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Preface

The dynamical behavior of quantum systems in the presence of time-dependent driving forces plays an increasingly important role in understanding the function of various kinds of physical and chemical systems. The articles collected in this issue focus on the behavior of driven quantum systems, involving such phenomena as control of tunneling, higher harmonic generation, manipulation of population dynamics, or interplay of driven dynamics with dissipative effects.

It is felt that there is a need for the development of novel interpretative concepts as well as new analytic and computational tools in this area. For example, well established and widely employed approximations may have to be abandoned in the limiting cases of very strong fields or ultrafast processes. The breaking of time translation invariance of the quantum dynamics by explicitly time-dependent interactions may lead to novel phenomena, such as localization and stabilization. The theory of dissipative effects in strongly driven quantum systems also needs further development.

Although the theme of this issue is mainly theoretical, it is closely interfaced with applications of considerable current interest in experimental physics and chemistry, e.g., strong-field ionization and dissociation, femtosecond pump–probe spectroscopy and control of chemical dynamics. It is in the spirit of this issue that the bearing of theoretical developments on experimental realizations is emphasized.

It appears timely to survey the present status of our understanding of the phenomena in this rapidly developing area and to emphasize future trends. In particular, it has been the intention of the guest editors to bring together leading practitioners of diverse backgrounds in order to promote the interdisciplinary exchange of ideas and methods. The guest editors share the confident belief that the presented works capture a snapshot of the present state of the art of this dynamic research area and that the readers will be invigorated in pursuing future research by the contributions selected herein.

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