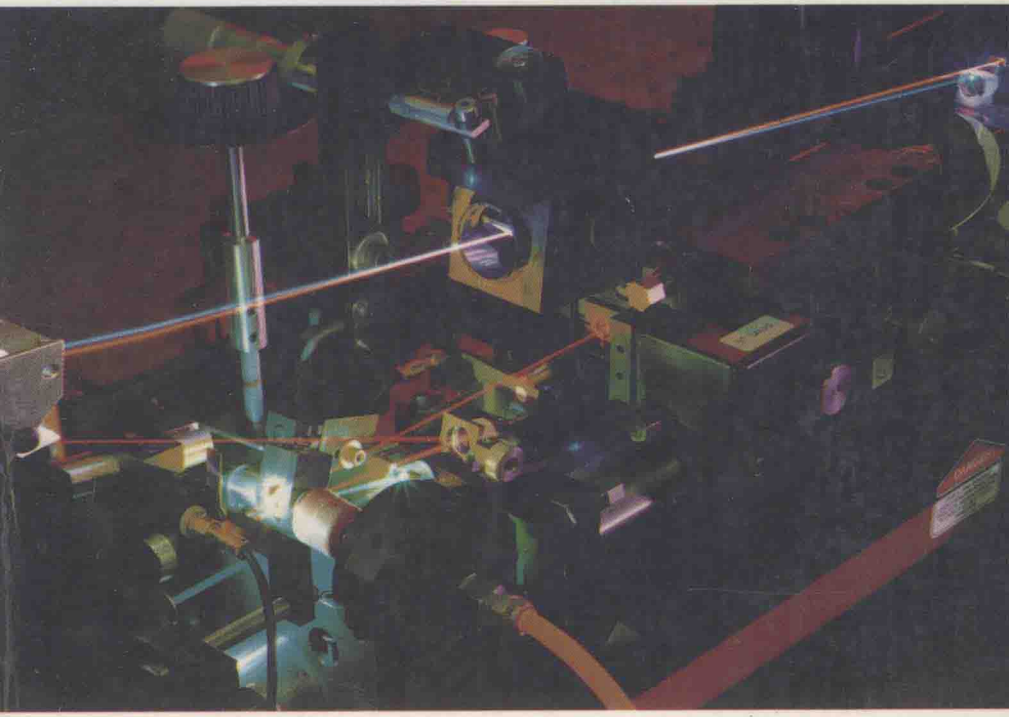
PHYSICS THROUGH THE 1990s



Atomic, Molecular, and Optical Physics

PHYSICS THROUGH THE 1990s

Atomic, Molecular, and Optical Physics

Panel on Atomic, Molecular, and Optical Physics

Physics Survey Committee

Board on Physics and Astronomy

Commission on Physical Sciences, Mathematics, and Resources

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Preface

This report was prepared by the Panel on Atomic, Molecular, and Optical (AMO) Physics of the Physics Survey Committee in response to its charge to describe the field, to characterize the recent advances, and to identify the current frontiers of research. In carrying out this task, we were helped immeasurably by the members of the AMO community and others whose names appear on the following pages. We thank all of them for their contributions.

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Contents

Summary

THE NATURE OF THE FIELD

The goals of atomic, molecular, and optical physics (AMO physics) are to elucidate the fundamental laws of physics, to understand the structure of matter and how matter evolves at the atomic and molecular levels, to understand light in all its manifestations, and to create new techniques and devices. AMO physics provides theoretical and experimental methods and essential data to neighboring areas of science such as chemistry, astrophysics, condensed-matter physics, plasma physics, surface science, biology, and medicine. It contributes to the national security system and to the nation's programs in fusion, directed energy, and materials research. Lasers and advanced technologies such as optical processing and laser isotope separation have been made possible by discoveries in AMO physics, and the research underlies new industries such as fiber-optics communications and laser-assisted manufacturing. These developments are expected to help the nation to maintain its industrial competitiveness and its military strength in the years to come.

EDUCATIONAL ROLE

AMO physics plays an important role in the education of scientists in the United States at both the undergraduate and graduate levels.