Description for the general public

Quantum mechanics is undoubtedly one of the greatest achievements of the human mind, a fundamental breakthrough in our understanding of theoretical physics with wide-ranging impact throughout science and engineering: from the revolution in biochemistry and biotechnology all the way to transistors, microprocessors, computers, CD and DVD players, mobile phones...

The proposed project is focused on two mainstreams

1. Dispersive equations of quantum mechanics

   Dispersive equations have dominated quantum mechanics since the pioneering work of Erwin Schrödinger, but their practical computation represents an enduring challenge, strains even the largest computing resources and has led to a number of Nobel Prizes in Chenistry (Walter Kohn, John Pople, Arieh Warschel, ...) The problem with partial differential equation in quantum mechanics is that they are not solvable analytically. The main objectives of this part od project is effective numerical an approximation of these complicated problems.

2. Applications in quantum physics and chemistry

   We wish to incorporate deep mathematical tools not just to the development and analysis of numerical methods for dispersive problems, but also to their applications in quantum mechanics and beyond: to physical chemistry, theory of electronic structure, solid mechanics and quantum control. The last one, for example is a very helpful tool in designing the laser shapers which, in turn, are of great importance in quantum optics.

Numerical problems in quantum mechanics are not only nontrivial but also necessary; this is the reason why the development of this part of science is so lively and attracts so many international leaders in physics, chemistry and mathematics. Results obtained within this project will definitely establish a new state of art in quantum computations.