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Complex Light and Optical Forces

David L. Andrews
Enrique J. Galvez
Gerard Nienhuis
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Jesper Glückstad, Risø National Laboratory (Denmark)

Introduction

Optical forces on matter often require light fields with special structures. The simplest optical tweezer methods are based on intensity differentials. Beams with vortices or other kinds of phase structures (hollow beams, tailor-made optical traps, sheets of light, and evanescent waves, for example) offer new opportunities for ultrafine control. Through the exchange of linear or angular momentum between light and matter, force fields and torques can be produced that have no counterpart in conventional optical beams.

Structured light affords a host of new methods for guiding the motion of particles. The fabrication of these forms of structured light, their theoretical analysis, and their applications are the unifying features of the articles that are collected in this volume. In fact, it is the close collaboration of fundamental theory, exploratory experiments, and practical applications that makes this field of physics a particularly lively one.

The articles in this volume were presented as papers at a conference in San Jose, which brought together researchers from essentially all continents of the globe. Progress in this field is rapid, and the relevance for various domains such as micro- and nano-manipulation, and quantum information with photons, gives scope for many stimulating cross-links. The flexibility of methods for sculpting light is large, easily counterbalancing any disadvantages of the intangible nature of photons.

The Conference Chairs and Program Committee are very grateful to all those who contributed to the success of the meeting. We hope that some of the excitement and the stimulation of the field will be conveyed to the readers of the articles in these proceedings.

Gerard Nienhuis
Enrique J. Galvez
David L. Andrews