Computational and Analysis Issues in the Control of Quantum Dynamics Phenomena

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Abstract.

The control of quantum phenomena embraces a variety of applications, with the most common implementation involving tailored laser pulses to steer the dynamics of a quantum system towards some specified observable outcome. The theoretical and computational aspects of this subject are intimately tied to the growing experimental capabilities, especially the ability to perform massive numbers of high throughput experiments. Computational studies in this context have special roles. Especially important is the use of computational techniques to develop new control algorithms, which ultimately would be implemented in the laboratory to guide the control of complex quantum systems and also analyze the control mechanisms.. Beyond control alone, many of the same concepts can be exploited for the performance of experiments optimally tuned for inversion, to extract Hamiltonian information. The latter scenario poses very high demands on the efficiency of solving the quantum dynamics equations to extract the information content from the experimental data.