

Laser Experiments for Chemistry and Physics

Robert N. Compton and Michael A. Duncan
Oxford U. Press, 2016. \$59.95 paper (432 pp.).
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In *Laser Experiments for Chemistry and Physics*, Robert Compton and Michael Duncan present a wealth of experiments designed to be integrated into laboratory classes in physics and physical chemistry. The book could serve as a reference for instructors interested in expanding laboratory experiment offerings or as a text for students taking a laboratory class with laser-based experiments. Taken as a whole, the book provides a valuable overview of some of the most commonly used laser techniques that a student or researcher new to the field of laser science would find useful.

After an introductory section on basic concepts in laser and optical physics, Compton and Duncan launch into descriptions of experiments that use lasers to investigate properties of atoms and molecules. The experiments are organized into four broad classes: thermodynamics, chemical analysis, quantum chemistry and spectroscopy, and kinetics. The number and scope of experiments presented are quite impressive, with topics ranging from thermal lens calorimetry to the Fermi resonance of carbon dioxide. The authors also present experiments appropriate for varying degrees of resources and experience. Some simple experiments, such as the one introducing laser refractometry, are inexpensive and easy to set up. Others, such as the exploration of third-harmonic generation in gases, require a more significant financial investment and some expertise in laser physics.

Many of the experiments described in the book are based on lab experiments that Compton and Duncan have set up at the University of Tennessee and the University of Georgia, respectively. The authors' descriptions of labs they have used contain substantial detail, including the manufacturers and model numbers of the equipment and the potential challenges of setting up and performing the experiment. Some examples even include data the authors' students have collected when doing those labs. Other



experiments, however, are presented more cursorily, with a brief discussion of the theory underlying the investigation and an outline of a possible lab setup. Although that variation in depth

creates an uneven text, in all cases the information provided is sufficient for someone with experience in optical physics to set up the experiments.

In many ways, the book is a testament to the ambitious and successful lab courses the authors have created. It presents many sophisticated experiments, and it is impressive that the authors have incorporated so many of them into undergraduate and beginning-graduate lab courses. For instructors who want to design new lab courses, this record is a valuable resource, both for the experiments themselves and because it illustrates the scope and level of complexity possible for a lab-based class.

Unfortunately, the book suffers from many errors and typos, particularly in the introductory section. First edition books frequently have mistakes that are corrected in later editions, but this book has enough errors, such as the wrong units and an incorrect description of circular polarization, that the errata become a serious detriment. In addition, in some sections the relevant equations and theory are insufficiently explained.

Nonetheless, *Laser Experiments for Chemistry and Physics* is a fine resource for experienced physics instructors looking to set up new experiments in advanced lab courses. Compton and Duncan provide both guidance and inspiration in their outstanding collection of laser experiments.

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