

# Preface

Light is all around us. Vision is our dominant sense, and we are richly rewarded with a palette of colors from red to violet. Our eyes do not detect the low-energy, long-wavelength infrared (IR) radiation, but we know it exists from discussions of war applications and televised images of guided weapons targets. Our eyes do not detect the higher-energy (above visible light energies) and shorter-than-visible-wavelength ultraviolet radiation, and yet we know it is there from the sunburn we receive in Arizona. We also know that window glass can block ultraviolet rays so we don't get a burn while driving with the windows rolled up.

We know about radio waves from the little boxes that talk to us and x-rays from the dentist office. These waves and rays belong to the same family of light, often called photons (from the Greek *photos*, light), that describes the spectra of electromagnetic radiation over 10 orders of magnitude from very low-energy radio waves to very high-energy x-rays and gamma rays.

This book starts with the visible — the straight path of light — because what we can see is a good starting point. It continues with reflection as we look at ourselves in mirrors and storefront windows. It includes a chapter on refraction, its discovery and description, and a chapter on lenses, which are familiar to the myopic (eyeglasses) and the football fan (binoculars). Color is introduced with the query, Why is the sky blue? After answering that and other similar questions, the book goes beyond the visible to the infrared and ultraviolet. It ends with analysis of Mars using x-ray emission.

This is a descriptive book rather than a technical book. It is designed for the general reader with no background in science but who has an interest in the light around us. There is an Internet site associated with the text called Images of Nature (<http://ion.eas.asu.edu>). It provides optical and electron microscopy images that can be downloaded by the reader and student for free. The site also provides additional information on x-ray emission techniques and comparisons between optical and electron microscopy. For the educator or curious reader, exercises, solutions, and exams are available by writing to the publisher.

The book originated in a general studies course at Arizona State University in the curriculum of Physical Science and in that of Society, Values and Technology. The course started with the support of Terry Woodin of the National Science Foundation for K–12 teachers. It expanded to the general undergraduate

population at Arizona State University and its enrollment is at 150 students each semester (enrollment started with 10 students in Elementary Education). Verne Hess of NSF supported Images.

At Arizona State University we want to thank Sue Wyckoff for her support through the Arizona Collaborative for Excellence in Teacher Preparation. We thank Elizabeth Mayer, who participates in the ASU course; Frank Mayer for handling the lab sessions; Rod Heyd, our web-master; and Misty Wing for manuscript preparation. Michael Weiland and Marc van Horne provided IT course support.

Thanks to Danny Adams and Rudolph Nchodu of the University of the Western Cape and Frank Mayer for the three years of Patterns workshops given to high school teachers in South Africa. Images of Nature arose out of their interest.

Steve Beeson would like to acknowledge the US Department of Labor for the time and computing resources in finishing this work. Additional thanks go to Alison, Lisa, and Lilly for advice; to Tyler for use of the 'vette; and to Laura and Karen for inspiration.

The line drawings were done by Jane Jorgensen and Ali Avcisoy. They were redrawn by Don Thompson of Graphixx.

T. von Forster read the original version and made extensive suggestions, which lead to the final manuscript.

Linda Young edited the manuscript. She has a sharp eye and made many corrections and improvements to the present manuscript.

James W. Mayer  
Tempe  
May 2007

Steve Beeson  
Washington, DC  
May 2007

Patterns of Light

Chasing the Spectrum from Aristotle to LEDs

Beeson, S.; Mayer, J.W.

2008, XIV, 196 p. 100 illus. in color., Hardcover

ISBN: 978-0-387-75106-1