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Craig S. Slater

Studies of Photoinduced Molecular Dynamics Using a Fast Imaging Sensor

Doctoral Thesis accepted by
University of Oxford, UK

 Springer

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Supervisor's Foreword

Over the past decade or so, advances in fast imaging sensors have revolutionised the study of gas-phase chemical dynamics and have unlocked the door to a huge array of new experimental possibilities. This thesis provides an excellent introduction to the principles and techniques that underpin the contemporary study of gas-phase photochemical dynamics and presents a detailed yet accessible account of a range of experiments that have significantly advanced the field.

Undoubtedly, the most impressive achievement of this work is the recording of a molecular 'movie', in which the motion of a substituted biphenyl molecule is imaged in real-time using a table top apparatus. The individual frames of the 'film strip' are separated by mere femtoseconds and the images recorded reveal the inherently quantum mechanical nature of motion on this scale. The measurements of molecular motion are intertwined with a study of the complicated dynamics of the Coulomb explosion process used to probe the instantaneous molecular structure. These experiments are particularly impressive for the relative simplicity of the approach and for the detail and complexity of the information revealed.

Work has already begun on extending the principles and techniques detailed in this thesis to new and exciting applications, and I have no doubt that many future studies will be inspired to follow in the same vein. I would highly recommend this thesis to anyone who is interested in the field of molecular dynamics and who would like to learn more about some of the exciting new possibilities in the field.

July 2015

Prof. Mark Brouard

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Over the past few years, I have become rather too familiar with the small stretch of South Parks Road outside the CRL, having crossed it to seek help from the electronics and workshop teams with a frequency only bettered by Benjamin Winter. I would like to express my gratitude to all those in the workshops and electronics department who have offered their help during the course of my D.Phil.

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