duration of a picosecond). The Schrödinger-Floquet theory is a general approach to treat light-matter interaction which has a large range of applications. The goal of this project is to study the mathematical foundations and the physical interpretations of this approach, to code an integrator of the Schrödinger equations based on this approach and to apply this one to the control of a 2 or 3-level atom and to a small diatomic molecule (H_2^+). The Schrödinger-Floquet theory fails if the field is strongly noisy. For the cases of chaotic noises, it can be yet generalized into the Schrödinger-Koopman theory. This one can be studied if time permits.

quantum dynamics, light-matter interaction, spectral integrators, mathematical physics

Responsable : David Viennot
Institut UTINAM, Observatoire de Besançon, Université de Franche-Comté
41 bis avenue de l'Observatoire - BP 1615 - 25010 BESANCON cedex
david.viennot@utinam.cnrs.fr
03.81.66.69.16